ABSTRACT

RUSSELL, SHAWN MICHAEL. Technology Integration for Vocational and Technical Faculty in North Carolina Community Colleges. (Under the direction of Dr. James Bartlett, III.)

Community Colleges are well known for their vocational and technical educational programs that provide students with the necessary technical training and related job skills that meet the demands of today’s technical workforce, which leads to gainful employment (Gray & Herr, 2008). The technical workforce of today is required to possess specific training, targeted skill sets, and certifications to design, operate, and repair equipment, machinery, and systems. These required workforce skill sets create a demand for technically competent vocational and technical community college faculty that can provide the necessary training, knowledge, and education to their students so they can satisfy the technical workforce demands (Purdue, 2012).

The purpose of this study was to examine North Carolina community college vocational and technical faculty’s level of technology adoption and integration (technology use), and other related factors such as; age, gender, years of teaching experience, education level, technology training sources, technology anxiety and barriers that might be used to predict their level of technology use (technology adoption and integration) in their teaching and learning process. The research methodology was a quantitative study that consisted of a simple survey design based upon the theoretical frameworks of the Technology Acceptance Model (TAM) by Davis (1989) and utilized the Kotrlik & Redmann (2005) Technology Integration Scale (KRTIS) for determining faculty technology use. The targeted population
was all North Carolina community college vocational and technical full-time faculty. Therefore, the sample was obtained from various institutions within the 58 North Carolina community colleges located throughout the state.

The study was expected to confirm that not all community college vocational and technical faculty were effectively integrating technology into their classrooms and/or andragogical philosophy. The explanations for such decisions were due to the influence of demographic factors, technology perceptions, technology anxiety & barriers such as; confidence, training, time, and resources. These findings will be of significance to better understand why only some vocational and technical faculty are integrating technology and what can be done to improve this situation. In addition, findings from the study will assist administrators in recognizing the demographic and characteristics of potential vocational and technical faculty new hires that best support technology integration Administration will also better understand and recognize the training needs and required resources to best support and improve the level of technology integration in the classroom, laboratory, and andragogical beliefs in order to meet both workforce demands and institutional needs.
Technology Integration for Technical and Vocational Faculty in North Carolina Community Colleges

by
Shawn Michael Russell

A dissertation submitted to the Graduate Faculty of North Carolina State University in partial fulfillment of the requirements for the degree of Doctor of Education

Adult and Community College Education

Raleigh, North Carolina

2014

APPROVED BY:

Dr. James E. Bartlett III, Committee Chair

Dr. Joe R. Busby, Member

Dr. Brad Mehlenbacher, Member

Dr. Saundra W. Williams, Member
DEDICATION

This dissertation is dedicated to my family – first and foremost to my understanding and patient wife Trisa, and to my wonderful daughters, Hannah and Hailey, who have always been there to support and encourage me through this academic process and personal journey. This research paper is also dedicated to all of my other family members and friends who provided encouragement throughout my studies and understood my lack of participation in some social events and travels. As I complete these academic requirements for my terminal degree, I look forward to spending a lot more time with my loving family and great friends.
BIOGRAPHY

For the past two years I have been a fulltime business instructor at Cape Fear Community College (CFCC). Prior to being a business instructor, I managed the engineering technology department at CFCC for six years. All together I have been teaching adult students for over 15 years. Before I entered higher education on a fulltime basis in 2006, I taught 2 year and 4 year college courses on a part time basis while working fulltime in the manufacturing industry as a quality engineer, supervisor, designer, and technician for several small and medium sized organizations starting in 1988.

I am married to my loving and dedicated wife Trisa and enjoy two wonderful and smart daughters, Hannah and Hailey, who are our inspiration and sense of joy. I like to surf, fish, and workout in my spare time and enjoy spending time with my family and friends.

Teaching with technology has become a passion for me and I really take pride in teaching adults new academic and life skills that will enhance their careers and quality of life. I really like to teach people how to learn and solve problems. This is why I selected such a topic for my dissertation.
# TABLE OF CONTENTS

LIST OF TABLES ........................................................................................................ vi
LIST OF FIGURES ........................................................................................................ ix

CHAPTER ONE ........................................................................................................... 1
INTRODUCTION ........................................................................................................ 1
Statement of Problem ................................................................. 5
Statement of Purpose ................................................................. 7
Research Objectives ................................................................. 8
Significance of the Study ......................................................... 10
Theoretical Framework ........................................................... 13
Conceptual Framework ........................................................... 16
Limitations and Delimitations ................................................ 18
Definition of Terms ................................................................. 18

CHAPTER TWO ....................................................................................................... 20
LITERATURE REVIEW .......................................................................................... 20
Historical Review of Technology in Higher Education ............... 21
Technology Adoption versus Technology Integration ............... 27
Technology Acceptance Model ................................................. 44
Kotlrik & Redmann Technology Integration Scale .................... 56
Variables and Factors that Influence Technology Integration .... 64
Higher Education Facts ............................................................. 89
Summary ..................................................................................... 91

CHAPTER THREE ................................................................................................. 92
METHODOLOGY ................................................................................................. 92
Introduction .............................................................................. 92
Research Design ....................................................................... 94
Participants ............................................................................ 97
Sampling ................................................................................ 99
Instrumentation ....................................................................... 106
Data Collection ......................................................................... 112
Data Analysis ........................................................................ 117
Anticipated Findings .............................................................. 126
Conclusion ............................................................................... 126
Timeline ................................................................................ 127
CHAPTER FOUR .................................................................................................................. 128

FINDINGS .............................................................................................................................. 128

Data Collection .................................................................................................................... 131
Pre Data Analysis ............................................................................................................... 132
Reliability ........................................................................................................................... 144
Analysis of Research Objectives ...................................................................................... 145
Summary ............................................................................................................................. 177

CHAPTER FIVE .................................................................................................................... 180

REVIEW, CONCLUSIONS, DISCUSSION AND RECOMMENDATIONS .............................................................................................................................. 180

Review and Conclusions .................................................................................................... 182
Discussion of Findings ........................................................................................................ 183
Summary ............................................................................................................................. 195
Recommendations .............................................................................................................. 197
Limitations .......................................................................................................................... 203
Recommendations for Further Research .......................................................................... 203

REFERENCES ..................................................................................................................... 207

APPENDICES ...................................................................................................................... 225

APPENDIX A: Request to Use Instrument – KRTIS ......................................................... 226
APPENDIX B: Permission to Use Instrument - KRTIS..................................................... 227
APPENDIX C: KRTIS Instrument ..................................................................................... 228
APPENDIX D: Request to Use Instrument - TAM ............................................................ 235
APPENDIX E: Permission to Use Instrument - TAM ......................................................... 236
APPENDIX F: TAM ............................................................................................................. 237
APPENDIX G: Budget ......................................................................................................... 238
APPENDIX H: Timeline ..................................................................................................... 239
APPENDIX I: IRB Approval ............................................................................................... 240
APPENDIX J: Data Collection Materials ......................................................................... 241
APPENDIX K: List of North Carolina Community Colleges (58) ................................. 243
APPENDIX L: Vocational and Technical Degrees, Programs and Associated Codes .... 244
LIST OF TABLES

Table 3.1 Enrollment and Faculty by Occupational Area.................................................98
Table 3.2 Stratified Sample Calculations for NCCCS Faculty.................................104
Table 4.1 Analysis of Variance Comparison of Early and Late Respondents on Technology Integration with Adoption, Integration, Technology Anxiety, Barriers, Perceived Usefulness, and Perceived Ease of Use……135
Table 4.2 Mean, Standard Deviation, Minimum, and Maximum Comparison of Early and Late Respondents by Numerical Demographic Characteristics Of Age and Years of Teaching .................................................................137
Table 4.3 Chi Square Comparison of Early and Late Respondents by Categorical Demographic Characteristics of Gender and Educational Level………………138
Table 4.4 Factor Loadings of KRTIS Scale Items Adoption, Integration, Barriers, Technology Anxiety and TAM Scale Items Perceived Usefulness and Perceived Ease of Use...............................................................141
Table 4.5 Reliability and Cronbach’s Alpha of Variables for KRTIS and TAM Scales ..................................................................................................................................145
Table 4.6 Respondent Frequencies and Percents by Vocational and Technical Discipline..................................................................................................................146
Table 4.7 Stratified Sample Difference Between the Number of Expected vs Actual Respondents for Vocational and Technical faculty of the NCCCS………148
Table 4.8 Frequencies and Percentages of Participants Gender and Education Level ..................................................................................................................................149
Table 4.9 Frequencies and Percentages of Participants Age and Years of Teaching Experience ..............................................................................................................150
Table 4.10 Respondents Mean, Standard Deviation, Minimum, and Maximum Age and Numbers of Years Teaching .................................................................151
Table 4.11 Frequencies and Percents of Sources of Technology Training for Vocational and Technical Faculty ..............................................................................152
Table 4.12 Frequencies and Percents of the Types of Technology Available for Use In Teaching Technology by Vocational and Technical Faculty ..........153
Table 4.27 Multiple Regression Analysis in Explaining the Variance to the Technology Integration Scale Adoption of the KRTIS ..............................172
Table 4.28 Stepwise Multiple Regression Analysis to Explore if KRTIS Variables and TAM Variables Explain a Significant Amount of Variance in Adoption .............................................................................................................. 173
Table 4.29 Multiple Regression Analysis in Explaining the Variance to the Technology Integration Scale of the KRTIS ...........................................175
Table 4.30 Stepwise Multiple Regression Analysis to Explore if KRTIS Variables and TAM Variables Explain a Significant Amount of Variance In Integration ........................................................................................................ 176
LIST OF FIGURES

Figure 1.1 Technology Acceptance Model Used for the Study ........................................16
Figure 1.2 Conceptual Framework for the Study ..........................................................17
Figure 2.1 Concerns-Based Adoption Model (CBAM) .................................................31
Figure 2.2 Innovation Decision Process Theory ..........................................................32
Figure 2.3 Diffusion of Innovation Bell Curve of Percentage of Adopters ....................33
Figure 2.4 Original Technology Acceptance Model .....................................................47
Figure 2.5 New Relationship Formulation - TAM .........................................................48
Figure 2.6 First Modified Version of Technology Acceptance Model .........................50
Figure 2.7 Final Version the Technology Acceptance Model ......................................51
Figure 2.8 Technology Acceptance Model “2” ............................................................53
Figure 3.1 Data Collection Steps by Bartlett (modified) .................................................115
CHAPTER ONE

INTRODUCTION

Now that educators, administrators, and institutions of higher education are practicing their craft in the twenty-first century, they face major turmoil from an unstable economy, shrinking budgets, aging facilities, increased competition, and high turnover and attrition at all levels. Many of them are expected to contend with the required efforts and consumption of resources to increase student enrollments while facing declining and questionable student completion rates (Basham & Mathur, 2010). The administration body of these institutions, along with faculty input, must develop specific strategies to combat these dynamic and monumental challenges and need to provide these educators with motivation, tools, and resources to best facilitate their efforts to meet the goals and objectives of teaching and learning for their students (Altbach, Gumport, & Berdahl, 2011).

One of the major considerations to meet and overcome these educational challenges is rooted in the notion from the U. S. National Education Technology Plan of 2010 and other educational governing bodies, that innovation and technology can provide efficiencies that reduce the amount of labor, space, and resources needed for traditional teaching and learning, while increasing access to anyone with an Internet connection, improving efficiencies, and to enhance the teaching and learning process through using instructional technology methods (Hershaft, 2011). According to Hershaft (2011), this technology based higher education innovation and technology initiative will assist the higher education institutions in meeting and overcoming these current challenges. In addition, it will prepare them for future
challenges such as; increasing competition, more regulation and growing student demand. This initiative will support the goals, objectives and mission of the institution in terms of producing a well-educated graduate who can obtain timely and gainful employment in the chosen industry. Most of the local industry depends upon their nearby higher education system to produce qualified graduates, along with workforce training, with the knowledge, skills, and fortitude required to handle today’s technical and highly specialized job requirements and responsibilities (Purdue, 2011).

The infectious sprawl of the Internet, computers, and more recently, mobile devices and instructional teaching devices, has generated a renewed interest in the role that technology can play in higher education and the teaching and learning arena (Dutton & Loader, 2002). It has also affected the teaching methods used by faculty and how students learn (DeLacey & Leonard, 2002; Radcliffe, 2002). Concurrently, there is a growing concern about the need for higher education reforms which includes better ways to match students with colleges, to provide competency-based delivery models, and to manage budgets (Ashford, 2011). Therefore, there is an urgent need to identify and adopt instructional technologies in higher education to assist the administration in providing resources for the faculty that will enable and support them in meeting their goals and objectives through effective and efficient instructional technologies and practices.

Administrators, faculty, and students continue to discover, experiment, and adopt new instructional technology methods and offerings for their educational needs and requirements. Technology as a whole will not slow down or be discontinued, on the contrary, technology
will continue to grow at a rapid pace (Glazner, 2012). Therefore, instructional technology has remained a controversial issue, but is undoubtedly a major factor for institutions of higher education (IHE) who are strategically planning how to not only survive in a sluggish economy and who face stiffer competition, but to get ahead of the curve to better support their institution’s current and future needs and requirements (Blumestyk, Parry, Johnson, & Rice, 2011).

Like many organizations in the 21st century, higher education is faced with growing demands of competition, accountability, funding reductions, and student demands, which creates a serious need for developing a plan and formulating improvement strategies in order to effectively and efficiently address these concerns (Wergin, 2005). One way to handle these overwhelming demands and challenges can be met by utilizing innovations and technologies to maximize effectiveness, efficiencies, and high quality problem solving (Wergin, 2005).

In today’s public demand for accountability in higher education, the need for quality control of educational programs is still one of the greatest challenges in higher education today (Bates & Poole, 2003; Meyer, 2004). Specifically speaking, community colleges in particular are facing competition from the for-profit education industry, demands from lawmakers for more accountability, the shifting needs of an increasingly complex student body, and intense financial pressures (Blumenstyk, Sander, Schmidt, & Wasley, 2008). According to the research of Rice & Taylor (2003), they found that 88% of the colleges and universities surveyed were engaged in some form of continuous improvement strategy and striving towards increased quality in all areas of the institution, which includes the utilization
of instructional technologies such as; using computers and the Internet, Web2.0, video, RSS, distance learning, on-line programs, and specialized software. Therefore, administrators, faculty, and students must come to terms with educational technology and its presence and determine what works best for their learning opportunities; understand their ability to embrace and utilize the technology, and to ensure what is best for the institution and all of the stakeholders (Shelton, 2012).

In particular, community colleges face stiffer and additional challenges due to their mission statements, open door policies, workforce development demands, smaller budgets and donor levels, reputation related to four year institutions, and perceived faculty ability (Cohen & Brawer, 2008). Community colleges as a whole operate on a much smaller budget and must be very efficient and effective in managing salaries, equipment, facilities, and other resources to remain competitive and stay in business (Shelton, 2012). In the State of North Carolina, there are 58 Community Colleges, which all are governed by the North Carolina Community College System (NCCCS) office. Since there are so many of them in the state, the overall challenges and competition amongst them is even greater than other community colleges in other states. In addition to these challenges and competition, North Carolina community college administrators and faculty of the vocational and technical programs have additional pressure on them to provide top notch graduates with the technical skills and knowledge who will become tomorrow’s workforce that the local industry demands (Perdue, 2012). That pressure fosters a continued need to identify practical strategies to best support and meet those needs for North Carolina community college administrators and faculty of the vocational and technical programs.
Statement of Problem

Many business and industrial organizations use technology on a regular basis to produce and provide their products and services to their customers (Rojewski, 2002). However, employers are struggling to find employees who possess these necessary and required technical skill sets to fulfill many of their current job openings that are left unfilled (Perdue 2012, Siemens Inc., 2010). Society in general now requires a minimum amount of technical ability just to conduct our daily lives (Shelton, 2012).

As a result, many technical and vocational teachers, faculty, and educational institutions are under increased pressures to ensure their students are learning and utilizing various types of required technology. If North Carolina community college vocational and technical faculty are not utilizing current teaching and learning technologies or industry technologies in the classroom, their students will not be fully prepared for the workforce or continuing their education (Redmann & Kotrlik, 2004).

In turn, this could impact the institution’s ability to provide adequate workforce education and therefore reduce the quantity of qualified student graduates entering the technical workforce, which could affect the economy and employment levels (Grey & Herr, 1998). According to Gray & Herr, (1998) “If a firm or nation is to compete, it is this majority, the nonprofessional/hourly workforce, that will need significant technical training. There is evidence that there is much work to be done” (p. 45). Furthermore, due to the large number of individuals who will be retiring over the next ten years, a critical shortage of individuals available to work in the manufacturing industry is looming and is exacerbated by
the lack of properly educated workforce that can meet the demands of the 21st century
manufacturer (Stone, Kaminski, & Gloeckner, 2009). According to Stone et al., (2009), these
two issues result in a steady reduction in qualified individuals for the millions of jobs
available in the U.S. manufacturing and technical industries. In addition, if the vocational and
technical faculty do not utilize the institution’s available instructional technology resources
and provide sufficient instruction to students, the community college will not be as effective
and efficient in meeting the numerous and various demands and challenges to remain
competitive (Zeidenberg, 2008).

There has been little research conducted on why teachers and faculty do not adopt and
utilize technology because most of the research on instructional technology has focused on
the impact of the technology on the learners (Zhao & CZiko, 2001). Some of the research has
focused on the technology itself such as; audio, television, on-line, web 2.0, mobile devices,
but not on why faculty adopt and integrate technology (Thirunarayanan & Perez-Prado,
2005). Researchers such as Redmann & Kotrlik (2005), Thirunarayanan & Perez-Prado
(2005), Kotrlik & Redmann (2005), and Abrahams (2010) have examined usage and levels of
technology integration and barriers to technology use. In studies involving technology
adoption (Davis & Venkatesh 1996; Huit 2003), there have been correlations between usage
and anxiety, beliefs, attitudes, and experiences. Without knowing the specific reasons for
vocational and technical faculty’s reluctance to utilize instructional technology, it is difficult
for administrators to provide effective training, equipment, and professional develop for
those faculty members who need it. Educational institutions are challenged with providing
students with the best education in order to prepare them for the workforce. Therefore, If
North Carolina community college vocational and technical faculty do not believe instructional technology is useful and can be easy to use or do not possess the required technical skill themselves, the probability of technology integration in their teaching and learning process and the classroom will be low. Furthermore, if the vocational and technical faculty do not keep up with the pace of instructional technology and industry demands their students will not gain the required skill sets and may not obtain employment as needed or required.

Statement of Purpose

The purpose of this study was to examine North Carolina community college vocational and technical faculty’s levels of technology adoption, acceptance, integration, and related factors that can be used to predict technology integration, including perceived technology anxieties, barriers, and demographic variables. In order to evaluate the level of technology integration and the factors that predict such, the Kotrlik & Redmann Technology Integration Scale (KRTIS) was used. In addition, the Technology Acceptance Model (TAM) was used to evaluate the faculty member’s level of technology adoption and acceptance.

This research information will provide higher education leaders with the knowledge to better understand and allocate resources that support faculty in the implementation of technology integration, while meeting additional goals and objectives. It will provide awareness for faculty of the reasons for the reluctance of technology adoption and integration. In addition, the research will also assist the vocational and technical faculty with
an improved understanding for their decision on the use of technology integration and to provide valuable strategies to dealing with the challenges of practicing technology integration. Furthermore, this information will assist and support the higher education institution to meet its goals and objectives.

Research Objectives

The objective of this study used a quantitative survey design that examined the level of instructional technology integration of vocational and technical faculty. The researcher wanted to identify basic demographic characteristics such as; age, gender, level of education, years of experience technology training sources that would impact the level of instructional technology integration. In addition, the following research objectives were developed:

- Research Objective One – Examined vocational and technical faculty’s’ perceptions of instructional technology usefulness and ease of use in their teaching and learning process, measured by the Technology Acceptance Model (TAM - 1996).
  - Q#1 - Do vocational and technical faculty who perceive instructional technology as useful more likely to integrate technology into their teaching and learning process?
  - Q#2 - Do vocational and technical faculty who perceive instructional technology as easy to use more likely to integrate technology into their teaching and learning process.
• Research Objective Two – Described vocational and technical faculties’ level of instructional technology integration in terms of the two constructs of technology use (adoption and integration) and factors that may influence technology use such as barriers to technology and technology anxiety as measured by the Kotrlik & Redmann Technology Integration Scale (KTRIS-2005).
  o Q#3 – What is the current perceived instructional technology use level (adoption or integration) of the vocational and technical faculty?
  o Q#4 - What are the current perceived instructional technology barriers and anxiety levels of the vocational and technical faculty?

• Research Objective Three – Examined the relationships between vocational and technical faculty’s instructional technology acceptance factors (perceived usefulness and perceived ease of use of technology) and level of technology integration with each of the two levels of technology use (adoption and integration) along with technology barriers and anxiety.
  o Q#5 – Is there a correlation between the vocational and technical faculty’s technology acceptance factors of perceived usefulness and perceived ease of use and their level of technology use of adoption and integration?
  o Q#6 - Is there a correlation between the vocational and technical faculty’s technology acceptance factors of perceived usefulness and perceived ease of use and their level of barriers to technology and technology anxiety?

• Research Objective Four – Explored which technology acceptance factors, demographic variables, and technology use factors (perceived technology barriers and anxieties,
sources of technology training) explained the variance in technology integration within each of the two levels of technology use (adoption and integration).

- Q#7 – Do technology acceptance factors, demographic variables, and/or technology use factors (perceptions of technology barriers and anxiety, sources of technology training) explain the variance in level of technology adoption?

- Q#8 – Do technology acceptance factors, demographic variables, and/or technology use factors (perceptions of technology barriers and anxiety, sources of technology training) explain the variance in level of technology integration?

Significance of the Study

It is mission critical for North Carolina community college vocational and technical faculty to possess and maintain the most current and effective teaching and industrial technology skills in order to provide state of the art training and effective learning opportunities that prepare students to obtain sustainable employment in a technical field which supports North Carolina’s economy (Perdue, 2011). According to Bates and Poole (2003), using technology in the classroom enhances student learning by supporting various learning styles of the students. In today’s fast paced technology requirements in the workplace is crucial that vocational and technical faculty receive the proper instructional tools and resources, training, and support to fulfill their obligation and duties for the
successful teaching and learning of their students. Therefore, this study is significant in terms of identifying the specific characteristics and factors of the North Carolina community college vocational and technical faculty that help predict their willingness and abilities to implement instructional technology integration, so that administration can provide sufficient training and resources in order to maximize the faculty’s capabilities and meet their institution’s goals and objectives. The administrators can then select the proper equipment, training opportunities, and support for their faculty so they become confident and successful. If not, the vocational and technical faculty will continue to struggle with instructional technology utilization efforts which could affect student learning in terms of not being properly prepared for the technical workforce.

Vocational and technical programs utilize and require a significant amount of technology, not only for the machinery, equipment, and tools of the specific program but also in the teaching and learning methods and processes. According to Gray & Herr (1998) “the effectiveness of any instructional modalities or media depends to a great extent on how they are integrated by the instructor or trainer into an effective instructional lesson, module, or experience” (p. 163). It is this effectiveness of instructional technology integration that adds cognitive and contextual learning in the classroom. Without proper use of instructional technology vocational and technical faculty will find it difficult to teach their students. Frey & Donehue (2002) state “technology is rapidly changing the dynamics of the community college learning environment, presenting both opportunities and challenges to faculty and administrators” (p. 3).
By examining and identifying the level that North Carolina community college vocational and technical faculty are integrating technology into their teaching and learning processes, it will assist in the identification of faculty hiring practices and administrative planning to increase instructional technology integration effectiveness. Attending community college is no longer just about obtaining one specific job skill and getting a job, as the new workforce of today requires technological and critical thinking skills, communication, and intrapersonal skills in order to be successful (Levin, Kater, & Wagoner, 2006). The technical disciplines have shifted from a more specific approach to a more generic, academic based approach (Rojewski, 2002). This shift created a new concept that is called “vocationalism” and it is defined as a strategy to prepare students for further education in the field rather than for an entry-level job (Jacobs & Dougherty, 2006). In today’s economy, employers are constantly searching for those technical employees who not only possess the specific technical skill such as a dental hygienist, engineering technician, or radiographer, but an employee who can think, speak, problem solve, and act accordingly in meeting all of the demands of the employment position (Levin, 2002). This new workforce requirement is what makes it so important for vocational and technical faculty to effectively integrate instructional technology in their teaching and learning in order to deliver technical and quality education. This study is of significance because there have been no other studies that focused on just North Carolina community college vocational and technical faculty.
Theoretical Framework

The theory that will be used in this study is the Technology Acceptance Model (TAM), which was originally developed by Fred Davis (1986) then modified several times leading to the final version (Venkatesh & Davis, 1996) as denoted in Figure 1.1. This study examined the level of technology adoption and integration by community college vocational and technical faculty based upon attitudes, beliefs, and experience. The TAM is a derivative of the Theory of Reasoned Action (TRA) first introduced by Fishbein & Ajzen (1975) and later revised (Ajzen & Fishbein, 1980). The TAM incorporates the theoretical foundation of the TRA to establish relationships among beliefs, user attitudes, intentions, and actual behavior. In turn, the TRA was based upon the Information Integration Theory (IIT) developed by Norman Anderson (1971) and rooted in attitudes and behavior. Moving from the IIT to the TRA, elements of behavior, attitudes, and norms were introduced into the TRA (Sheppard, Hartwick, & Warshaw, 1988). According to Hale, Householder, & Greene (2003) this migration in theory was “born largely out of frustration with traditional attitude-behavior research, much of which found weak correlations between attitude measures and performance of volitional behaviors” (p. 259).

These theories were developed by social psychology researchers in the context of social settings. In particular, three elements defined the TRA which are: Behavioral Intentions (BI); Attitudes (A); Norms (N). This leads the TRA to suggest “that a person’s behavioral intention depends upon the person’s attitude about the behavior and subjective norms” (Hale et al., 2003, p. 206). This means that if a person intends (their behavioral intention, attitudes, and norms) to perform a behavior, then it is highly probable that the
person will actually perform that behavior (Hale et al., 2003). In other words, the behavioral intentions (BI) of a person to perform behavior could be calculated using a simple formula of BI = A + SN, with A as a measure of the attitude toward the behavior and SN as a measure of subjective norm associated with the behavior considered. According to Chutter (2009), the TRA provided a useful model that could explain and predict actual behavior of an individual. Even though the TAM had similar structure to the TRA, there are distinct and recognizable differences. Davis (1989) made two changes to the TRA to create the TAM. Firstly, he did not take subjective norm into account in predicting actual behavior because it was the least understood aspect of the TRA and it had uncertain theoretical status. Secondly, instead of considering several salient beliefs to determine attitudes towards a given behavior he relied upon only two distant beliefs of perceived ease of use (PEOU) and perceived usefulness (PU) (Chutter, 2009). Therefore, the TAM assumes that beliefs about PU and PEOU are always the primary determinants of use decisions (Mathieson, 1991).

Research has shown individuals either accept or reject technology integration for various reasons and tend to either utilize or not utilize a specific technology based upon their belief how it will assist or benefit them in their job performance, which is defined as perceived usefulness (PU) (Davis, 1989; Hale, Householder & Greene, 2003). Concurrently, if the users’ believe that a specific technology is useful, they may still believe that the system or technology is too difficult to use and therefore do not learn how to use it (Davis, 1989). According to Davis, Bagozzi, & Warshaw (1992) “because new technologies such as personal computers are complex and an element of uncertainty exists in the minds of decision makers with respect to the successful adoption of them, people form attitudes and intentions
toward trying to learn to use the new technology prior to initiating efforts directed at using” (p. 670). In addition, it is these formed attitudes and intentions that influence the benefits of usage which can offset the effort required to utilize the specific application, which Davis (1989) calls perceived ease of use (PEOU).

In the original TAM there were four constructs which were PU, PEOU, attitude towards using (AT) and behavioral intention to use (BI) that directly influenced actual use (AU). Overtime, researchers discovered that AT and BI was not significant on actual system use and therefore dropped from the model (Davis, 1989). Therefore, the two main constructs that formed the framework of the TAM are perceived usefulness (PU) and perceived ease of use (PEOU) (Davis, 1989).

Throughout the literature researchers have acknowledged the TAM is reliable and can be easily applied in various situations (Chua, 1996; Davis et al., 1989; Venkatesh 2000). There have been several studies to examine the relationship between PU, PEOU, AT, and system use (Adams, Nelson, & Todd, 1992; Szanja, 1996; Venkatesh & Morris, 2000). Their findings suggest that PEOU and PU can help predict AT, which can therefore predict the usage of technology. By understanding these factors, the development of effective training, identification of resources, and hiring criteria and characteristics can be considered in order to be effective in user acceptance and use of instructional technologies.

This research study will use the TAM to examine and determine the influence of the PU and PEOU upon the use of instructional technology integration for vocational and technical faculty. Results will provide administrators with a better understanding of the required resources and training of faculty and hiring considerations as indicators to
successful technology adoption and integration. Figure 1.1 displays the theoretical model below.

![Figure 1.1 Theoretical Model Used for the Study - Final version of the Technology Acceptance Model (Venkatesh & Davis, 1996, p. 453)](image)

**Conceptual Framework**

The conceptual framework of this study was derived from the original and modified TAM framework and customized to focus on the constructs that seem to be most significant in the current literature. The TAM examines the Behavioral Intentions (BI) for system use, which are derived from Perceptions of Usefulness and Ease of Use. It also examines the Attitudes (A) that partially determines an individual’s attitudes towards the Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) of the given technology. The Perceived Ease of Use (PEOU) is a direct determinant of Perceived Usefulness (PU) and both are direct determinants of Behavior Intention (BI)/Attitude (A) according to Davis (1989). In this
study’s conceptual framework it is important to understand that PU equates to the users’ perceptions of the level to which utilizing the system (instructional technology) will effectively improve their teaching and learning capabilities and their PEOU of instructional technology will be level of effort it takes to implement the technology (Davis, 1989). In addition, the demographic factors and technology barriers influence behavior and attitudes, while technology anxiety influences PU and PEOU. Therefore, the independent variables of PU, PEOU, technology barriers, technology barriers, and demographic factors, will determine the level of faculty technology integration in the classroom. These factors and elements identified in the conceptual framework will be the focus of this study. Figure 1.2 below displays the conceptual framework used for this research.

![Conceptual Framework](image)

Figure 1.2 Conceptual Framework for the Study
Limitations and Delimitations

Limitations

The study was limited to North Carolina community college full-time faculty who are current vocational and technical instructors. The sample will be limited only by those who decide not to participate or respond to the survey. Due to the limited amount of specific and available literature of vocational and technical faculty in two year institutions, there may be a small scope of opinions from the short list of researchers and authors on the subject.

Delimitations

This study was delimited to the scope of the focus and perspectives of North Carolina community college full-time vocational and technical faculty who were part of the sample that was actually obtained.

Definition of Terms

Denoted below are specific terms used throughout this study

- Andragogy – “The art and science of helping adults learn” (Knowles, 1973, p. 54).
- Instructional Technology – “All of those technologies that are used for and/or enhance the teaching and learning process for the instructor and students” (Redmann & Kotrlik, 2004).
- Institutions of Higher Education (IHE) - Includes all two and four year colleges and universities, both private and public. (Higher Education Act of 1965, 2013).
- Instructional Technology Initiative (ITI) - The effort of higher education institutions to identify, develop, implement, and utilize instructional technology (computers,
Internet, distance learning, mobile devices, e-learning, etc.) for effective teaching and learning outcomes (Glazner, 2012).

- **Pedagogy** - “The art and science of helping children learn” (Knowles, 1973, p. 54).
- **Perceived Ease of Use** – “The degree to which a person believes that using a particular system would be free of effort. This follows from the definition of "ease": freedom from difficulty or great effort” (Davis, 1989, p.320).

- **Perceived Usefulness** – “The degree to which a person believes that using a particular system would enhance his or her job performance” (Davis, 1989, p. 320).

- **Teaching/Learning Process** – “The implementation of instructional activities that are designed to result in student learning” (Redmann & Kotrlik, 2004, p. 78).

- **Technology** – “Instructional high-tech media such as computers (e-mail, Internet, listservers, CD-ROMs, computer-based software, laser disc players, interactive CDs) and digital imaging (digital cameras, scanners, digital video, digital camcorders, etc.)” (Redmann & Kotrlik, 2004, p. 78).

- **Technology Acceptance Model** – “An information theory that models how users come to accept and use a technology” (Davis, 1989, p. 319).

- **Technology Integration** – “Employing the Internet, computers, software, CD-ROMs, interactive media, satellites, teleconferencing, and other technological means in instruction to support, enhance, inspire, and create learning” (Redmann & Kotrlik, 2004, p. 78).

- **Vocational and Technical (V/T) Faculty** – Instructors who teach in occupational programs such as: welding, automotive, nursing, and engineering type of skill sets. See Table 3.2. (NCCCS, 2012).
CHAPTER TWO

LITERATURE REVIEW

The foundation of this study rests on the body of literature that describes technology adoption and technology integration found in secondary schools and higher education classroom and curriculum. This study was designed to determine the level of practice in which community college vocational and technical faculty are adopting and integrating technology into their classroom, curriculum, and their teaching and learning process. This study started with a thorough overview of how instructional technology has progressed through the decades in higher education. The researcher also examined variables and factors that help influence and determine technology adoption and integration. The similar and distinct constructs of technology adoption and technology integration were examined as well. In addition, the researcher sought out vocational and technical faculty experiences and perceptions related to the Technology Acceptance Model (TAM) of Fred Davis (1989) and the Kotrlik & Redmann Technology Integration Scale (KRTIS) (Redmann & Kotrlik, 2003).

This literature review will be divided up into five different sections and will start with a historical review and progression of technology in higher education. The second section will provide an overview of technology adoption and technology integration, which will include some of the similarities and differences between the two concepts, which are often viewed as having the same meaning. In the third section, the researcher will examine the TAM (Davis, 1989), which will serve as the primary theoretical framework of this study. The TAM theory describes the factors that influence a user to adopt and use technology. The
TAM was developed from the Theory of Reasoned Action (TRA) of Ajzen & Fishbein (1975), which explains causal relationships between beliefs and motivation, user attitudes and norms, intentions, and actual behavior. The fourth section will examine the development and application of the Kotrlik & Redmann Technology Integration Scale (KRTIS) and its influence in the research of instructional technology. The last section will examine the demographic variables and factors that influence technology integration such as; age, gender, years of teaching experience, technology anxiety, and barriers of implementing and integrating technology. In addition, some higher education facts and figured will also be examined.

This literature review will mainly focus on instructional technology in terms of technology usage in higher education, but does include some references, considerations, pedagogy, and practices from the secondary school ideology and institutional practices.

Historical Review of Technology in Higher Education

Higher education in the United States has been around for a long time, starting with the establishment of Harvard College in 1636 (Morison, 1935). From there, higher education has evolved into many things, but has always been a platform of self improvement and a means to advance one’s career opportunities (Gagne, 1970). Technology has been a means for primary, secondary, and higher education to migrate from a simple ‘lecture and listen’ concept to an ‘experience and learn’ concept for many educators and their institutions (Altbach, Gumport, & Berdahl, 2011).
Historically speaking and according to Saettler (1968), theoretical and methodological foundations of the modern audiovisual, radio, television, and programmed instruction complex have been provided by educational theorists from the Elder Sophists of the fifth century B.C., to the reformers of 1700-1900, to the psychologists of the 20th century. As Saettler (1968) stated, “in the 20th century, scientific technology joined learning theory in classroom application and thus instructional technology was born” (p. 5).

Instructional technology, in the traditional sense of public and private schools, has been around for a while. According to Gagne (1970), classrooms of the early 1900s were very traditional consisting of individual desks (bolted to the floor and facing the front) a blackboard and a teacher desk. Teachers basically lectured and practiced repetition so students would have to memorize and repeat back what they learned. It was definitely one way learning with only textbooks, artifacts, and storytelling as the defined instructional technology.

Before the introduction of computers, a number of other forms of technology such as film, radio, and television had been introduced into the classroom with varying degrees of success (Cuban, 1986). Most of the teachers and instructors who utilized this technology had some type of firsthand experience with the equipment. Those who did not had to depend upon someone else who knew it, obtain training themselves, or would forgo the use of instructional technology (Reiser, 1987).

During World War II, film and film projectors, along with other audiovisual equipment, were employed in the military forces and in various industries. The devices included overhead projectors, slide projectors, and audio equipment. Each one of these had a
specific usage from aircraft and ship recognition to foreign language to flight training (Reiser, 1987). According to Cagne (1970) many soldiers and workers could be trained at one time and the materials be used over and over for new cohorts of various groups. This created large scale effective and efficient method of training soldiers.

The audiovisual movement of the 1950s was sparked by an increased interest in television as a medium for delivering instruction (Reiser, 1987). This interest was supported by the Federal Communications Commission to provide over 200 channels for educational purposes. In addition, the Ford Foundation provided over $170 million in educational television during the 1950s and 1960s (Gordon, 1970). Furthermore, leaders of audiovisual instruction became interested in various theories and models of communication (Reiser, 2001). These instructional technologies were utilized in two year technical schools for training students who were acquiring new skills sets to fulfill local workforce demands of the surrounding industries (Gray & Herr, 1998).

The audiovisual movement continued into the 1960s, but started to experience identity reform by realizing the field was broader than the term implied (Reiser, 1987). Therefore, the Department head of Audiovisual Instruction (DAI) created a commission on Definition and Terminology to define the field and associated terminology (Ely, 1983). According to Ely (1983), the new focus should be on “the design and use of messages which control the learning process” rather than the actual audiovisual devices themselves (p. 18). This paradigm shift sparked the first distinction between and separation of instructional technology and the specified technology itself (Gagne, 1970). This is where educators first encountered the decisions of adopting technology versus integrating technology (Reiser,
In their minds, just because the technology is available does not necessarily mean it is being used or increases student learning.

In the 1970s, the movement steadily increased the distinction between instructional technology and audiovisual devices. Changes were made such as renaming the DAI to Association for Educational Communications and Technology (AECT) and providing a new definition of instructional technology which focused upon the facilitation and providing learning resources for students (Reiser, 1987). During this time the term audiovisual instruction was replaced with educational technology and instructional technology (Reiser, 2001). In addition, the personal computer began to find its way into schools and the classrooms (Sharp, 2006).

Even though some of the early work with computers started in the 1950s, with Computer Assisted Instruction (CAI) developed by IBM, it was not until the 1980s when wide-spread interest of personal computers for instructional use became apparent (Reiser, 2001). After the introduction of the micro-computer was made available to the public in the early 1980s, an increased interest in using the computers for instructional purposes arose. Obviously, the personal computer started to replace the audiovisual technology. By 1983, computers were being used for instructional purposes in more than 75% of all secondary schools in the United States (Reiser, 2001). According to Becker (1998), nationally, 43 percent of school computers were located in computer labs, compared to 48 percent in classrooms. As of 1998, ninety percent of schools were wired for Internet access and 30 percent of faculty had access to the Internet in their classrooms (Becker, 1998). In addition, videotdiscs, laser printers, and VCRs were used for instructional purposes (Keengwe, 2008).
In the 1990s, on average, it was estimated that there was one computer for every nine students (Resiser, 2001). However, the use of computers was far from innovative in that the actual usage was for computer related skills such as word processing (Anderson & Ronnkvist, 1999). Since 1995, advances in computers such as, digital technology and the Internet, has led to an increased interest in and use of these media for instructional purposes for both industry and education (Bassi & Van Buren, 1999). In addition, by 1998, the ratio of computers to students rose from 1:9 to 1:6 and school Internet access rose from 50% to 90% (Anderson & Ronnkvist, 1999).

In the 21st century, instructional technology continues to advance with computer technology that is capable of making it easier for educators to utilize various forms of media such as print, video, and audio. Shelton (2012) suggests as distance education (also coined distance learning and distributed education) becomes more readily available through new technology (faster computers, specialized software, and learning management systems such as Blackboard and Moodle, and testing software) as well as, the increased demands from adult learners for greater flexibility, instructional technology began to rapidly grow (Reiser, 2001). After a slow start, many higher education institutions realized the various benefits of instructional technology, especially the online formats. According to Rudestam and Schoenholtz-Read (2010), both administrators and faculty determined there was a place for instructional technology in their institutions due to the cost savings, regulatory compliance, faculty flexibility, and student demand.

In the 2010s administrators and faculty began to see student demand for more online, hybrid, and other type of non-traditional learning opportunities to obtain workforce related
skills & knowledge, college credit, and to finesse their college courses into meeting their work responsibilities, family obligations, and social schedules (Thirunarayanan & Perez-Prado, 2005). In addition, the actual technology itself moved towards a more “mobile platform” with the innovations of wireless Internet connectivity, Web 2.0 capability, podcasts, and mobile devices such as PDAs, smart-phone, I-pads, and tablets (Altbach, et. al., 2011). It is through this natural evolution of instructional technology that allow educators to provide the types of higher education services that make operations more efficient and effective, as well as, satisfy the needs of their customers (students), while meeting increased demands of the institution and regulators (CNI, 2012).

Future considerations for the use of instructional technology in higher education should include student learning and available technologies. Instructional technology itself will continue to grow as both technology advances and student demand increases. According to Rudestam & Schoenholtz-Read (2010), as the demand for higher education and the paradigms of pedagogy and andragogy continue to evolve; instructional technology will be one of the determining factors in providing the structure and ability to meet the many demands and challenges for higher education of the future. According to Knowles (1973), pedagogy is defined as “the art and science of teaching children to learn” and andragogy is defined as “the art and science of helping adults learn” (p. 54). Furthermore, the current U. S. administration’s National Education Technology Plan (NETP) of 2010 states “Education is the key to America’s economic growth and prosperity and to our ability to compete in the global economy” (p. 6). This NETP presents a model of learning powered by innovation and technology (Hershaft, 2011). With such political backing, instructional technology will be at
the top of the list when it comes to help solving the current education and financial crisis the U.S. is experiencing. In addition, this political policy will help fuel the instructional technology movement in both the academic and private sectors (Hershaft, 2011).

Some researchers such as Drucker (1997) predict traditional colleges and universities will see an increase in competition from non-traditional and fully on-line higher education organizations and private firms who can and will provide these educational services at a very competitive price in the future. In a report from the John William Pope Center for higher education policy (Schalin, 2011), the North Carolina legislature is exploring changes in the state statute to eliminate customized training funds to “remain available until expended”, which would wipe out the $11.7 million dollar reserve the college system has been able to stockpile and use for other related purposes (p. 2). Therefore, it will be very important to consider instructional technology to keep operation costs under control while improving the effectiveness and quality of instruction, all while satisfying the needs of the 21st century student.

Technology Adoption versus Technology Integration

The impact technology has had upon society today cannot be measured. In fact, it has had such an impact that if it were wiped out then the human race would be thrown back into the ‘Dark Ages’ (Learmond, 2011). Using technology as a teaching tool is not new, as each new technology has been introduced into society, its use in education has been tried and tested (West, 1999). In particular, institutions of higher education have been using instructional technology to assist their faculty and students in the teaching and learning

27
process for over 100 years (Reiser, 1997). Even though the terms technology adoption and technology integration have similar meanings and are often interchanged with one another in the education industry, they both have distinct intentions and applicability based upon the user’s perception(s) of the given technology (Chutter, 2009). Therefore, there is a need to clarify and understand the context and meaning of the two terms, which raises the following questions: What are the differences between technology adoption and technology integration; why integrate instead of just adopting; how should faculty integrate technology?

Technology Adoption Defined

In simple terms, technology adoption can be defined as, “the level at which and individual feels comfortable and capable with using a given technology” (Davis, 1987, p. 12). According to Reiser (2001), ever since the early 1900s, educators have utilized various types of technology into the classroom claiming they will significantly improve the learning process. Examples of the innovations and technologies that were adopted and integrated include; film, radio, recording devices, programmed instruction, educational television, computers, and the Internet (Ely, 2008; Gagne, 1987; Reiser, 2001). Each innovation had varying degrees of both success and failures in terms of teaching and learning process (West, 1999). Gumport & Chun (1999) report that each technology was perceived as meeting a need and received initial commitment and support of resources from high level administration. However, according to Keengwe & Onchwari (2008), the educational technology adoption process usually followed an administrative approach where the technology came from the top and was required of the faculty who had little to no input and
insufficient support once acquired or installed. The success of the technology adoption was
dependent upon the knowledge and capabilities and sometimes the coercive powers of the
administrative body in the institution (Ely, 2008).

The use of educational technology in higher education is steadily growing due to the
advances in instructional technology and governmental regulations (Keengwe et al., 2008).
Specifically speaking, computers seem to be the instructional technology of choice, due to
their data storage capabilities, ability to perform research, ability to perform complex and
speedy calculations, and provide distance education course over the Internet (Thacker, 2007).
According to Robertson (1998) the electronic computer is the single most important
invention in the history of technology and is the foundational learning tool in higher
education today. Therefore, society as a whole has learned to embrace technology in which a
majority of them use some type of computer or communication device on a daily basis for
work, school, or home (Glazner, 2012). However, not all faculty believed the computer was
of value or needed to be part of the daily teaching routine and only utilized them on special
occasions (Reiser, 2001). Obviously, there was a difference between an institution of higher
education acquiring an instructional technology and the faculty actually adopting and
integrating the instructional technology in their teaching and learning process.

There are various adoption theories and models in the literature. Two of the most
recognized are Hall and Louck’s Concerns-Based Adoption Model (Hall & Louck, 1979) and
Rogers’ Diffusion of Innovations (Rogers, 1995). These theories help explain technology
adoption through various steps an individual will experience when considering the adoption of a new technology.

The Hall and Loucks’ (1979) Concerns-Based Adoption Model (CBAM) examines the individuals’ concerns of new learning that will cause change. In other words, when the faculty is faced with a technological or policy change, they become concerned on how it affects them within the organization (Loucks-Horsley, 1996). The CBAM identifies and provides seven stages of concern that teachers or faculty experience when faced with adoption of a new method or innovation:

1. *Awareness* - the teacher has little concern or involvement with the innovation.
2. *Informational* - the teacher is generally involved in learning about the innovation and the implications of its implementation.
3. *Personal* - typically reflect strong anxieties about the teacher's ability to implement the change, the appropriateness of the change and the personal costs of getting involved.
4. *Management* - is reached when the teacher begins to experiment with implementation; at this point, teacher concerns intensify around the logistics and new behaviors associated with putting the change into practice.
5. *Consequence* - teacher concerns focus predominantly on the impact of the change on students in their classrooms and on the possibilities for modifying the innovation or their use to improve its effects.
6. *Collaboration* - reflects the teacher's interest in working with other teachers in the school to jointly improve the benefits of change.
7. *Refocusing* – teachers consider the benefits of the innovation and think of additional alternatives that might work even better. (Hall & Loucks, 1978, p.3)

The CBAM provides information on the degree of concern(s) of the individual who is faced with an innovation on each of the seven stages of the process. Figure 2.1 denotes the constructs that define the CBAM.
Figure 2.1 The Concerns-Based Adoption Model (CBAM) by Hall & Loucks (1979).

Rogers’ (1995) Innovation Decision Process Theory suggests there are five named steps of the innovation diffusion process. The five stages of the adoption process are listed below:

1. **Knowledge** - In this stage the individual is first exposed to an innovation but lacks information about the innovation. During this stage of the process the individual has not been inspired to find more information about the innovation.
2. **Persuasion** - In this stage the individual is interested in the innovation and actively seeks information/detail about the innovation.
3. **Decision** - In this stage the individual takes the concept of the change and weighs the advantages/disadvantages of using the innovation and decides whether to adopt or reject the innovation. Due to the individualistic nature of this stage Rogers notes that it is the most difficult stage to acquire empirical evidence (Rogers 1964, p. 83).
4. **Implementation** - In this stage the individual employs the innovation to a varying degree depending on the situation. During this stage the individual determines the usefulness of the innovation and may search for further information about it.
5. **Confirmation** - In this stage the individual finalizes his/her decision to continue using the innovation. This stage is both intrapersonal (may cause cognitive dissonance) personal, confirmation the group has made the right decision. (Rogers, 1995, p.36)
According to Rogers (1995), those individuals who are faced with the decision to adopt or use innovation go through a five stage process. Figure 2.2 represents the five stage process which results with an accept or reject decision.

![Five Stages in the Decision Innovation Process](image)

Figure 2.2 The Innovation Decision Process Theory by Everett Rogers (1995).

According to Rogers (1995), during the innovation of diffusion process he defines adoption as “the relative speed with which members of a social system adopt an innovation” (p.37). Typically, those individuals who are the first to adopt innovation (early adopters) require less time than late adopters and laggards (Redmann & Kotrlik, 2004).

A diffusion of innovation bell curve describes the percentage of adopters over time. As the curve in Figure 2.3 represents, approximately 16% of individuals adopt the innovation
in the beginning, while the majority at 68% account for the middle, and the laggards make up the final 16% at the end who feel like they have to even though they do not want to adopt (Rogers, 1995). Figure 2.3 denotes the bell curve breakdown for adopter categories for the Diffusion of Innovation.

Figure 2.3 Roger’s (1995) Diffusion of Innovation Bell Curve of Percentage of Adopters.

Roger’s (1995), bell curve describes that only 16% of individuals are innovators and early adopters. Then the additional 34% of individuals make up the early majority. In total, this represents only 50% of those individuals who consider technology adoption on their own. The remaining 50% of individuals typically only adopt if they are forced or shamed into adopting the technology.
These theories and models explain the adoption and diffusion of innovations process in general terms, but lack a specific understanding to explain technological innovations in education. Specifically speaking, these two models do not address the issue of faculty and technology in the classroom. Fortunately, there is current research that examines the implementation of instructional technology in the classroom, curriculum, and the teaching and learning process.

According to Spotts (1999), digital computers have been on college campuses now for three decades or more with the expectation that new instructional technologies would revolutionize teaching and learning in American higher education. However, even though the 21st century has brought computers, the Internet, and instructional technologies to almost every institution of higher education, including two and four year public and private schools, not all faculty have implemented or actually utilized these instructional technologies in their classroom, curriculum, and teaching and learning process (Thirunarayanan & Perez-Prado, 2005). This led many researchers to the concept that just because the instructional technology is in place it remains unproductive and wasteful if it does not get utilized and integrated by teachers and faculty in their classrooms and the teaching and learning processes. In the article titled “The Integration of Instructional Technology in Public Education: Promises and Challenges” by Rodney Earle (2002), he quoted the following: “Money spent on school technology is wasted without an equal effort to help teachers with its use and integration into the curriculum” (Zehr, 1997, p. 24). Therefore, it is equally important to not only acquire the instructional technology, it is imperative that teachers and faculty members receive the resources (training, time, and support) they need for successful and timely implementation.
In a study conducted in a 1995/1996 academic year of 760 full-time faculty members at a mid-sized, public university in the Midwest, found that only 40% of the faculty had good to expert knowledge or experience with instructional technology and less than 20% admitted they used them on a weekly basis (Spotts and Bowman, 1995). The findings suggest that even though instructional technology was readily available and embedded firmly in the university’s environment, less than half of them adopted the technology, and less than half of those used it in their classroom teaching. According to Spotts (1999), the survey questions were based on a model suggesting that five variables influence a faculty member’s adoption and use of technology in the classroom. The five-variable model consisted of the following elements:

1. *The Learner* – Students were evaluated by the faculty on their ability to use and appreciate the technology that faculty used in their instruction and classrooms.
2. *Faculty* – Faculty evaluated themselves and provided their perceptions regarding their status and role as a faculty member and the implications and benefits of instructional technology.
3. *Technology* – Available instructional technologies were evaluated by faculty including access, support, effectiveness, and attitude towards using.
4. *Environment* – Faculty evaluated the working environment which included policies and procedures of the institution that affect the promotion and tenure decisions of departments and colleges.
5. *Perceived Value* – Faculty evaluated the benefits and value they experienced by adopting instructional technology. (Spots, 1999).

The study examined the differences between the faculty who were categorized as high, medium, and low level users of the instructional technology within each of the five variables as denoted above. Comparisons were made between the high level and low level
user’s perceptions of each of the five variables to better understand why some faculty adopt instructional technology versus those who do not adopt (Spotts, 1999).

The results indicated no significant characteristic or demographic differences in how the high and low level users if instructional technology responded to the five variable questions. However, there was a significant difference in the attitudes and perceived value or benefits the faculty felt they received of using instructional technology (Spotts, 1999). In other words, those faculty who experienced positive gains from adopting the technology cited benefits such as; time savings, increased learning for students, reduced course prep work (when teaching on-line course the second time around), and flexible schedules by teaching on-line were more inclined to adopt and integrate the technology. In addition, the faculty responses indicated if administrators wanted to increase the technology adoption rates of the faculty they need to consider providing technical and facilities/training support, allow time to implement what they learned, and finally offer recognition and promotion/tenure by the institution (Spotts, 1999).

This study also provided early insights into technology adoption in the higher education classroom; however, the study was limited because it was based upon only one four year university. Never the less, this study was part of the research movement towards a better understanding and identification of the faculty levels of adoption and integration of instructional technology in higher education.

In America and abroad, the explosive growth of instructional technology and distance education is rapidly transforming post-secondary education, as the primary driving forces are
economics and compliance (Moller, Foshay & Huett, 2008). With an average growth rate of 9.7% annually for online student enrollment in two-year associate institutions, it is even more important for institutions to properly prepare and provide training resources for their faculty in order to handle this rapid growth (Pagliari, Batts, & McFadden, 2009). Furthermore and according to Governor Beverly Purdue (2012), our society must advocate for investing in innovative education solutions to prepare students to compete in the 21st century global economy. For many individuals, the decision to adopt a specific technology has been based upon personal perceptions of user benefits whereas technology integration has been more about personal perceptions of technical ability and skills (Ertmer, 2005). Therefore, future administrators and educators must not be so reluctant in offering and adopting instructional technology; they must also support integration and incorporate it into their classrooms, curriculums, and the teaching and learning process, as well as, provide and identify the various benefits and values of such adoption and integration (Ertmer, 2005).

Technology Integration Defined

Technology integration in education has been around for a while but has started to rapidly grow in the educational classrooms starting with 1983 reports of computers being used for instructional purposes in more than 75% of all secondary schools and 80% of all higher education institutions in the United States (Center for Social Organizations of Schools, 1983). In addition, by 1998 the ratio of computers to students rose from 1:9 to 1:6 and Internet access rose from 50% to 90% (Anderson & Ronnkvist, 1999). Furthermore, it is estimated that every higher education institution in the U.S. now has computers and Internet
connections for all students, which allow the faculty to develop and implement instructional technology as part of their curriculum if they so desire (Surry, Stefurak, & Gray, 2011). However, even with all of the investments and installations of such instructional technology in our higher education institutions, not all faculty know how or are willing to make technology integration a part of their classroom instruction (Jacobsen, 2000; Wilson, 2001). Therefore, we can conclude that currently there are instructional technologies in higher education, but they are not fully exercised or utilized.

In order to better understand what comprises technology integration, we can first look at what technology integration is not about. The integration of technology in higher education is simply not the installation of computers or Internet connection in the classroom without first obtaining input from the faculty and then providing them with training and support in the use of the technology (Mehaffy, 2012). Technology can be a very effective tool when used properly. Computer software should not be used for the sake of using computers in the classroom (Mandell, Sorge, & Russell, 2002). The uninformed or haphazard use of technology, regardless of quantity, may in fact be evidence of a lack of what Mishra & Koehler (2006) call technological pedagogical content knowledge.

Teaching with technology is a “wicked problem” in that it has “incomplete, contradictory, and change requirements” (Koehler & Mishra, 2009, p. 10). According to Lin, Singer, & Ha, (2010), “when people are introduced to a technology, they can possibly draw on facilities/technological features, norms/organizational forms, and interpretive schemes/institutional arrangements to either implement and use the technology or resist it”
(p. 41). Technology integration is not simply installing technology in the classroom in hopes that some faculty members and students will use it for learning purposes. According to Woodbridge (2004), appropriate integration of computers tools constitutes a major change in people’s lives; technology integration is a complex phenomenon that involves understanding teachers’ motivations, perceptions, and beliefs about learning and technology. Technology integration requires faculty to not only learn and use technology in the classroom, but to actually integrate it into their pedagogical and andragogical philosophies and lesson plans, which requires using a different approach and materials to educate their students, which in turn requires personal change (Keengwe & Onchwari, 2009).

Faculty who have integrated technology into their classrooms and curriculums have been faced with complex decisions and often spend a great deal of their own time figuring out how to operate the technology (Thirunarayanan & Perez-Prado, 2005). According to Dexter & Thomas (2012), “new ways of confronting this complexity must address core knowledge base components that include content, pedagogy, and technology” (p. 2). The problem is not that higher education has an issue with acquiring instructional technology equipment and resources, nor the fact that many of the faculty are not willing to adopt or utilize instructional technology, it is the fact that most institutional administrators do not provide the proper resources for their faculty to reach or obtain successful technology integration in their classroom and curriculum (Grasha & Yangarber-Hicks, 2000). According to the 1999 National Survey of Information Technology in U.S. Higher Education, assisting faculty efforts to integrate technology into instruction remains the most important challenge confronting American colleges over the next two or three years (Charp, 2000).
Even though higher education has recently made large investments in instructional technology that include; faster computers and increased Internet capabilities, learning management systems (LMS), and mobile device applications, to increase efficiencies in order to overcome budget challenges and student demand, it does not necessarily mean that all faculty or information technology (IT) personnel know how or are convinced to use the technology (NMC Horizon Report, 2012). In the book titled ‘Effective Teaching with Technology in Higher Education: Foundations for Success’ (Bates & Poole, 2003), it provides clear evidence that technology and computers have been in the higher education classrooms since the early 1980’s however, this does not mean the higher education faculty utilize them on a regular basis nor finds them of andragogical value.

According to Kortlik & Redmann (2004) they define technology integration as “employing the Internet, computers, CD-ROMS, interactive media, satellites, software, teleconferencing, and other technological means in instruction to support, enhance, inspire, and create learning” (p. 4). The keyword is “employing” the technology into the teaching and learning process and not simply just acquiring the technology and installing it. Wachira & Keengwe (2010) define technology integration as “a means incorporating technology and technology based practices into all aspects of teaching and learning specifically, incorporating appropriate technology in objectives, lessons, and assessment of learning outcomes” (p. 2). In both of these definitions, it is evident that the specific technology that is used is not as important as the method or applicability is towards the teaching and learning outcomes.
In a 2008 Instructional Technology study of higher education students reported a number of benefits of using instructional technology in their education (Kennedy, Judd, Churchward, Gray, & Krause, 2008). Students felt the digital instruction was effective and preferred receiving information quickly; be adept at processing information rapidly; prefer multi-tasking and non-linear access to information; have a low tolerance for lectures; prefer active rather than passive learning, and rely heavily on communications technologies to access information and to carry out social and professional interactions (Kennedy et al., 2008.). This includes the many types of technologies used to support and supplement the course such as; email, RSS feeds, podcasts, you-tube, the Internet, computers, discussion boards, and blogs. Technology integration should focus organizing the goals of the curriculum and technology into a coordinated and harmonious whole (Redmann & Kotrlik, 2005). Some technology integration researchers believe it is the curriculum and faculty member who should drive the type of technology utilized so it can be most effective and commonplace for all. In this shift of technology integration teaching in the classroom to learning in the classroom, a new paradigm will be required (Rogers, 2000).

Result of Adoption and Integration

Technology adoption and technology integration are similar in context, but are distinct and have slightly different meanings as technology adoption refers to “the decision of whether or not an individual will adopt a particular technology to meet an intended outcome” (Woodbridge, 2004, p.1) and technology integration refers to “the means of viewing technology as an instructional tool for delivering subject matter in the curriculum already in
place” (Woodbridge, 2004, p. 1). However, both of these technology focused behaviors are the catalyst for the successful utilization of instructional technology in higher education classrooms, curriculums, and the teaching and learning process. Successful technology adoption and integration requires a concerted focus on the mission of improving education for all students (Earle, 2002). In many higher education institutions, technology adoption and integration promise to be the one element to assist them through the challenges they face such as; budgets, competition, and regulation (Hershaft, 2011). However, the debate over just “how” effective is technology in the teaching and learning process, still resonates throughout the literature as researchers continue to provide studies in the field (Bates & Poole, 2003).

The growth of distance education and the demand for instructors and faculty has developed over the past ten to fifteen years (Pagliari, Batts, & McFadden, 2009). The 9.7% growth rate for online enrollment in two-year associate institutions is much greater than the 1.5% overall growth of the higher education student population (Allen & Seamen, 2007). This technology integration requires faculty training and development to assist higher education faculty with online instruction (Pagliari, Batts, & McFadden, 2009). Numerous other studies also support this realization for technology training of faculty (Almala, 2006; Bathe, 2001; Frey & Donehue, 2002, Moon et al., 2005) in order to obtain successful instructional technology integration.

Technology integration requires faculty to master the instructional technology and keep up with all the changes, as well as, to incorporate the technology into their actual teaching philosophies. For many educators, this requires personal change and commitment, which can be uncomfortable and slow moving for some faculty (Keengwe & Onchwari,
This change requires a paradigm shift from how classroom technology was used in 19th century, where the teacher merely lectured and wrote on the chalkboards, gave handouts, and students took notes and read textbooks in hopes retaining and reiterating information, to a 21st century of critical thinking, problem-solving, technical skills, and good communication (Privateer, 1999). For example, think about the faculty member who might receive an email, text, or chat session from a student needing clarification on a concept or problem at 10pm at night or on Saturday morning. This access to the faculty member along with a timely response, greatly enhances the students ability to learn, which should assist the faculty member with their responsibility and capabilities (Glazner, 2012).

Everybody is talking about technology integration, but few practicing teachers profess to know exactly how to proceed. “The fact is that real integration requires change. . . . However, what seems to be lacking is a model that teachers and faculty can use to guide them through the necessary changes they will need to make to be successful in integrating new technology into their classroom” (Johnson & Liu, 2000, p. 4). In fact, according to Surry, Stefurak, & Gray (2011), this technology integration is even changing the relationship between faculty and students in a good sense.

In the article titled “Understanding Technology adoption: Theory and Future Directions for Informal Learning” by Evan T. Straub (2009), he examined teacher and faculty adoption of technology through the lens of the same and similar theories and models such as; Roger’s innovation diffusion theories, the Concerns-Based Adoption Model (CBAM), the Technology Acceptance Model (TAM); the United Theory of Acceptance and
Use of Technology (UTAUT). In his findings, these combined theories and models suggest technology adoption and integration is a complex, inherently social, developmental process; individuals construct unique (yet malleable) perceptions of technology that influence their adoption decisions. According to Straub (2009), “successfully facilitating technology adoption and integration must address cognitive, emotional, and contextual concerns” (p. 645).

Academia will continue to be effected by technology which is dynamic and continues to grow. Technology adoption and integration will always be a part of the teachers and faculty teaching and learning process (Woodbridge, 2004). They will need to learn how to change alongside of the advancing technology and find the most effective ways to incorporate technology into their curriculums (Mitchell, 2011).

Technology Acceptance Model

The Technology Acceptance Model, also known as the TAM, is a theoretical understanding and explanation of the reasons why individuals accept or reject technology in the workplace and/or their daily lives. Researchers have applied the technology acceptance model to various educational and workplace studies in order to better understand why teachers and faculty either accept or reject a given technology. The TAM theory is used to identify the variables and factors that explain and predict why or why not individuals adopt a specific technology. According to Davis (1989), the TAM consists of two main elements: perceived ease of use (PEOU) and perceived usefulness (PU). These elements are the main
constructs of the model and are perceived by those individuals facing the technology adoption or rejection situation. Therefore, the TAM will be used as the theoretical framework of this study to examine the technology adoption and technology integration of full-time vocational and technical faculty in North Carolina community colleges.

Technology designed for the higher education classroom has been around for a while. According to Venkatesh & Davis (1996), individuals and faculty are faced with decisions on whether or not to accept, adopt, and utilize instructional and informational technologies on a daily basis. Prior research efforts have examined and discovered that perceived usefulness (PU) and perceived ease of use (PEOU) are the key determinants of individuals’ intent to use the technology (Venkatesh & Davis, 1996). These primary constructs of the model are the driving forces of technology acceptance or rejection. The TAM uses two specific beliefs: (1) Perceived Usefulness (PU), which is defined as the user’s perception of the degree to which by using the system (technology) will improve their performance in the workplace and (2) Perceived Ease Of Use (PEOU), the user’s perception of the amount of effort required to use the system (Venkatesh & Davis, 1996). As Venkatesh & Davis (1996), point out, these user intentions have proved to be better predictors of actual system usage than other competing predictors such as; realism of expectations, motivational forces, value, and user involvement and satisfaction.

History of the TAM

The 1970s produced major advancements in technology and the use of technological workplace needs (systems) began to rapidly grow, but at the same time experienced a high
failure rate of technology system adoption of individuals in organizations. Therefore, predicting technology system use became an area of interest for many researchers and the studies began (Chutter, 2009). However, many of these studies (Bandura, 1982; Robey, 1979; Schultz and Slevin, 1975), which included some elements of human psychology, did not produce reliable measures that could explain system acceptance or rejection (Davis, 1989). In 1985, Fred Davis proposed the Technology Acceptance Model (TAM) in his doctoral thesis at the MIT Sloan School of Management (as cited in Chutter, 2009). According to Chutter (2009), Davis proposed that “a system use is a response that can be explained or predicted by user motivation, which, in turn, is directly influenced by an external stimulus consisting of the actual system’s features and capabilities” (p. 1).

Building upon the prior work by Fishbein & Ajzen (1975), who developed the Theory of Reasoned Action (TRA), Davis refined his conceptual model to include three factors that can explain a users’ motivation for system use. Those factors were Perceived Ease Of Use (PEOU), Perceived Usefulness (PU), and Attitude Toward Using (AT) the system (Chutter, 2009). According to Davis (1989), this version of the TAM hypothesized that the attitude of a user toward a system was a major determinant of whether the user will actually use or reject the system. The attitude of the user was considered to be heavily influenced by two major beliefs: PU and PEOU, with PEOU having a direct influence on PU. In addition, both PU and PEOU were hypothesized to be directly influenced by the system design characteristics X1, X2, and X3 as shown in Figure 2.4.
Figure 2.4 Original TAM proposed by Fred Davis (1986, p. 24).

Davis made two main changes to the Theory of Reasoned Action model, as he continued to develop his TAM in terms of a users’ acceptance of an information system. The first was to remove the Subjective Norm (SN), as it was the least understood aspect of the TRA and had uncertain theoretical status. Second, instead of considering several individual salient beliefs to determine the attitude towards a given behavior, he relied upon the two distinct beliefs of PU and PEOU that were sufficient enough to predict the attitude of a user toward the use of a system (Chutter, 2009). Davis (1985) defined his two main constructs of the TAM as follows:

Perceived usefulness - The degree to which an individual believes that using a particular system would enhance his or her job performance.

Perceived ease of use - The degree to which an individual believes that using a particular system would be free of physical and mental effort.

Fred Davis (1985, p. 250)
Davis then developed measurement scales for PEOU and PU by using psychometric scales used in psychology to be used in three stages; pretesting phase, an empirical field study, and a laboratory experiment in which he modified and refined the scales until they were consistent (Davis, 1989). In addition, Davis conducted a field study with 112 employees working for IBM in Toronto, Canada in order to test the reliability and validity of his new 10 item scale. According to Davis (1989), “all the tests showed a high reliability and validity for the 10 item scales” (p. 7). By analyzing the results of his IBM experiment, Davis found a positive correlation between the scales and self-predicted future usage. He used regression analysis to determine the relationships that existed within the TAM. Then led to the realization there were additional relationships in the TAM, in which he modified again as shown in Figure 2.5 (Chutter, 2009).

Figure 2.5 New relationship formulation in TAM (Davis, 1993 p. 481)
As several other studies followed the work of the original TAM to explore and investigate a more in depth relationship between the different variables in the TAM model, the model would continue to be modified as researchers performed experiments and conducted studies on individuals and groups on perceived intentions to use the systems. Behavioral intention (BI) would become a new variable that would be greatly influenced by the PU of a system (Davis, Bagozzi, & Warshaw, 1989). This was the case when given a system, which was perceived useful; an individual might form a strong behavioral intention to use the system without forming any attitude. Furthermore, another change brought to the original TAM was the consideration of other factors (external variables) that could influence the beliefs of a person towards a system. External variables (EV) typically included system characteristics, user training, user participation in design, and the nature of the implementation process (Venkatesh & Davis, 1996). In other words, variables such as age, gender, race, degree of training and related items influence the PU and PEOU which has a causal relationship with attitudes towards using (AT) and then onto the behavioral intention (BI) for actual system use (AU). These modified constructs gave rise to a modified version of the TAM, as shown in figure 2.6 below.
Davis, Bagozzi, & Warshaw (1989) used this first modified model to conduct a longitudinal study with 107 users to measure their intention to use a system after a one hour introduction to the system, and again in 14 weeks later. In both time frames, the results indicated a strong correlation between reported intention and self-reported system usage with perceived usefulness (PU) responsible for the greatest influence on people’s intention. According to Chutter (2009), in this study, “the perceived ease of use (PEOU) was found to have a small but significant effect on behavioral intention (BI) which later subsided over time” (p. 10). The main finding of the study was the fact that both PU and PEOU were found to have a direct influence on behavioral intention, thus eliminating the need for the attitude construct from this version of the TAM (Davis, Bagozzi, & Warshaw 1989). Therefore, by eliminating the attitude towards using (AT) construct and introducing the behavioral intention (BI) construct, it would better explain the direct influence of perceived usefulness (PU) on actual system use. At the same time, it eliminated any direct influence observed
from the system characteristics to attitude variable (Venkatesh & Davis, 1996). This led to the final version of the TAM as shown in figure 2.7 below.

Figure 2.7 Final version of TAM (Venkatesh and Davis, 1996 p. 453).

With the final version of the TAM in place, further research led to; 1) replicating TAM and testing its propositions and possible limitations; 2) comparing TAM with other models such as the TRA and TPB; 3) adapting TAM for various settings such as mandatory scenarios, different applications and cultures, and; 4) extending the model to include other variables such as subjective norms (SN), extrinsic motivations, playfulness, and so on (Chutter, 2009).

Analysis of TAM

There have been various studies that have replicated the TAM (Adams, Nelson, and Todd, 1992; Hendrickson, Massey and Cronan, 1993; Subramanian, 1994; Davis & Venkatesh, 1996) in an attempt to test the TAM’s variables and scales for their validity and
reliability. In all of these studies, the results indicated that the TAM model maintained its consistency in predicting and explaining system adoption, PU and PEOU scale items exhibited significant test-retest reliability, and that grouping of scales did not change the validity and reliability (Chutter, 2009).

Even though the TAM has over 700 citations to the original model, Davis’ research to Davis, 1989) has been adapted and extended in many ways. There have been several attempts consolidate the results from these studies. Early meta-analysis studies can be found in Lee, Kozar, & Larsen (2003), Sharp (2006), King & He (2006), Lee, Kozar, & Larsen (2003), Ma & Lui (2004), and Legris, Ingham, & Collerette (2003). The technological systems ranged from email, voicemail, fax, word processor, spreadsheet, and presentation software to decision support systems, expert support systems and telemedicine technology.

According to Chutter (2009) most of these studies found significant statistical results for the high influence of perceived usefulness (PU) on behavioral intentions (BI) to use a specific system. Mixed results for the direct relationship between perceived ease of use (PEOU) and usage behavior were also concluded. Generally speaking, most all of these studies demonstrated strong evidence to support the TAM as a model to predict system usage behaviors. Unfortunately, the TAM could not go beyond the general items that measured perceived usefulness (PU) and perceived ease of use (PEOU) (Chutter, 2009). In other words, it was difficult to identify the reasons behind the PU and PEOU variables used in the model. In addition, most of the TAM researched focused upon voluntary settings with little focus on mandatory settings. Therefore, Venkatesh & Davis (2000), concluded the TAM had some
limitations in explaining the reasons for which an individual would perceive a given system useful and proposed the addition of variables as antecedents to the PU. Thus the TAM 2 was developed and shown in Figure 2.8 below.

Figure 2.8 The Technology Acceptance (TAM) 2 (Venkatesh and Davis, 2000)

One of the main criticisms of the TAM is the fact the model assumes system usage is volitional, that is, there are no barriers that would prevent an individual from using a given system, such as an Information System (IS) if they chose to do so (Mathieson, Peacock, and
Chin, 2001). Previous research has explained that an individual’s access to resources does not necessarily affect system usage (Mathieson, 1991; Taylor and Todd, 1995). As seen in the field, there may be situations in which an individual wants to use an IS but is prevented by lack of time, money, expertise and so on (Mathieson, Peacock, & Chin, 2001).

Another criticism of the TAM was the lack of antecedents for the PEOU variable. Therefore, Vankatesh (2000) proposed two main groups called: anchors and adjustments. Anchors were considered as general beliefs about computers and computer usage (computer self-efficacy, perceptions of external control, computer anxiety, and computer playfulness), whereas adjustments were considered as beliefs (perceived enjoyment and objective usability) that are shaped based on direct experience with the target system (Chutter, 2009). This theory was tested in three different organizations with 246 participants in a longitudinal study, in which the results indicated strong support for the variables in explaining the PEOU for a given system (Venkatesh, 2000).

According to Chutter (2009), other researchers (Legris, Ingham, and Collerette, 2003; Yousafzai, Foxall, & Pallister, 2007; Lee, Kozar, & Larsen, 2003; Yang & Yoo, 2003; Burton-Jones & Hubona, 2006; and Bagozzi, 2007) have pointed out several important limitations of the model which fall into three categories 1) the methodology used, 2) the variables and relationships that exist within the TAM model, and 3) the core theoretical foundation underlying the TAM. Each of these researchers and their studies have experienced some limitations of the TAM due to a lack of universal application and the lack of control for self-reporting scale measures.
In a 2007 study titled “University Instructors’ Acceptance of electronic Courseware: An Application of the Technology Acceptance Model, by Park, Lee, and Cheong (2007), the TAM provided a theoretical framework to help predict the factors of why faculty either accept or reject Internet based course management systems such as Blackboard and WebCT, which are categorized as Information and Communication Technologies (ICT). Despite the popularity of electronic courseware that provide benefits such as; meeting student and regulatory demands, cost efficiencies, and improved revenues, many of the previous studies focused on the student and very little attention was focused on the teacher, instructor, or faculty member. The results indicated that perceived ease of use had a significant impact on perceived usefulness, as the TAM suggested (Park, Lee, & Cheong, 2007). This suggests that individuals who had a high PEOU had a positive impact on PU and then had a high behavioral intention and onto a high system use.

According to Venkatesh (2000) “the main purpose of the TAM is to provide an understanding of the impact of external variables on internal beliefs, attitudes, and intentions” (p. 51). Therefore, the TAM is a theoretical model that provides a better understanding of why individuals accept or reject a given technology. The two main constructs of perceived usefulness (PU) and perceived ease of use (PEOU) remain in place and have been proven amongst other researchers and numerous studies to be the major determinants of a users’ intention to actually use a given technological system (Davis, 1993; Szanja, 1994; Venkatesh and Davis, 1996).
In a similar study involving Career and Technical Educators (CTE) who teach in the North Carolina secondary public school system (mainly high school) were examined to determine the level of their technology integration in the classroom and the teaching and learning process, along with which variables or factors influenced their level. The study concluded that a majority of the participants were 50-60 years of age, had 0-5 years of teaching experience, and were female. In addition, the majority of the participants were in the technology exploration and adoption phase (the first two out of 4 levels) of technology integration, with over 95% of them learning the technology through workshops and conferences. Technology anxiety and barriers did not significantly affect their technology integration (Jones, 2011).

This instrument continues to assist researchers and practitioners with a better understanding of an individual’s perceptions of technology usage and how to best understand those perceptions in order to increase the probability of technology acceptance and adoption.

Kotrlik & Redmann Technology Integration Scale

The Kotrlik & Redmann Technology Integration Scale (KRTIS) framework was developed to better measure the level at which teacher and faculty member integrate instructional technology in their teaching/learning process and classroom (Redmann & Kotrlik, 2004). Whereas the TAM framework only examined the probability and reasons why individuals (ex: teachers and faculty members) would or would not adopt or integrate a given technology into their workplace or classroom. No one can deny the fact that major
investments in instructional technology (hardware and software) have been made in the K-12 and higher education institutions (Green, 2001; Jacobsen, 2000; Rogers, 2000; Moser, 2007), and that many individuals believe technology improves the teaching and learning process for both the instructor and the student (Moser, 2007; Olqren, 2000; Valdez, 2000) however, not all faculty use technology on a regular basis in their classroom instruction (Spots and Bowman, 1995; West, 1999; Rogers, 2000; Struab, 2009). Jointly, the KRTIS and the TAM theoretical frameworks can be combined to assist in the identification and solution for the reluctance of instructional technology utilization in North Carolina community college vocational and technical faculties’ classroom and regular instruction.

Since the research has shown that the workforce of today need skills beyond the basic reading, writing, and math, traditional high school requirements, and mediocre interpersonal skills (Moser, 2007) and the fact that learners need to acquire lifelong-learning skills and the ability to cope with constantly changing workplaces (Kotrlik & Redmann, 2005), it is up to our educational institutions, both primary and secondary, along with higher education in vocational and technical programs (two and four year colleges and universities) to properly prepare these students for the workplace (Gray & Herr, 1998). Therefore, the pressure and challenges of producing such capable and workforce ready students/graduates (workforce members) rests in the decisions of administrators and upon the shoulders of the faculty of our higher education institutions. In particular, vocational and technical faculty need to be proficient in the use and demonstration of the specific types of technological machines and equipment (machining, electronics, computers, health care, and related) they are also teaching their students how to operate the technology (Gray & Herr, 1998). In addition, the
faculty must be proficient in using instructional technology in order to effectively provide instruction and to ensure students are learning (Moser, 2007). Although the conditions for successful technology integration finally appear to be in place, including ready access to technology, increased training for teachers, and a favorable policy environment, high-level technology use is still surprisingly low (Ertmer, 2005). Something must be done to facilitate technology adoption and technology integration for vocational and technical instructors in the North Carolina community college system.

One of the major elements of the student/learner readiness challenges is to educate teachers and faculty how to use technology in the development and formulation of their lesson plans, classroom instruction, and the overall teaching and learning processes (Thirunarayanan & Perez-Prado, 2005). Therefore, in order to establish a starting point, researchers needed a measurement device to accurately measure the current levels and associated constructs of teacher and faculty perceptions of technology and technology integration. Kotrlik & Redmann (2004) define technology integration as "employing the Internet, computers, CD-ROMs, interactive media, satellites, teleconferencing, and other technological means in instruction to support, enhance, inspire and create learning" (p. 77). They believed technology integration will be influenced by the teaching and learning process. According to Kotrlik & Redmann (2004), the teaching and learning process can be defined as “the implementation of instructional activities that result in student learning” (p. 80).
The researchers, Joe Kotrlik & Donna Redmann (2004), entered the picture by developing a reliable scale to examine and evaluate technology integration in the teaching and learning process. They expanded the work of Ringstaff, Sandholtz, & Dwyer (1991), which was a research and development collaboration project between Apple Computer, Inc., public schools, universities, and research agencies. The project was called “the Apple Classroom of Tomorrow” (ACOT). This study explored the behaviors and perceptions of teachers and students as they adopted new teaching and learning elements in technology abundant classrooms (Ringstaff, et al., 1991). The findings showed that traditional teaching and learning processes remained in place during the early years of the project even though there were significant physical changes to the classroom. However, over time, gradual shifts in teach beliefs were experienced, which contributed to improved classroom practice (Ringstaff et al., 1991). The realized progression of changes was viewed as an evolutionary process, which is common in many other theories and models in educational changes (Ringstaff et al, 1995).

Kotrlik & Redmann (2004) also used the work of Russell’s (1995) stage of technology adoption and email as a basis for their model. Russell (1995) evaluated the six stages adult learners experience as they as their comfort level increases in the adoption of technology in hopes to better understand the “how” adult learners learn new technologies. The six stages included; awareness, learning the process, understanding and application process, familiarity and confidence, adaption, and creative application. The findings demonstrated the six stages offer a formal developmental schema for how naïve email learners develop and increase their confidence in using the new technology until the
technology becomes background (or second nature) to the relevant task at hand (Russell, 1995).

These two research projects became the basis of the Kotrlik & Redmann model that would provide a better understanding of technology integration among teachers and faculty members in the teaching and learning process and also allowed a variety of technologies used in the classroom and supporting areas. Kotrlik & Redmann (2004) realized there were various types of instructional technology that were available and utilized by educators beyond computers and email. Therefore, they needed a model that includes adoption and integration of technology, in which they realized five significant factors such as; perceived integration barriers, perceived teaching effectiveness, technology anxiety, training resources, and technology availability influenced the integration of technology (Kotrlik & Redmann, 2004). To better examine and understand these factors the Kotrlik Redmann Technology Integration Scale (KRTIS) was developed.

The KRTIS 2005 instrument titled “Technology Integration in the Teaching-Learning Process” (Kotrlik & Redmann, 2003, 2004, 2005) originally contained three multi-item scales: the Technology Integration Scale (which included four subscales) consisting of 1) Exploration – Thinking about using technology, 2) Experimentation – Beginning to use technology, 3) Adoption – Using technology regularly, and 4) Advanced Integration – innovative use of technology, the Barriers to the Integration of technology Scale, and the Perceived Teaching Effectiveness Scale. It also included some personal and demographic variables such as; age, gender, years of teaching experience, sources of technology training,
types of technology available for the teachers use, and level of technology anxiety (Kotrlik & Redmann, 2004).

However, as Kotrlik & Redmann continued their research, they discovered that most teachers and faculty members were beyond the exploration and experimentation phase of utilizing technology. They concluded in today’s education environment most all educators have already explored technology and were experimenting with it to a certain degree and therefore, the exploration and experimentation were no longer included (personal communication with Dr. Kotrlik, 2012). Therefore, the current KRTIS 2005 scale includes adoption, integration, barriers, anxiety, educator demographics, types of technology used (Kotrlik, 2012). The two underlying constructs of technology integration in the KRTIS (2005) are adoption and integration:

1. *Adoption* – Using Technology Regularly. Physical changes are very evident in the classroom and/or laboratory with technology becoming a focal point in the classroom and/or laboratory organization. Instructors employ presentation software and technology-based instructional exercises using games, simulations, spreadsheets, databases, word processors, the Internet or other technology tools as a regular and normal feature of instructional activities. Student-shared responsibility for learning emerges as a major instructional theme.

2. *Integration* – Using Technology Innovatively. Instructors pursue innovative ways to use technology to improve learning. Students take on new challenges beyond traditional assignments and activities. Learners use technology to collaborate with others from various disciplines to gather and analyze information for student learning projects. The integration of technology into the teaching/learning process leads to a higher level of learning. (Redmann et al., 2003, p. 34)

Earlier versions of the KRTIS included exploration and experimentation, but are no longer included. This particular model offers two distinct phases that explain how educators
implement technology to improve the teaching and learning process. Educators can answer the self reporting survey from the perspective of how they are currently using technology in the classroom. However, this does not include just having technology in place (ex: computers, Internet access, Web2.0, CD-ROM’s, LCD projectors, and related equipment) in the classroom. It also includes the use of all the aspects of the provided technology to develop new teaching and learning paradigms. This concept reflects the suggestion of Roger’s (2000) thoughts of “effective use of technology in the classroom will require a paradigm shift from ‘teaching’ to ‘learning’, which will require adequate training in technology and learning styles, as well as adequate technical support” (p. 19). In other words, educators need to understand how to make technology part of their classroom instruction as part of their everyday teaching and learning processes in order to achieve successful instructional technology integration.

The KRTIS was developed by Kotrlik & Redmann with careful consideration given to the specific scales and demographic criteria in order to obtain high validity, which was important to the researchers in providing valid and reliable results of their research. According to Kotrlik & Redmann (2003 and 2004), the validity of the instrument was evaluated by several expert groups including; university faculty and doctoral-level graduate students with expertise in andragogy, instrument design, research methodology, e-learning, and technology integration evaluated the face and content validity of the instrument. After the original instrument was field tested with 29 teachers, the expert panel made several changes to “the wording of items and the instructions for completing the instrument” (Kotrlik & Redmann, 2004, p. 209). The standards for instrument reliability for Cronbach’s alpha by
Robinson, Shaver & Wrightsman (1991) were used to measure the KRTIS factors and were found to possess exemplary reliability as follows: “Technology Integration Scale - .95; Exploration subscale - .84, Experimentation subscale - .93, Adoption subscale - .95, Integration subscale - .92, barriers scale - .85, and effectiveness scale - .91” (Kotrlik & Redmann, 2004, p. 209). The expert panel agreed with his assessment. The test/retest correlation with a 2-week interval was .81, which indicates exemplary reliability according to the standards for reliability by Robinson et al. (1991).

The KRTIS is a proven instrument that researchers can use to examine and evaluate teachers and faculty members’ level and degree of the technology integration process to determine what resources and training needs are required to increase and improve their levels. This instrument was developed to examine and evaluate various types of instructional technologies with the intent of improving the methods and levels of participation in how technology is integrated into educational pedagogical and adragogical practices in our secondary and postsecondary institutions. However, some limitations of the instrument include; the location of the study (geographic location, size, access to technology), periodic review/update of current vs. older instructional technologies. At the same time, these limitations create additional research opportunities to determine differences, if any, in those educators at other locations. This can also add to the current body of knowledge in better understanding of technology resistance throughout various locations and related factors. In summary, the KRTIS instrument continues to be a popular, valid, and valuable measurement of technology integration for those researchers interested in evaluating the “reasons” why
educators do not embrace and sometimes resist using technology in their teaching and learning process.

Variables and Factors that Influence Technology Integration

In today’s fast paced technology driven workplace and society, individuals must continually make decisions on whether or not to use technology and then decide the level or degree in which they integrate such technology into their workplace and daily lives (Glazner, 2012). According to Davis (1989), these decisions are based upon beliefs and perceptions of usefulness and ease of use of a given technology that greatly influence how individuals decide to either accept or reject that specific technology. These beliefs and perceptions are based upon various individual variables and factors, such as demographic characteristics and beliefs that can influence an educator’s level of technology adoption and integration in their instruction and classroom (Venkatesh, Morris, & Ackerman, 2000). There is an established base of research on both an individual and educator’s personal beliefs, that affect their perceptions and decisions in their teaching and learning practices (Ertmer, 2005; Kotrlik & Redmann, 2004; Kotrlik & Redmann, 2009 Russell, 1997; Rogers, 2000, Spotts, 1999; Mathieson, Peacock, & Chin, 2001; Kotrlik & Redmann, 2004; Kotrlik & Redmann, 2009). Even though there are many variables and factors that influence an educator’s perceptions and beliefs, this study will only examine and evaluate several major constructs that include; age, gender, experience and education level, sources of technology training, technology anxiety and barriers to technology integration.
Age and Technology Integration

A large body of research on aging differences exists in the psychology literature (Minton & Scheider, 1980; Rhodes, 1983), focusing particularly on understanding mean differences in abilities, traits, or performance outcomes (Sharit & Czaja, 1994). According to Morris & Venkatesh (2000), “little, if any, research has aimed at understanding age differences in the salience of different attributes – that is, the relative importance of potential determinants in decision making processes related to technology adoption” (p. 378). Research has shown that as the basic physiological processes decline with age, older workers are less able to process complex information processing tasks (Birren, Woods, & Williams, 1980). Furthermore, it is believed that older workers have a more difficult time adapting to various changes in the work environment and are more likely to take refuge in methods and practices that are familiar to them (Dalton & Thomas, 1971; Myers and Conner, 1992; Sharit & Czaja, 1994). Conversely, younger workers typically have more experience with technology and demonstrate a higher capacity to adopt and learn new technologies (Sharit & Czaja, 1994).

For many years, researchers argued that aging was accompanied by a decline in intellectual ability or intelligence (Wechsler, 1958). However, in today’s contemporary views, research has focused on specific types of abilities having different age functions – for example, verbal scores do not change with age while performance scores decline with age (Botwinick, 1967, 1977). Likewise, crystallized intelligence does not change with age while fluid intelligence can change or remain constant (Baltes & Lindenberger, 1997). Recent
evidence suggests that age differences in information processing have an impact on older workers’ performance of computer-based tasks such as; data entry, file maintenance, and inventory management (Czaja and Sharit, 1993; Sharit and Czaja, 1994). In a study titled “Age Differences in Technology Adoption Decisions: Implications for a Changing Work Force by Morris and Venkatesh (2000), they suggest that there are clear differences with age in the importance of various factors in technology adoption and usage in the workplace for both short and long term usage decisions. Within the theoretical framework of the Theory of Planned Behavior (TPB), the study found:

Initial acceptance decisions of younger workers found attitude toward using new technology to be more salient than older workers found that older workers; conversely, older workers weighed the importance of subjective norm and perceived behavioral control more strongly than younger workers in determining usage of a new technology in the short term (Morris & Venkatesh, 2000, p. 392).

For the long term usage decisions, “the pattern of results for attitude toward using technology and perceived behavioral control was consistent with the initial adoption decision; however, there were no differences in subjective norm” (Morris & Venkatesh, 2000, p. 392). Therefore, the results suggest the younger workers appear to be more driven by underlying attitudinal factors, whereas older workers are more motivated by social and process factors. This could be explained best by the fact that the opportunity for older workers to interact with informational technology before entering the workplace was much more limited and the fact that younger workers were probably exposed to technology at a younger age in elementary or secondary school (Morris & Vankatesh, 2000a). Regardless of the theoretical explanation of reasons for the observed differences, these results support
practical implications for today’s workforce in terms of user support. Given the differences between younger and older workers, training programs should be structured with the needs of both groups taken into account, such as emphasizing the increased productivity or effectiveness (instrumentality) of the new technology for the younger workers. For the older workers, the training should emphasize the ease of use (perceived behavioral control) and perhaps obtain buy in from opinion leaders within the organization (social factors) for a better adoption and usage of a new technology. This is also supported by research of Plett & Lester (1991), in which older workers see themselves as unsuited to new learning and lack confidence in training situations. In addition, older workers also tend to learn at slower rates than their younger counterparts (Plett & Lester, 1991). In this case, technology trainers might consider opportunities for ‘technology familiarization’ prior to teaching the specific details of a new given technology (Morris & Venkatesh, 2000). Additional research also supports this notion that older workers are often ‘out of practice’ in understanding how to learn (Warr, 1990), which may explain why older workers can have difficulty with absorbing new material or demonstrating competence at new tasks.

According to Lane and Lyle III (2011), if institutions of higher education are going to implement and expect adoption and integration of instructional technologies, it is important to gather pertinent information on the common barriers that the users encounter and to identify which resources of support they find most beneficial. Furthermore, a comprehensive understanding of how differences in user traits such as; age, gender, and technological expertise may impact the use of technologies to support instruction is vital to overcome non-adoption. Previous research mostly explored associated barriers of educational technology
which did not include user traits (Anderson et al, 1998; Pajo & Wallace, 2001). Lack of support, time and incentives were ranked the most popular constructs of associated barriers (Lofstrom & Nevgi, 2007; Rogers, 2000; Vodanovich & Piotrowski, 2005), but the effect that user traits such as age, have on the severity of these obstacles is not well understood. A university-wide study of faculty at the University of Washington found that even though there were few statistically significant differences among age groups (26-40, 41-55, and 56+) the two older faculty member groups cited a “lack of time to learn how to use technology” and “lack of timely support for technical problems” as greater concerns than the younger group (26-40). In addition, the second age group (41-55) reported greater concerns about technical problems affecting their teaching compared to the other age groups (Lane and Lyle III, 2010). The older faculty group also found the departmental technical support resource considerably more helpful than the younger faculty group, in which they found the self (trial and error) support much more beneficial. However, this study concluded that in contrast to conventional wisdom, gender and age are less important than expertise when it comes to minimizing barriers and provide support. Furthermore, other research (Morris, Venkatesh, & Ackerman, 2005; Kotrlik & Redmann, 2005; Spotts, 1997) shows some evidence of how an educator’s age influences the decision to adopt and/or integrate technology into the classroom. However, the literature does not specifically focus on vocational and technical community college faculty, which could be a factor in user adoption and integration of technology. This study will explore and evaluate the significance of the age construct of technology adoption and integration.
Gender and Technology Integration

One of the most important user traits is gender, as it plays a significant role in the understanding of user acceptance and integration of technology by determining how individuals make decisions about the adoption and utilization of a given technology (Venkatesh, Morris, & Ackerman, 2000). Gender difference debates have been in existence for many years and have become part of a category of ‘user traits’ in modern day research, which are often treated as modifiers when analyzing its effect on other user traits and theoretical constructs (Venkatesh, Morris, & Ackerman, 2000). Consensus among numerous studies is that females report higher levels of computer anxiety than males (Brosnan and Davidson, 1996; Farina et al., 1991; Igbaria and Chakrabarti, 1990; Okebukola and Woda, 1993). According to Venkatesh and Morris (2000), “there is a significant body of evidence outside of the domain of information systems, in general, supporting the viewpoint that social influence and gender do indeed play a critical role in influencing behaviors in a wide variety of domains” (p. 116). For example, in a 2007 naturalistic study of gender differences in the decision making process, evidence showed that females are more concerned with uncertainty, doubts, and the dynamism that are involved with the decision. They also place more value on time and money; that are more concerned about the consequences that may derive from the decision, no matter whether these affect them or other people. Also, females are more aware of the given constraints and their emotions are more important to them in the decision process. Conversely, males assign more importance to the analysis of the information required to carry out the decision and to the definition of the goals or purpose of the decision. Also, males are more motivated during the process and also feel more intensely the pressure
from all of the work related aspects (Sanz de Baquedano & Cardelle-Elawar, 2007). In
support of these findings, some of the fundamental literature for understanding gender
differences in decision making comes from research in social psychology, which indicates
males and females in deed make decisions differently due to their norms (Tannen, 1991),
social status, and certain interested powers imposed on society (Henely & Kramarae, 1991;
West & Zimmerman, 1991). The 2007 study concludes these gender decision making
differences could be considered the result of “reciprocal determination among cognitive,
behavioral, and environmental factors” (Sanz de Baquedano & Cardelle-Elawar, 2007, p.
388).

In the literature of psychology research evidence exists there are fundamental
differences in the decision making processes which indicates that schematic processing
between men and women are different (Bem and Allen, 1974; Loch and Conger, 1996; Miller
and Ubeda, 2011). As Bem and Allen (1974) argue that “women and men encode and
process information using different socially constructed cognitive structures that, in turn,
help determine and direct an individual’s perception” (as cited in Venkatesh and Morris,
2000, p. 117). As a result, individuals have a tendency to make decisions which reflect
personal biases inherent in their own experiences, perceptions, and behaviors. Therefore, this
means gender schemas can be considered to be normative guide that causes unconscious or
internalized action consistent with the schema (Venkatesh & Morris, 2000).

Loch and Conger (1996) provided evidence that significant gender differences were
discovered in their study titled ‘Evaluating Ethical Decision Making and Computer Use.’ In
their study using the Theory of Reasoned Action (TRA), which was a derivative of the TAM, they concluded “both attitudes and social norms play an important role in determining individual’s intention to perform computing acts relating to privacy and ownership, and that men and women use different decision cues in forming their intentions toward computing acts. Women relied predominately and consistently on their social norms in determining intentions: while men relied on their attitudes towards computing acts as predictors of their intentions” (p. 82). Men have a tendency to embrace and seek out technology, whereas, women tend to be somewhat timid and unsure of technology and are often perceived as being “technophobia” (Gilbert, Lee-Kelly, & Barton, 2003). Furthermore, Brosnan (1998) makes the proposition that apparent sex differences are due to the masculinising of technology. This has implications for the understanding of sex or psychological differences in technophobia. This is reflected by a recent survey by the American Association of University Women which found that girls possess the ability to learn and use computers but do not want to be associated with the “geeky” image of technical careers by “guys” tapping on the keyboard all day long (Gilbert, et al., 1997). This gender differentiation (bias) seems to be rooted in our social norms and has been embedded in our cultural and society.

According to Spotts, Bowman, and Mertz (1997), this social normative starts in preschool, in which males spend a considerable amount of time in computing and other technological activities than their female peers. The perceived cultural norms of femininity and masculinity, not physical or biological attributes should be the factors to consider when examining origins of technophobia and technology integration gender differences (Gilbert, et al, 1997). Venkatesh and Morris (2000) discovered “active involvement in computer
activities may ultimately translate into higher achievement for males in computer-based technology, both in academic and career settings” (p. 118). Furthermore, Bem and Allen (1974) have subsequently developed their gender schema theory, which proposes that sex typing is a learned phenomenon mediated by cognitive processing. Therefore, it is perceived that computing has developed a masculine image on par with the traditionally masculinized subjects such as mathematics, physics, and engineering (Gilbert, et al., 1997). Furthermore and according to the National Center for Education (2011) gender differences in program area were apparent among full-time faculty and instructional staff at 4-year institutions. Male-dominated fields included engineering (90 percent were male, 10 percent were female), the natural sciences (77 percent were male, 23 percent were female), and business (73 percent were male, 27 percent were female). Education was the only program area with a larger proportion of women than men (58 percent were female, 42 percent were male).

So far, the literature has supported the noticeable difference gender plays between men and women and their behaviors towards technology adoption and integration, where most of the research shows men to possess a higher probability to use technology in the workplace over women. Prior studies have highlighted the importance of gender differences in technology adoption and use (e.g. Brosan, 1998; Schumacher & Moraham-Martin, 2001; Stephan & El-Ganainey, 2007; Venkatesh & Morris, 2000; Venkatesh, Morris, & Ackermen, 2000; Whitley, 1997), but the results have been mixed (Kay, 1992; Rosen and Maguire, 1990) and not totally convincing. Using the TAM framework, the research of Vankatesh & Morris (2000) showed that “men considered perceived usefulness (PU) to a greater extent than women in making their decisions regarding the use of a new technology. On the other
hand, perceived ease of use (PEU) was more salient to women compared with men both after initial training and over time with increasing experience” (p. 128). This resulted in no significant difference between men and women because they both decided to adopt and integrate technology in the workplace, but chose to do so for different reasons. In addition, Brosnan (1998) highlights that in contexts where technology is not masculinized, there is no apparent variance between gender and psychological differences in aversion to technology. According to the research of Kotrlik & Smith (1989) they found no significant differences among males and females in anxiety towards technology. In a complete opposite finding of the U.S. study by Loch and Conger (1996), a recent study from China found that men were more notably affected by subjective norms, while women were more strongly influenced by their attitudes (Dong and Zhang, 2011). The study also found perceived behavior control was equal for men and women in China, but higher for men versus women in the US.

The body literature and research is not conclusive and very contradictory at times (Kotrlik & Smith, 1989; Lane & Lyle, 2011; Spotts, 1997). This could be best explained by the lack of specific research and literature on vocational and technical community college faculty, which could be a significant decision factor in actual technology adoption and integration of the vocational and technical community college faculty. Therefore, this study will investigate and evaluate the user trait of the gender construct and its significance in technology adoption and integration.
Number of Years of Experience and Technology Integration

The research provides some evidence on how the number of years an educator has been teaching or providing instruction effects their technology adoption and integration in the teaching and learning process. According to Rosenfeld & Martinez-Pons (2005), even though over 40 states have technology standards for K-12 students, teachers who have been in the field for more than 10 years often do not have the expertise to use technology with their students. In their study of how to prepare CTE teachers in K-12 and vocational and technical faculty at 2 year colleges, they discovered that entry level and beginner teachers and faculty reported frequent use of computers, Internet, and related technologies in their classroom instruction over those with 20+ years of experience who reported seldom use of such technology. However, the highest reported use of technology came from those educators with five to ten years of experience. They concluded since the younger teachers and faculty members most likely had prior experience with technology during their own educational and personnel experience, they felt more comfortable and were more experienced with technology (e.g. computers, Internet, and presentation equipment), whereas, the educators who had more experience in teaching did not possess the skill set nor were comfortable with the technology (Rosenfeld and Martinez-Pons, 2005). In the case of those educators who were in between, the researchers believed they had both technology experience and were comfortable using it, as well as, experience in the classroom and a good understanding of their own pedagogical or andragogical beliefs. Also, they showed that “the particular field of instruction influenced the level of technology use over the number of years of teaching or instruction of the discipline” (Rosenfeld and Martinez-Pons, 2005 p. 147). For example,
those educators who taught computers or engineering (sciences) utilized technology more than educators who taught English or psychology (social sciences). In addition, they surmised that it was not the number of years of teaching or instruction in the discipline, but the amount of time in training or teaching with technology that led them to utilize the technology as part of their teaching and learning pedagogy (Rosenfeld and Martinez-Pons, 2005).

In the article titled “How Teachers’ Uses of Technology Vary by Tenure and Longevity” by Russell, O’Dwyer, Bebell, and Tao, (2007) suggested there is evidence to support the hypothesis that newer teachers’ familiarity with technology leads to increased technology integration, a question remains about whether technology use is not only related to the number of years they have been in the teaching profession, but also the number of years they have been teaching at their current school or institution. They concluded that “actual technology adoption and integration is heavily influenced on the schools’ or institutions’ position on technology use by teachers and faculty in the classroom, which is highly encouraged and supported with various resources and training from administrators” (Russell, et al., 2007, p. 5).

According to Green, Alejandro, & Brown (2009), there is evidence to suggest that faculty members who are tenured, or on a tenure track are less motivated to use technology (teaching online course) than their non-tenured and adjunct faculty counterparts. The faculty state “they are discouraged by the amount of work it takes to develop, teach, and maintain the online course compared to face to face courses” (Green et al., 2009, p. 10). In addition, they must also put time into learning the technologies that are required to teach online, which at
times can change and require additional hours of preparation and training. Typically, the tenure and tenure track faculty have more years of teaching experience than non-tenured and adjunct and remain at the institution in which they have or will achieve tenure membership (Green et al., 2009). Therefore, the research is again contradictory in nature as there is no clear evidence that the number of years of teaching or instruction experience significantly impact teachers and faculty to adopt and integrate technology in their teaching and learning processes.

Since the scope of the literature seems quite wide, in terms of examining whether or not the number of years of teaching experience plays a significant role in the practice of technology adoption and integration for teachers and faculty members, it is difficult to determine if this factor impacts community college vocational and technical faculty. Therefore this study will examine and evaluate this factor and its’ significance in technology adoption and integration.

Technology Anxiety of Technology Integration

Even though there is a large amount of research on technology anxiety, most of it is specifically centered upon computer anxiety, there seems to be a lack of sufficient literature that examines faculty and teacher technology anxiety (of many other instructional devices and equipment, besides computers) in terms of adopting and integrating technology in their teaching and learning process. This large body of knowledge of computer anxiety will be
discussed first, and then crossover to specifically discuss faculty and teacher technology anxiety in the teaching and learning process.

The current body of literature examines both individual and educator levels of and the understanding of technology anxiety related to using computers (Bandura, 1988, 1994; Brosnan and Davidson, 1996; Chua, Chen & Wong, 1999; Redmann et al., 2003). Computer anxiety is defined as “a feeling of fear and apprehension felt by individuals when using computers or even considering the use of a computer” (Simonson, Maurer, Montag-Torardi, & Whitaker, 1987). Computers in the U. S. first emerged in the 1970s, and then began to populate and infiltrate the primary, secondary, and postsecondary schools and institutions in the early 1980s. This adoption and migration of computer technology into educational classrooms caused individuals to perceive its’ impact very differently. People’s perception of such computer technology was based upon their personal beliefs and experiences with computers, which were seen as either - competition, cooperator, or a powerful friend (Bauer & Kenton, 2005). Depending upon individual perceptions and beliefs, some of the teachers, faculty, and students saw the computer as a friend (a machine that could assist them in work or school), while others saw the computer as a foe (a machine that could replace them in the workplace and/or be very hard to operate) when arrived in the classroom (Gilbert, Lee-Kelley, & Barton, 2003). At first, most teachers and faculty saw it as a foe. According to the literature, the original research on computer anxiety focused upon computers as programs or instructional management tools using “word processors, databases, etc.” (Redmann, Kotrlik & Douglas, 2003 p. 32). It was seen as a standalone and specialized machine that only certain people could understand and operate. Computers then shifted towards a more interactive
(user friendly) machine or tool that could perform complicated calculations faster than humans could and store large volumes of data and files. It soon became one of the primary means to complete daily work tasks and school activities, thus turning out to be a friend (Johnson, Wisniewski, Kuhlemeyer, Isaacs, & Krzykowski, 2012).

Since computers and related technologies were rapidly expanding into the workplace and the education industry during the late 1980s, many individuals began to experience computer and computer related technology anxiety. This created a phenomenon called ‘non-adoption’ or ‘non-users’ of technology, which became rampant and frustrating for employers and administrators. This sparked the interest of researchers like Fred Davis to study and examine this phenomenon, which led him to develop his Technology Acceptance Model (TAM) that demonstrated the perceived usefulness (PU) construct of the model was the most influential determinant of an individual’s decision to use or not to use the given technology (Davis, 1993). According to Davis (1993), technology anxiety results from a user’s perception of the given technology and how it may or may not benefit them in some form or fashion. These perceptions result in a positive adoption of technology if the user perceives the technology will provide useful benefits beyond the efforts of learning how to operate the technology.

Previous research tried to determine if the computer anxiety was rooted in either computer attitudes or as a specific computer anxiety (Conrad & Munro, 2008). These studies attempted to assess computer anxiety which have resulted in the development of measurement scales (CARS) using Likert-type self-endorsements to rank anxiety creating
items. For example, the Computer Anxiety Scale (CAS) was developed by Heinssen, Glass & Knight (1987) to measure computer anxiety and positive attitudes to computers. The Computer Aversion Scale (CAS) was developed by Loyd & Gressard in 1984 and was based upon social learning theory and conceptualized computer anxiety as an aversion compromising three components: efficacy, reinforcement, and outcomes. These instruments played an important role in the studies, which captured the reasons why individuals exhibited behaviors of technology anxiety towards using computers. Most of the findings revealed that people simply did not fully understand the computer, which created uncertainty and a lack of trust, which ultimately led to anxiety of computer use (Bauer and Kenton, 2005; Ertmer, 1999; Redmann et al., 2003). In addition, Brosnan (1998) has shown the relationship between computer anxiety and demographic variables such as; age, gender, and academic qualifications should not be overlooked. For example, he surmises that females are likely to use computers only when they have a direct and useful purpose in their lives and that there is a convergence of the notions of attitude and computer anxiety to arrive at an overall concept of technophobia. Conversely, Rubin & Greene (1991) found that it is possible to explain apparent sex differences in personality and intelligence using psychological gender rather than biological sex (as cited in Gilbert et al., 2003). Since the literature contains some contradictory findings between computer anxiety and user demographics, this led most researchers to the conclusion that the most significant factor that influenced computer anxiety was their own level of computer experience or skills (Ertmer, 1999; Fletcher and Deeds, 1994; Gilbert, 2003). For example, Gilbert et al. (2003) discovered that those educators who had prior computer experience, either in their own education or place of employment, were
twice as likely not to exhibit signs of computer anxiety when required to perform their duties with a computer. Furthermore, prior experience with computers also increased the likelihood of those individuals who would be willing to use other types of technologies (Gilbert et al., 2003).

As discussed, computer anxiety has dominated the body of literature; however the more specific construct of faculty and teacher technology anxiety has begun to appear in more recent literature. This is evidence that the field is still growing, as more options of instructional technology devices become available, it continues to put pressure on faculty to overcome technology anxiety (Johnson, et al., 2012). Therefore, many educators will continue to consider and/or use instructional technology in their teaching and learning process. Technology anxiety is defined as “the inability of understanding and using specific types of technological devices and tools used in the workplace or classroom beyond the personal computer” (Conrad & Munro, 2008, p. 54).

According to Johnson et al., (2012), “the reluctance to design and teach online courses in higher education is often attributed to technology anxiety (p. 4). Many higher education faculty have not taught their courses in an online format, which requires several proficiencies in various instructional technologies. Johnson et al., (2012) recommends a faculty “boot-camp” style training program to alleviate technology anxiety. The training program includes specific and intentionally designed materials to support the faculty such as; faculty development, principles of andragogy, transferability of learning, technical equipment and software capabilities for online teaching and learning. To help support this notion, Cuban
(1999) states that professors and students at the university level have grown comfortable with e-mail and Web pages, but less than 10 percent of faculty use these technologies for teaching. Christensen (2002) further reports technology anxiety may be reduced if faculty members are taken through training which offers several stages of adoption. It is through these adoption stages instructors increases their confidence and competency levels when integrating technology into their coursework.

The digital divide exists not only between those who possess technology and those who do not, it extends to those (either personally or professionally) who know how to properly use such technology or not (Hare, Howard, & Pope, 2002). In higher education, as well as K-12, faculty are expected to have the latest knowledge, skills, and abilities (KSA) to integrate technology into their teaching and learning process. However, not all faculty members see the value or have adequate training to possess the required KSA for successful implementation of instructional technology (Northrup, 1997). Faculty members who do not embrace and learn the new technologies may not get promoted, receive poor student evaluations, and find themselves out of a job when things get tight (Shelton, 2012). To make matters even more challenging, today’s educational industry, driven by some tech-savvy administrators, faculty and students, are now dealing with wireless Internet and communications, along with mobile devices all over campus (Corbell & Valdes-Corbell, 2007). It seems apparent that several of these new technologies are showing up in the classrooms at a faster pace than faculty or curriculum can prepare for (Redmann & Kotrlik, 2004). For many faculty just the thought of having to learn one or two of these newer
technologies could increase their level of technology anxiety, especially for those who just recently overcame computer anxiety (Fabry & Higgs, 1997).

There are many new forms of educational technology that are emerging on the campuses of higher education such as; Ipod, MP3 Player, E-book Reader, PDA, USB drive, Smart Phone, Ultra-Mobile PC, Laptop/Tablet PC, Wikis, podcasts, blogs. These technologies take time to learn and become proficient and are not always intuitive in nature (Corbell & Valdes-Corbell, 2007). In addition, some faculty members may get embarrassed if their students know more about the technology than they do, as well as consuming large chunks of time to learn the technology, which is a major deterrent to acquiring the necessary KSA to effectively adopt and integrate technology in their teaching and learning process (Fabry & Higgins, 1997). There is a high level of certainty that faculty will continue to be faced with new and emerging educational and instructional technologies related to their practice. In order to be best prepared to for this trend, faculty and administrators must develop strategies to combat and overcome technology anxiety and try to stay ahead of the learning curve in order to best serve their students and institutional goals (Gilbert et al., 2003). As discussed, there are both human and psychological factors of technology anxiety that reside with individual faculty members. Even though some of the factors are related to user traits and demographic variables, that are not controllable, other factors such as; perceptions, training and resources can be influenced to assist faculty in over-coming their technology anxieties.
There is a gap in the literature that does not specifically address community college faculty technology anxiety beyond computer use, therefore, this study will examine the factors and variables that may impact the constructs of technology anxiety with additional instructional technology in hopes to better understand the reasons why and provide practical strategies to help reduce or eliminate the technology anxiety for the community college faculty.

Barriers to Technology Integration

There is an extensive body of literature that examines and evaluates the barriers to technology adoption and integration. The early research mainly focused on the barriers of computer technology and usage in both the secondary and postsecondary educational institutions (Cuban, 1993; Davis, Bagozzi, & Warshaw, 1989; Dusick & Yildrim, 2000). Many researchers in this field agreed the integration of the personal computer in the classroom had a significant ‘technology effect’ on the entire educational industry. However, for many teachers, faculty and administrators, this ‘technology effect’ was both positive and negative. On the positive side, it enhanced student learning and engagement, created efficiencies, and increased accesses. On the negative side, it created various barriers for some faculty who could or would not pursue technology adoption and integration. This negative ‘technology effect’ sparked the interest of researchers to better understand and explain the growing phenomenon (Bandura, 1988, 1994; Brosnan & Davidson, 1996; Chua, Chen and Wong, 1999; Davis, 1989; Moldafsky & Kwon, 1994; Redmann et al., 2003). This led the researchers to formulate a very important and common question “how can an institution
encourage their faculty members to move forward with using instructional technologies?” (Osika, Johnson, & Buteau, 2008, p. 1). The answer is, based upon a general consensus in the available literature, ‘the institution’s administration must reduce the identified barriers, while the faculty strive to overcome their specific barriers that prevent or hinder their ability to embrace and participate technology adoption and integration in the teaching and learning process’ (Abrahams, 2010).

Many researchers (Abrahams, 2010; Butler and Sellborn, 2002; Ertmer, 1999; Kotrlik & Redmann, 2004; Kotrlik & Redmann 2005; Osika et al., 2008; Rogers, 2000) have examined these teacher and faculty barriers to technology adoption and integration and have surmised there are both internal and external factors that comprise the constructs of technology use. In particular, Osika et al., (2008) states ”the most common internal factors that influence an instructor’s decision to incorporate technology in teaching are individual: Beliefs; Feelings of anxiety; Fears, preferences and perceptions; Feelings of competence” (p.2).

According to Kane, Sandretto, & Heath (2002), through her assessment of available research, asserts that “teachers personal beliefs, perceptions, attitudes, and orientations are correlated with their teaching practices” (Kane et al., 2002, p. 182). In other words, the decision to incorporate new pedagogy into teaching comes from what they learned and their feelings about themselves. Furthermore, Grasha & Hicks (2000, p. 3) found that teaching styles are based on “the needs, emotions, motives, beliefs, and attitudes of the teacher and that these teaching practices, when used positively are the force behind student success” (as
cited by Osika, et al., 2008). In addition, Ferguson (2004) builds on this notion and indicates that teachers’ decisions to integrate technology into instruction are based upon their teaching styles and strategies. Ferguson’s study places faculty into four types based upon their use of technology in instruction: first-wave (self-starters), second wave (traditionalist), third-wave (careerists), and fourth-wave (reluctant). It is the personal beliefs of each group that either encourage or hinder the use of technology in instruction. For example, the ‘reluctants’ are not enthusiastic when it involves technology integration because they believe in “superiority of the traditional models of learning” (Ferguson, 2004 p. 136). According to Albion & Ertmer (2003), these “teacher and faculty personal beliefs about technology use are formed during time spent in the classroom as either teachers or students” (p. 36). Regardless where teachers and faculty members form their pedagogical beliefs about using technology, it is important to make sure they improve their interaction with technology early in their career in order to overcome the technology barriers.

Computer apprehension or anxiety is related to psychological factors which can be addressed with the right instruction (Rovai & Childress, 2002/2003). As faculty members take courses that build self-efficacy and expand their knowledge, skills and ability of computers and related instructional technologies, it will minimize the anxiety they feel towards adopting and integrating technology into their classrooms and teaching and learning process (Osika, et al., 2008). Christensen (2002) further reports technology anxiety may be reduced if faculty members receive training and are guided through the stages of adoption. Through these adoption stages faculty increase their competency, which increase their confidence when integrating technology into coursework. To continue this notion, Ferguson
(2004), suggests those faculty who are contemplating technology adoption and integration find or get paired up with a fellow faculty member or mentor who has experience and is proficient with instructional technology in order to reduce anxiety.

Technology competency is another internal factor that influences faculty technology use. Technology incompetency is one of the main reasons faculty choose not to incorporate technology in their teaching and learning process. In fact, Goral (2000) found that “only ten percent of teachers feel ‘very well prepared’ to use computers and the Internet for classroom instruction” (p. 2). Among the other 90% who do not feel well prepared are those who have been in the field for ten or more years. This could be best explained by the fact that those faculty simply lack the skills need to integrate the technology because they have not been trained or exposed to technology early in their academic career (Rosen and Martinez-Pons, 2005). Furthermore, Bandura & Schunk (as cited in Ertmer, 2005) state “highlight the importance of building teachers’ confidence through successful experiences with small instructional changes before attempting larger changes” (p. 33). If all of these internal factors do not align with institutional or student goals and objectives, then the probably of technology adoption and integration success will be low to non-existent.

The external factors of the barriers to technology adoption and integration come from faculty demographics. In particular, age, gender, class size, and institutional support are the four main factors that affect technology use. “The demographic factors of age and gender are the most important factors that influence whether or not faculty members use technology” (Cooper, 2006, p. 311). As stated earlier, age does play a role on a faculty members
perception of technology use, in which younger faculty tend to have more experience with technology and therefore embrace it. The opposite is true for older faculty members, as they are more reluctant to include new technologies in their coursework and classrooms. In a study by Peluchette & Rust (2005) they discovered at the university level, those faculty in the middle of their careers can be either “allies or stubborn opponents as their institutions adjust to competitive pressures, revise programs to meet the needs of increasingly diverse students, and integrate new educational technologies” (p. 201). The reasons why this may be true is the fact that tenured faculty may not be compelled or motivated to use technology and the fact that older or senior faculty members may not have the skills or training to use such technology.

Another external factor is gender differences. As stated previously, male faculty have a tendency to rate their own knowledge and use of technology higher than female counterparts (Spotts, 1997). However, some female instructors take factors such as lack of time and professional advancement into consideration when deciding whether or not to integrate technology into the curriculum (Osika et al., 2008). In addition, Lumpe and Chambers (2001) posit female instructors believe administrators, students, equipment, and professionalism directly influence a person’s ability and motivation to be successful with technology integration.

The third external factor is class size. According to Pleuchette & Rust (2005), when faculty members use instructional technology such as email and discussion boards, large classes can be more difficult to manage, especially when teaching an online course.
According to Kelly & Maushak (2004), there is no answer to the question of what is the ideal class size, as subject matter as well as the types of assignments instructors use are factors to take into consideration when integrating technology into the curriculum. In other words, it is difficult to predict the most effective (revenue versus quality) class size for a technology rich course because the instructor has determined the course content based upon previous classroom predictions and then makes adjustments as needed.

The final external factor is institutional support, which encompasses a wide range of topics including faculty development, ease of access, policies and procedures, and technical support. Osika et al., (2006) explained successful technology programs require a lot of support from many different departments throughout the institution. This notion was also supported by the Allen & Seaman (2008) study where those institutions that were most successful with their on-line and instructional technologies also had included technology initiatives as part of their long term strategies. Therefore, if a higher education institution is serious about adopting and integrating technology for their students and faculty on their campus, they must buy into the initiative and support it both financially and strategically.

David Abrahams (2010) conducted a study at a mid-western university in the U.S. using Roger’s (2003) diffusion theory of innovation to examine the barriers faculty experience when trying to adopt and integrate technology in their teaching and learning process. Even though the study was very detailed and used concept mapping, along pattern matching analysis, it was revealed there are seven common barriers such as; perception; resistance to change; technological support, financial support, infrastructure;
knowledge/information; technophobia. The second objective of the study advocated developing a systematic process in determining and remedying an institutions technology adoption and integration barriers. Abrahams developed the six step model which includes; defining study objectives and selecting participants at random; use focus statements to guide the brainstorming sessions; statements are structured through participants sorting and rating ideas into schemes; conduct multivariate analysis to generate concept maps; conduct map interpretation; use results to develop: strategic plans, reports, measurements, needs assessment, program goals, and objectives (Abrahams, 2010).

It is clear that successful faculty technology adoption and integration in the classroom and the teaching and learning process is a complex issue facing many higher education institutions. Therefore, institutions and faculty must first start with a thorough understanding of both the internal and external factors of the technology barriers of the faculty member because they are the most crucial factor and play a significant role in the implementation of instructional technology. The second requirement is to develop practical and timely strategies in eliminating and overcome the barriers and make sure the faculty members have the resources and training to handle technology adoption and integration. Complete collaboration and positive attitudes are also recommended for a successful outcome.

Higher Education Facts

According to the National Center for Education (2011), as of the fall 2009 semester, degree granting postsecondary institutions that were qualified for Title IV eligible funding,
including two and four colleges and universities, employed 1.4 million faculty (comprised of .7 million of each full-time and pat-time status), who provided instruction for 21 million students. Of those 1.4 million faculty, 47.5% were tenured, 20.6% were on tenure track, 23.7% were not on tenure track, and 8.3% had no tenure track at the institution. As of the fall 2003 semester, just over .5 million faculty housed in approximately 5,700 postsecondary institutions, awarded 10.6 million degrees to students who were seeking career fields (often referred to as CTE and vocational and technical programs). The largest group of career faculty taught in public 4-year institutions (39 percent), followed by public 2-year institutions (34 percent) and private not-for-profit institutions (26 percent), and trailed by private not-for-profit 2 year institutions (1 percent). In addition, career education represented a substantial percentage of the total undergraduate enterprise: 90 percent of institutions offered programs in career fields in 2005 and 63-67 percent of students majored in this area. The three largest postsecondary career teaching fields in the fall 2003 semester were health (109,000 teaching faculty), education (95,000 teaching faculty), and business (82,000 teaching faculty) at both 2 and 4 year schools (IES CTE 1990-2005 Report, 2005). The higher education industry continues to grow in size, direction, and enrollment, with the largest increase coming from the CTE and the vocational and technical segments of the degree offerings. With this steady enrollment and program growth, along with the demands from policy makers and local employers, the higher education industry must be properly prepared to educate and train students through the effective and efficient use of instructional technology of their faculty members and institution.
Summary

A review of the related literature provided a historical review of technology in higher education, which provided an insight to the progression and types of instructional technologies throughout the last century. A review of technology adoption and technology integration was, discussed to examine their similar but distinct characteristics and constructs. The literature review also explained Davis’ Technology Acceptance Model (TAM) which serves as the theoretical framework for this study to examine the technology adoption and integration levels of North Carolina community college vocational and technical faculty in their teaching and learning process. The Kotrlik & Redmann Technology Integration Scale (KRTIS) was evaluated to help identify faculty using technology integration. Finally, the literature review explored and evaluated factors and variables that motivate, influence and determine technology adoption and integration in teachers and faculty.
CHAPTER THREE

METHODOLOGY

The methodology chapter provides an overview of the methods and research design that were utilized to conduct the research study. It will begin with a brief introduction and description of the various methods and research design the researcher selected. The researcher will then provide a detailed discussion on the participants, sampling plan, instrument used, data collection information, and finally the data analysis, followed by expected results and brief conclusion of the methodology.

Introduction

This study utilized a quantitative, non-experimental research design. According to Creswell (2009), “quantitative research is a means for testing objective theories by examining the relationship among variables. These variables, in turn, can be measured, typically on instruments, so that numbered data can be analyzed using statistical procedures” (p.4). In addition, quantitative research collects raw data which is then converted into numerical equivalents that are necessary to describe the data in order to determine whether or not it supports the researcher’s hypothesis (Wysocki, 2008).

In both experimental and non-experimental (often called survey design) research the results or findings from a sample are generalized to a population; however, “the basic intent of an experimental design is to test the impact of a treatment (or intervention) on an outcome,
controlling for all other factors that might influence that outcome” (Creswell, 2009, p. 145). The non-experimental research design does not have an experimental variable but does have variables that can be measured (Sproull, 1995). According to Johnson (2001) a significant amount of quantitative higher education research comes from non-experimental designs because there are many important variables and factors that are of interest that cannot be manipulated. Furthermore, Johnson (2001), states that in non-experimental design there are two elements to consider; the research objective and the time dimension. Johnson (2001) suggests the research objective element should evaluate whether the study is descriptive, predictive, or explanatory. The time element identifies if the design of the study is cross-sectional, longitudinal, or retrospective.

Based upon the intent and scope of the study, along with the methodology options, the researcher selected a quantitative and non-experimental research design. This research design was selected in order to best support the examination of the relationship(s) among faculty variables and factors to determine their level of technology adoption and integration decisions and behaviors, without having to introduce or manage a treatment or intervention. Under the non-experimental design, the explanatory element was chosen to describe the reasons for the correlations and relationships among the variables and factors. The cross sectional element was also selected to support the various faculty groups (disciplines) of the population and within the allotted time that was available for the study.

This study implemented a non-experimental quantitative survey consisting of explanatory and cross sectional elements as the research design. As previously stated, there
are many studies that have explored, examined and documented the utilization of technology in the classroom and the teaching-learning process which has increased student learning and provided efficiencies (Brown, Goyal, & Venkatesh, 2012; Redmann & Kotrlik, 2004; Redmann & Kotrlik, 2005; Thirunarayanan & Perez-Prado, 2005; Vankatesk & Davis, 1986). However, there has not been a study specifically focused on vocational and technical faculty in community colleges who are considering technology adoption and integration in their teaching and learning process. Therefore, there is a need for further exploration of this technology integration movement in higher education.

Research Design

Much consideration was given to this quantitative, non-experimental research design, which is the development of a plan which usually includes specification of the elements to be examined and the procedures to be used in the study (Sproull, 1995). In order to create a study that examines faculty who are considering technology adoption and integration in their teaching and learning process, a non-experimental quantitative descriptive survey, which utilized explanatory and cross-sectional elements, was selected for the research design. The quantitative descriptive design allows the researcher to assign numerical values to the variables and factors which can be used in statistical analysis to provide empirical evidence to support proposed questions and hypotheses (Wysocki, 2008).

Experimental research, which typically manipulates one or more of the independent variables in order to see the effects on the dependant variable in a ‘cause and effect’ outcome
(Sproull, 1995). In addition, Wysocki (2008) proposes that experimental design can be classified into three main types: true experimental design, quasi-experimental design, and double-blind procedures. All of these experimental designs require an in depth approach with multiple and easy access to the sample population. Sproull (1995) proposes that in non-experimental survey design the process is typically consistent, but the main difference is the study’s ability to prove a ‘cause and effect’ outcome due to the lack of control over the independent and dependant variables. Furthermore, non-experimental research conclusions are based on correlational procedures which reflect the association or relationship between or among variables but never that one variable causes another (Sproull, 1995). According to Sprull (1995), non-experimental research is important but does not include the highly controlled aspects (manipulation, intervention or treatments of the variables) typically found in experimental research, which allows the researcher to assume true cause and effect. As Trochim & Donnelly (2008) point out, “if random assignment to groups are not used and if multiple groups or multiple waves of measurements are not used, it is classified as non-experimental design (p. 174).

Explanatory research seeks to identify the causes and effects, under the correlation and relationship approach, of some phenomenon based upon the studies’ description or findings (Wysocki, 2008). Once explored and a good description is established, the researcher may wonder about it; leading them to ponder questions like “Why it happens the way it does?” or “Does it occur in the way you think it does?” in order to identify a possible explanation (Wysocki, 2008, p. 62). In other words, based upon the results, can the researcher assign some type of reasonable explanation for the outcome?
According to Sproull (1995) “A cross sectional design examines characteristics of samples from different populations during the same time period” (p. 372). This allows the researcher to receive data from various participants across the entire population at one specific point in time, which provides some consistency and ease of the collected data. For example, this study will examine the technology integration levels of vocational and technical faculty in various disciplines within the NCCCS during one survey opportunity at the beginning of the 2013 fall semester. Therefore, a non-experimental quantitative-descriptive, explanatory, cross-sectional survey design was developed.

A self-administered survey was adopted, revised, and approved for use to collect information from a sample to infer or generalize to a larger population (Trochim & Donnelly, 2008). This specific survey was chosen to obtain data from the vocational and technical faculty perceptions of their level of technology use, barriers and anxiety of technology use, types of technology available for use in teaching-learning, along with some demographic information.

Therefore, this research design of a quantitative, non-experimental study was developed to meet the study’s intent and followed the purpose of the non-experimental design in terms of identifying relationships among or between variables and factors, which will be observed or measured (Sproull, 1995). Through survey questions and participant responses, this study provided an element of predictability and understanding of the level of technology adoption and integration of vocational and technical faculty, which was better explained.
Participants

The targeted population for this study includes all full-time vocational and technical faculty in the North Carolina Community College System (NCCCS), which is comprised of 58 individual institutions throughout the 100 counties in the state of North Carolina. This population provides instruction to students in 98 different Associates of Applied Science (AAS), degree programs, one year diploma, and certificate programs ranging from Accounting to Welding (NCCCS, 2013). See appendix C for a complete list of all the applicable programs. These 98 programs are divided among ten different occupational program areas in which the estimated 3,562 full time vocational and technical faculty teach. The ten occupational program areas consists of: Agricultural and Natural Resources Technologies, Biological and Chemical Technologies, Business Technologies, Commercial and Artistic Technologies, Construction Technologies, Engineering Technologies, Health Sciences, Industrial Technologies, Public Service Technologies and Transport Systems Technologies. The frame for this study was provided by the NCCCS Office (NCCCS, 2013), which included the Fall 2012 headcount of all full-time faculty by area of instruction, which had to be categorized into the ten different occupational programs that form the vocational and technical division of the institutions. Also, college transfer, part time faculty, and related faculty were not included in the headcount. Table 3.1 below shows the frame of this study.
Table 3.1 *Student Enrollment and Number of Faculty by Occupational Program Area (Fall 2012).*

<table>
<thead>
<tr>
<th>NCCCS Program Area</th>
<th>Student Enrollment Fall 2012</th>
<th>Number of Faculty Fall 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural and Natural Resources Tech</td>
<td>1,704</td>
<td>86</td>
</tr>
<tr>
<td>Biological and Chemical Technologies</td>
<td>747</td>
<td>17</td>
</tr>
<tr>
<td>Business Technologies</td>
<td>37,528</td>
<td>795</td>
</tr>
<tr>
<td>Commercial &amp; Artistic Production Tech</td>
<td>3,151</td>
<td>56</td>
</tr>
<tr>
<td>Construction Technologies</td>
<td>4,223</td>
<td>65</td>
</tr>
<tr>
<td>Engineering Technologies</td>
<td>4,899</td>
<td>317</td>
</tr>
<tr>
<td>Health Sciences</td>
<td>22,594</td>
<td>1,058</td>
</tr>
<tr>
<td>Industrial Technologies</td>
<td>5,192</td>
<td>282</td>
</tr>
<tr>
<td>Public Service Technologies</td>
<td>32,806</td>
<td>695</td>
</tr>
<tr>
<td>Transport Systems Technologies</td>
<td>5,308</td>
<td>191</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>118,152</strong></td>
<td><strong>3,562</strong></td>
</tr>
</tbody>
</table>

Note: Information received from the North Carolina Community College System Office 2013.

These participants are the targeted population of the study. Since there was not a single comprehensive list of all the full time vocational and technical faculty, the NCCCS suggested contacting each individual institution and determine the single best contact person to properly notify the qualified faculty members. This would assist with the proper distribution of information and the survey link since many institutions have their own organizational structure and program offerings. Typically, this would be a President, Vice
President or Dean level position. Therefore, the researcher chose to contact each of the 58 community college Presidents or known VP of instruction to support and assist the proper distribution of the survey information and survey link.

Sampling

According to Sproull (1995), a population consists of all members of a defined group or category of elements such as people, events, or objects. The population of this study is all full-time vocational and technical faculty who are in one of the 58 community colleges in the NCCCS. Instead of using selected or random institutions to serve as the sample, this study included all 58 institutions, knowing that not all of the targeted population will participate in the survey. However, to be sure a sufficient sample is obtained to satisfy the statistical component of the data analysis; a sampling plan will be created. According to Trochim & Donnelly (2008) sampling is defined as “the process of drawing a subset of people or objects from a population so that results with a subset may be generalized to the population (p. 36). In this study the targeted sample is all full time vocational and technical faculty in the NCCCS who officially respond to the survey that was sent to all the Presidents or VPs at each of 58 institutions for distribution to their specific qualified faculty. Since there is no official listserve of this population the researcher decided it would be best to contact each individual institution to seek support and guidance in which the President of VP could much easier determine their own qualified faculty who could be included in the study. This approach will help ensure direct support from a local administrator, as well as, provide a
wide reach of qualified faculty members, instead of just a blind email from an unknown researcher.

In order to be considered a vocational and technical faculty member in this study the survey respondent must be a full time faculty member who provides instruction in a program that is in at least one the ten occupational program areas of the NCCCS as their primary duties at the institution. Since there are so many community colleges in the state and the fact each one determines which programs go into either vocational or technical category, this program distinction will be made and be stated in the survey information and instructions and to inform the Presidents and VPs. These ten occupational programs are defined as: Agricultural and Natural Resources Technologies; Engineering Technologies; Biological and Chemical Technologies; Health Sciences; Business Technologies; Industrial Technologies; Commercial & Artistic Production Technologies; Public Service Technologies; Construction Technologies; Transport Systems Technologies.

These ten occupational program areas encompass the 98 vocational and technical programs that are offered by the NCCCS. There are approximately 3,562 faculty who teach in these programs and possess a wide range of perceptions about technology adoption and integration. Even though the survey will be sent to each institution, with a request of President and VP endorsement and assistance to forward it to their entire vocational and technical faculty, there is a possibility that the responses received might not be equally represented between the ten program areas. It is important to obtain a representative sample in order to infer findings to the entire population in the study (Wysocki, 2008). Obtaining a
good representative sample is the most important purpose in developing a sampling plan (Sproull, 1995). To ensure there is equal input from all ten program areas, a stratified sample was selected. According to Trochim & Donnelly (2008), stratified sampling involves dividing the population into homogeneous subgroups (called stratum) and then taking a simple random sample in each subgroup. The selected strata are based on the different amounts or category of a variable that may be related or associated with the major variable (Trochim & Donnelly, 2008). The study strived to obtain key information on all subgroups in order to explain any differences, while generalizing to the larger population as a whole. In addition, stratified sampling will incorporate all the advantages of a random sampling, and increase the precision of the analysis because of its homogenous groupings (Sproull, 1995). Furthermore, stratified sampling has more statistical precision than random sampling if the strata or groups are homogeneous, which creates lower variability within the groups than the variability for the population (Trochim & Donnelly, 2008). The major advantages of the stratified samplings are; it can control for variables that are possible sources of influence on the major variable; it yields excellent results because it provides a bias-free sample and controls for those variables used in the stratification process (Sproull, 1995).

In order to accurately obtain applicable findings and then generalize to a population from a survey research the sample size must be statistically sound and measurable (Trochim & Donnelly, 2008). According to Bartlett, Kotrlik & Higgins (2001), “the determination of sample size is a common task for many organizational researchers. Inappropriate, inadequate, or excessive sample sizes continue to influence the quality and accuracy of research” (p. 43). Trochim & Donnelly (2008) explain that it is important to not only define the primary
variable, but to determine an acceptable sample size from it too. Proper sample size selection is imperative for the study to be recognized as sound and statistically robust, but is often not sufficient and routinely criticized by other readers (Holosko, 2006). This study’s primary variable was technology integration. Therefore, the sample size was determined and calculated based on the Cochran formula below, which took into consideration the KRTIS and TAM scale of a five response item. According to Bartlett, Koterlik & Higgins (2001), research that identifies its primary variable as continuous, the study should use Cochran’s sample size formula as follows:

\[
    n = \frac{(t)^2 \times (s)^2}{(d)^2}
\]

\(t = \) “the level of risk the researcher is willing to take that true margin of error may exceed the acceptable margin of error” (Bartlett et al., 2001, p. 45). The acceptable margin for error is .05 (\(t = 1.96\)).

\(s = \) “estimate of standard deviation in the population” (Bartlett et al., 2001, p. 45). This study uses a five point scale and 98% of the data will fall within six standard deviations.

\(d = \) “acceptable margin of error for mean being estimated” (Bartlett et al., 2001, p. 45). The acceptable margin of error for this study is .02.

\[
    n = \frac{(1.96)^2 \times (5/6)^2}{(5 \times .02)^2} = \frac{3.84 \times .694}{.01} = \frac{2.664}{.01} = 266
\]

Therefore, the sample size should be at least 266 survey responses to be returned. However, since this sample size exceeds more than five percent of the population (3,562 *
.05 = 178), Cochran’s (1997) correction formula should be used to calculate the final sample size (as cited by Bartlett, et al., 2001).

\[
\frac{n_1}{n_0} = \frac{266}{(1 + \frac{n_0}{\text{Population}})} = \frac{266}{(1 + \frac{266}{3,562})} = \frac{266}{(1 + 0.07467)} = \frac{266}{1.0746} = 248
\]

Where population size = 3,562

Where \(n_0\) = “required return sample size according to Cochran’s formula” = 266 (Bartlett et al., 2001, p. 46).

Where \(n_1\) = “required return sample size because sample is > 5% of the population. (Bartlett et al., 2001, p. 46).

Therefore, the adjusted minimum sample size for delivered surveys is 248. However, Bartlett et al., (2001) suggests researchers need to account for the anticipated response rates. Since the minimum sample size has been established at 248, it is crucial to adjust for non-respondents based upon previous response rates. In social science research low response rates can impact a study’s ability to be statistically sound and consider valid (Trochim & Donnelly, 2008). According to Redmann & Kotrlik (2003), previous response rates with this type of population have varied between 50 and 57 percent. Therefore, the researcher selected a conservative estimate of a 30 percent response rate (248/.30) due to these previous response rates and the fact the survey is voluntary and would be self-administered via email, which would require the obtainment of a sample size of at least 826 participants. Since this study
utilized a stratified sampling method the calculations for each subgroup is denoted in Table 3.2 below.

Table 3.2 *Stratified Sample Calculations for Vocational and Technical faculty of the NCCCS*

<table>
<thead>
<tr>
<th>NCCCS Program Area</th>
<th>Faculty per Program Discipline</th>
<th>Discipline Total</th>
<th>Divided by Sample Size</th>
<th>Sample to be Collected from Each Discipline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural/Natural Resources</td>
<td>86</td>
<td>0.024143</td>
<td>19.94</td>
<td>20</td>
</tr>
<tr>
<td>Biological/Chemical</td>
<td>17</td>
<td>0.004772</td>
<td>3.94</td>
<td>4</td>
</tr>
<tr>
<td>Business Tech</td>
<td>795</td>
<td>0.223189</td>
<td>184.36</td>
<td>185</td>
</tr>
<tr>
<td>Commercial/Artistic Production</td>
<td>56</td>
<td>0.015721</td>
<td>12.98</td>
<td>13</td>
</tr>
<tr>
<td>Construction Tech</td>
<td>65</td>
<td>0.018248</td>
<td>15.07</td>
<td>16</td>
</tr>
<tr>
<td>Engineering Tech</td>
<td>317</td>
<td>0.088994</td>
<td>73.50</td>
<td>74</td>
</tr>
<tr>
<td>Health Sciences</td>
<td>1,058</td>
<td>0.297024</td>
<td>245.34</td>
<td>246</td>
</tr>
<tr>
<td>Industrial Tech</td>
<td>282</td>
<td>0.079165</td>
<td>65.39</td>
<td>66</td>
</tr>
<tr>
<td>Public Service Tech</td>
<td>695</td>
<td>0.195115</td>
<td>161.16</td>
<td>162</td>
</tr>
<tr>
<td>Transport Systems Tech</td>
<td>191</td>
<td>0.053621</td>
<td>44.29</td>
<td>45</td>
</tr>
</tbody>
</table>

*Note.* Calculated stratified sample to be collected from the survey.

The researcher desired a minimum sample size of 826 participants and to obtain the identified quantities in Table 3.2 of the stratified sample to be collected from each discipline to satisfy the sampling plan. However, the actual number of participants may vary and will
be denoted in the results of the study. According to Sproull (1995), sampling error is defined as “the difference between the parameter value and the sample estimate of the parameter value which occurs when sampling from a population” (p. 122). Therefore, a proper stratified sampling plan was created using Cochran’s formula and using the guidelines from Bartlett et al., (2001). This led the researcher to try and obtain at least 826 responses. Sample surveys have potential sources of bias that include; missing data, sampling bias, response bias, and non-response bias (Agresti & Finlay, 2009). According to Hair et al. (2006), the impact of missing data can cause a reduction in the actual sample size and sometimes exclude a certain individuals within the group known as the ‘hidden bias’ (p. 50). In order to control for these bias’ probability sampling and minimum sample size were utilized as previously mentioned. For the response bias the survey questions, which were derived from the proven TAM and KRTIS instruments, have been determined to consist of high and established validity and reliability based upon previous research by Redmann & Kotrlik (2005) and Davis & Venkatesh (1996) and are reported in the instrumentation section of the study. In addition, a comparison of early and late survey responses were reviewed to determine if any incorrect responses were given and if the question wording or order was confusing or misleading. According to Agresti & Finlay (2009), “Poorly worded or confusing questions result in response bias” and in some cases even the order of the questions can influence the outcomes dramatically (p. 20).

Furthermore, the researcher was able to include all 58 of the institutions in which the entire faculty belong to and offered incentives to motivate and capture those participants who refuse or fail to answer some questions. This study also used descriptive statistics to compare
the faculty technology integration level and perceived ease of use and usefulness form the responses of the participants. In order to provide the best generalization to all ten of the vocational and technical program areas, the study followed previous research methods and recognized guidelines to obtain the best sample size in order to research all participants from the sampling frame provide, while controlling for all of the possible response bias.

Instrumentation

This study utilized two separate instruments that were based on existing research instruments, in the form of surveys, to capture and measure response data from the individuals who participated in this research. According to Trochim & Donnelly (2008), a method to measure the variables and factors from the sampled participants is required in order to manage and analyze the data. Sproull (1995) suggests using an instrument to assist in the measurement of these variables and factors. He defines an instrument as “whatever device is used to measure variables, which can range from written to oral materials to physical devices” (p. 177). A few examples of the various types of instruments include; questionnaires, rating scales, skills sets, checklists, materials created by the researcher (Sproull, 1995). For this study, the researcher considered several types of instruments in the obtainment of participant data, including the questionnaire and checklists options. However, the instrumentation research suggests that in social and behavioral science research there are two major types of instruments used by most researchers (Babbie, 2008). According to Babbie (2008), there are commercially published and established scales that have proven
validity and reliability measurements, which can be purchased for use in others’ research. In addition, there are noncommercial published scales that have been developed by previous researchers for their specific research area or field of study which may be granted approval for use in new research. In addition to deciding which instrument to utilize in the study, a few other considerations must be determined; the instrument must measure the variables accurately, are properly valid and reliable, yields the appropriate level of measurement, requires appropriate amount of time, is easy to administer and interpret, and is in the researchers budget and best supports the research objectives (Sproull, 1995).

Due to all of the various choices in selecting an instrument for a study, it is crucial that the researcher selects the best instrument to support the data collection method of the study. Sproull (1995) states, “before you make the choice of selecting or designing, remember that the data collection method selected often determines the type of instrument used” (p. 178). Considering all of the elements and options of using an instrument the survey/questionnaire was selected to best support this study. Therefore, a slightly customized, but proven survey to understand and measure vocational and technical community college faculty perceptions of technology adoption and integration was developed from several other established and statistically sound instruments for this study. In order to effectively reach such a large sample size and to remain within budget and the required time frame, a self-administered survey was administered over the intranet using the surveymonkey platform (Surveymonkey.com). In educational research, the practice of using and sending self-administered surveys through the Internet are widely used and accepted because of their benefits such as; to easily reach a mass audience, ease and convenience, low
costs, and timely feedback (Trochim & Donnelly, 2008). This survey methodology would support the researcher’s goals, while meeting the parameters of the study and allow the community college vocational and technical faculty to have awareness and access to the survey.

The first instrument that was developed and utilized in this study came from Venkatesh & Davis’s (1996) improved TAM, which is also this study’s theoretical framework. This study’s first instrument was comprised of a total of 12 questions, in which six questions from each of the two constructs (PU and PEOU) were included in the survey, to better understand the perceptions of technology use by the faculty members. See appendix C for this instrument.

Davis spent a considerable amount of time and energy in achieving a robust model by obtaining such high reliability and validity values through continued development, testing, and refinement of the TAM. This is how Davis went about in the creation of the TAM. According to Davis (1989), a step by step process was used to develop multi-item scales which had high reliability and validity elements. In previous literature the conceptual definitions of perceived usefulness and perceive ease of use were used to generate approximately 14 candidate items for each of the two constructs (Davis, 1989). In addition, pre-test interviews were conducted to evaluate the semantic content of the generated items, with those best fitting the definitions of the constructs were retained, which yielded ten items for each construct (Davis, 1989). Then Davis conducted a field study (pilot study) on 112 users to help determine reliability, convergent validity, discriminant validity, and factorial, in
which the item scales were further defined and reduced to six items per construct, which became the final version of the TAM (Davis, 1989). This final TAM was refined and maintained reliability and validity which focused more on behavior than attitude and is widely used in various studies (Venkatesh & Davis, 1996).

The reliability of the instrument was then calculated using Cronbach’s alpha for each construct, which resulted with a .97 for perceived usefulness and a .91 for perceived ease of use (Davis, 1989). Both of these constructs measure of reliability were very high, as reliability is usually measured in the range of 0 to 1, with values of .60 to .70, being the lower limit of acceptability (Hair, Black, Babin, Anderson, & Tatham, 2006). Next, convergent and discriminant validity were tested using multitrait-multimethod (MTMM) analysis. According to Davis (1989) the MTMM matrix contains the inter-correlations of items (methods) applied to the two different test systems (traits or constructs). Convergent validity refers to whether the items comprising a scale behave as if they were measuring a common underlying construct (Davis, 1989). In order to demonstrate convergent validity, items that measure the same trait or construct should correlate highly with one another (Davis, 1989). For perceived usefulness, the MTMM correlations were all 90 monotrait-heteromethod correlations were significant and perceived ease of use was at 86 out of 90 or 95.6% (Davis, 1989).

The discriminant validity is concerned with the ability of a measurement item to differentiate between objects being measured (Davis, 1989). The test for discriminant validity is that an item should correlate more highly with other items intended to measure the
same trait than with either the same item used to measure a different trait or with different items used to measure a different trait (Davis, 1989). This would reduce the presence of “common method variance” as well. For perceived usefulness, 1,800 such comparisons were confirmed without exception and for perceived ease of use only 58 exceptions or 3% were found (Davis, 1989). Therefore, the discriminant validity test revealed that perceived usefulness and ease of use scales possess a high concentration of trait variance and are not strongly influenced by methodological artifacts (Davis, 1989).

A second instrument was developed for this study which came from the research of Kotrlik & Redmann (2004). See appendix F for details. This second instrument was based on Kotrlik & Redmann’s instrumentation called (KRIS), which was utilized to analyze technology integration of individuals. This instrument incorporated the technology integration scale (KRTIS), the barriers to technology scale (KRBT) and the technology anxiety scale (KRTAS). The technology integration scale (KRTIS) contained two subscales: adoption and integration, which was two less than the prior KRIS instrument. According to Kotrlik, the two previous subscales of technology exploration and experimentation were no longer seen as of interest since most all teachers and faculty members are beyond that phase of teaching with technology J.W. Kotrlik. (personal communication, September 11, 2012). In addition, the scale contained questions pertaining to sources of technology training, types of technology available for use in teaching, and some demographic parameters. All of these scales and related items were developed by Redmann & Kotrlik after reviewing the literature and the face and content validity were evaluated by an expert panel of career and technical educators” (Redmann et al., 2003 p. 35). The instrument was also pilot tested with 29
teachers of marketing, business, family, and consumer sciences, and agricultural (Redmann, et al., 2003). The standards for instrument reliability for Cronbach's alpha by Robinson, Shaver, & Wrightsman (1991) were used to judge the quality of the three scales in the instrument (as cited in Redmann, et al., 2003):

- .80-1.00 = exemplary reliability
- .70-.79 - extensive reliability
- .60-.69 = moderate reliability, and < .60 = minimal reliability

Using these standards, all scales possessed exemplary reliability based on the following results:

- Technology Integration = .92
- Adoption subscale = .97
- Barriers Scale = .82

(Redmann, Kotrlik, & Douglas 2003, p. 35)

For this study, only the technology adoption subscale, technology integration and technology barrier & anxiety scales were utilized due to being beyond the technology exploration and experimental phases of teaching with technology.
Data Collection

This study’s data collection plan incorporated web based survey research dimensions from several well known researchers and studies in the social and behavioral sciences. According to Trochim & Donnelly (2008), data collection is defined as “the process of preparing, collecting, and storing data or facts for the purpose of turning it into usable information to keep on record, to make decisions about important issues, or to pass information on to others” (p. 112). This definition is supported by Sproull (1995) who suggests that the data collection method is the means by which information about variables are collected and then analyzed. Researchers can use four different methods to collect data which include; interviewing, observation, instrument administration, and examination of documents (Trochim & Donnelly, 2008). The researcher decided to utilize the instrument administration option because it was the most feasible method to support the nature, size, timeliness, and location of the participants of the study. Instrument administration is a data collection methods in which participants respond to questions, tasks, scales, or other such devices of obtaining information (Sproull, 1995). According to Babbie (2007), these instruments can be administered in several different ways such as; face to face, telephone, mail, or online formats. Dillman (2007) suggests the researcher should align their specific study parameters with the most appropriate survey format that yields the highest and most accurate response rates.

Since this study used an electronic survey delivered via the Internet, several factors needed to be considered to ensure a positive, accurate, and successful return of responses.
According to Birnbaum (2004), some of the advantages and disadvantages of using the World Wide Web (Internet) include:

The advantages are the efficiency of recruiting large, heterogeneous samples quickly, recruit specialized samples (people with rare characteristics), and standardized procedures, making studies easy to replicate. Alternative programming techniques (procedures for data collection) are compared, including client side as opposed to server-side programming. However, web studies have methodology problems; for example, higher rates of drop out and of repeated participation. Web studies must be thoroughly analyzed and tested before launching on-line. (Birnbaum, 2004, p. 803)

These concerns are further supported by Dillman & Bowker (2000) who suggest doing surveys on the world wide web is challenging and often overlook the four types of survey errors such as; sampling, coverage, measurement and non-response. Also, Dillman and Smyth (2007) suggest the following elements are considered when developing web survey designs; articulate questions and options clearly, use ‘bells and whistles’ sparingly, avoid borrowing question wording and formats from other surveys, evaluate it before sending, use design elements with consistency and regularity.

These Internet survey concerns were addressed by the adoption and implementation of research findings from Dillman & Smyth (2007) who suggested that multiple contacts are essential for maximizing response to surveys. He also stated “there are five levels of contact the researcher needs to engage the participants which include; a brief pre-notification letter, questionnaire mailing with a detailed cover letter, a thank you postcard, replacement questionnaire (if needed), and a final contact” (Dillman & Smyth, 2007, p. 303). Therefore, the researcher made sure all participants received a pre-notification email which included all of the suggestions of Dillman & Smyth (2007). Dillman & Smyth’s (2007) suggestions for a pre-notification included; a description of the research, what will occur in the study, the
scope and usefulness of the study, a sincere thank you, signature of the researcher, and a
token incentive. Since the pre-notification letter was the first correspondence in a series of
email notifications, it was important to address any and all returned (undeliverable) emails by
verifying the email address and resending the pre-notification letter to make sure all 58
institutions at least receive the pre-notification letter. If for some reason the President or Vice
President or designee’s email address is still undeliverable or not opened, the researcher will
follow up with a phone call to ensure delivery of the survey. This will help ensure that every
North Carolina community college in the state (all 58) has an equal chance of participating
and to meet the minimum sample size as denoted in the sampling plan. Once the pre-
notification letter is properly delivered, the participants will receive a consent form and link
to the survey two days later. This second email included Dillman & Smyth’s (2007) criteria
such as; a description of the research, what will occur in the study, the scope and usefulness
of the study, a sincere thank you, signature of the researcher, and a token incentive. One
week after the second email (participant consent and link to the actual survey), respondents
who completed the survey received a thank you note directly from the researcher, which was
the third (1) email. For those who did not complete the survey, a final request to complete the
survey, including the instructions and link, along with a note of the importance of
participation was emailed, which was second part of the third (2) email. One week after the
third (1 & 2) email, a fourth and final email was sent thanking those who participated in the
study. In order to control for non-response bias, early and late adopters were compared. In
addition, any unusual or incomplete responses were reviewed and treated accordingly. By
implementing all of these suggested data collection best practices the response rates should meet the requirement while maintaining consistent survey methodology and reducing errors.

The researcher obtained approval from North Carolina State University’s Institutional Review Board (IRB) in support of this research. In addition, the NCCCS office was notified and permission to proceed was granted as a precautionary measure. In addition, several of the institutions required their own IRB approval in which the researcher complied. The actual survey was conducted through Survey Monkey via the Internet to the participants using email notification and information dissemination. The survey results were tabulated and stored in Survey Monkey and then transferred to SPSS software for data analysis and backed up. Figure 3.1 below denotes the steps for data collection in this study.

Figure 3.1 Data Collection Steps Modified from Bartlett (2009) Data Analysis
The data analysis section will prepare, describe and analyze the collected data through several statistical tests to determine if there is evidence of any significant relationships among or between the variables and factors with technology integration of the faculty. The selection of the appropriate statistical test is one of the major steps in the hypothesis and related testing processes which requires thorough consideration and selection (Sproull, 1995). Proper analysis of the data provides the researcher to understand, interpret, and articulate results based upon relationships that are more complex than previously encountered (Hair et al., 2006). In social science research, data analysis involves three major steps, typically performed in the order denoted below:

- **Data preparation** - which involves checking the data in, check for accuracy, entering the data into the computer, transforming the data, and developing and documenting a database structure that integrates the various measures.
- **Descriptive statistics** – describes the basic features of the data. Provide simple summaries about the sample and the measures. Along with simple graphical analysis, they form the basis for every quantitative analysis of data.
- **Statistical analysis** of the research design tests the research hypothesis or objectives. (Trochim & Donnelly, 2008).

According to Hair et al., (2006), the first step of examining the data is to attain a basic understanding of the data and relationships between variables. They also state “A thorough knowledge of the variable interrelationships can aid immeasurably in the specification and refinement of the multivariate model as well as provide a reasoned perspective for interpretation of the results” (p.41). The second step is to ensure that the data underlying the analysis meet all of the requirements for analysis (Hair et al., 2006).
Data Analysis

In this study, the first step of data analysis was to evaluate the data for any possible response bias. Creswell (2009) states “response bias is the effect of non-responses on survey estimates” (p. 151). The two main levels of technology integration, along with the variables and factors to predict integration were compared between respondents and non-respondents with t-test and ANOVA analysis. In support of Hair et al., (2006) the second step carefully examined the data using various techniques such as graphical representation to look for; missing data, outliers, data value range, frequency, and other measures to ensure it met the conditions and assumptions of being used to perform multivariate analysis. Missing or incomplete data was handled using the most effective technique, such as replacing the missing values with means or regression analysis or eliminating them from the study. The data was then evaluated to determine if there were any other patterns or deficiencies that caused concerns within the entire data set.

To evaluate the construct validity of both the TAM and technology integration scales, a factor analysis was performed. Factor analysis defines and explains in broad, conceptual terms, the fundamental aspects of factor analytic techniques and “is suitable for analyzing the patterns of complex, multidimensional relationships” (Hair et al., 2006, p. 101). As stated earlier, in order to perform factor analysis the data must meet several criteria and assumptions. Hair et al., (2006) provide their model for “assumptions in factor analysis” which include; conceptual and statistical elements, criteria identification for extracting variables, and determining the appropriate rotation and are denoted below (p. 113-114):
1. Assumptions required
   a. Conceptual assumption
      i. Some underlying structure does exist in the set of selected variables.
   b. Statistical assumption
      i. Some degree of multicollinearity is desirable because the objective is to identify interrelated sets of variables.
      ii. If visual inspection reveals no substantial number of correlations greater than .30, then factor analysis is probably inappropriate.
      iii. The Bartlett test of sphericity tests for the presence of correlations among the variables with significance to continue of greater than .05.
   c. The third measure to quantify factor analysis is the Measure of Sampling Adequacy (MSA) with an index of 0 to 1, when reaching 1 means perfectly predicted and .50 or above acceptable and less than .50 is unacceptable.

2. Selecting the Factor Extraction Method
   a. Component factor analysis – used when data reduction is a primary concern.
   b. Common factor analysis – used to identify the latent dimensions or constructs.

3. Criteria for the Number of Factors to Extract
   a. Latent Root Criterion – A common technique used to decide which factors to remove which is “based on a factor’s variance on another factor whose eigenvalues is greater than one” (Hair et al., 2006, p. 120).
   b. Scree Test Criterion – used to “identify the optimum number of factors that can be extracted before the amount of unique variance begins to dominate the common variance structure” (Hair et al., 2006, p. 120).
This study used the latent root techniques to decide which factors to remove based upon the eigenvalues greater than 1. In addition, a scree plot was used to visually determine which factors are above and below the optimum number of factors to be extracted.

4. Rotation of Factors
   a. Orthogonal Factor Rotation – the simplest method to use, in which the axes are maintained at 90 degrees.
      i. QUARTIMAX – to simplify the rows of the factor matrix.
      ii. VARIMAX – to simplify the columns of the factor matrix.
      iii. EQUIMAX – to simplify both rows and columns of the factor matrix.
   b. Oblique Factor Rotation – not being constrained to the 90 degree angle between the reference axes.
      i. OBLIMIN – a method to optimize factor loading using SPSS software.
      ii. PROMAX and ORTHOBLIQUE – a method to optimize factor loading using SAS software.

The oblique factor rotation seems to be the best option since data reduction or subsequent use are not of real concern in this study. In addition, it supports the objective of obtaining several theoretical meaningful factors or constructs because few constructs in the real world are uncorrelated (Hair et al., 2006). Also, the OBLIMIN was selected to optimize factor loading values using SPSS software for the data analysis.

Once all of the assumptions and considerations have been made, factor analysis can be conducted in order to interpret the factor loading values. Using the guidelines from Hair et
al., (2006, p.128), the study used the following criteria to determine significance; +/- .30 to +/- .40 are minimally acceptable, and +/- .50 as significant, noting significance is dependent on sample size. When examining the factor matrix of loadings, most researchers report the results of the factor pattern matrix instead of the factor structure, which becomes more difficult to distinguish which variables load uniquely as the number of factors increase (Hair et al., 2006). Lastly, factors were identified and Cronbach’s alpha were conducted to determine reliability.

This study examined and described the elements and constructs of four research objectives which were evaluated through statistical testing and analysis methods to determine any significant relationships of the variables and factors that influence faculty adoption and integration of technology. The research objectives and the explanation of analysis for each are denoted below.

**Research Objective One** – Examined vocational and technical faculty’s’ perceptions of instructional technology usefulness and ease of use in their teaching and learning process, measured by the Technology Acceptance Model (TAM - 1996).

- **Q#1** - Do vocational and technical faculty who perceive instructional technology as useful more likely to integrate technology into their teaching and learning process?
- **Q#2** - Do vocational and technical faculty who perceive instructional technology as easy to use more likely to integrate technology into their teaching and learning process?
Descriptive statistics such as means, standard deviations, frequencies, and percents were calculated to meet this objective.

**Research Objective Two** – Described vocational and technical faculties’ level of instructional technology integration in terms of the two constructs of technology use (adoption and integration) and factors that may influence technology use such as barriers to technology and technology anxiety as measured by the Kotrlik & Redmann Technology Integration Scale (KTRIS-2005).

- Q#3 – What is the current perceived instructional technology use level (adoption or integration) of the vocational and technical faculty?
- Q#4 - What are the current perceived instructional technology barriers and anxiety levels of the vocational and technical faculty?

Descriptive statistics such as means, standard deviations, frequencies, and percents were calculated to meet this objective.

**Research Objective Three** – Examined the relationships between vocational and technical faculty’s instructional technology acceptance factors (perceived usefulness and perceived ease of use of technology) and level of technology integration with each of the two levels of technology use (adoption and integration) along with technology barriers and anxiety.
Q#5 – Is there a correlation between the vocational and technical faculty’s technology acceptance factors of perceived usefulness and perceived ease of use and their level of technology use of adoption and integration?

Q#6 - Is there a correlation between the vocational and technical faculty’s technology acceptance factors of perceived usefulness and perceived ease of use and their level of barriers to technology and technology anxiety?

Correlation tests were utilized to meet this objective.

Research Objective Four – Explored which technology acceptance factors, demographic variables, and technology use factors (perceived technology barriers and anxieties, sources of technology training) explained the variance in technology integration within each of the two levels of technology use (adoption and integration).

Q#7 – Do technology acceptance factors, demographic variables, and/or technology use factors (perceptions of technology barriers and anxiety, sources of technology training) explain the variance in level of technology adoption?

Q#8 – Do technology acceptance factors, demographic variables, and/or technology use factors (perceptions of technology barriers and anxiety, sources of technology training) explain the variance in level of technology integration?
To meet these objectives, multiple regression analysis using a stepwise approach was used.

Research Defined

In social science research, quantitative studies are a means for testing objective theories by examining the relationship among variables (Creswell, 2009). In fact, the majority of today’s research is more correlation based instead of experimental (Sproull, 1995). One common method of evaluating these variable relationships is through multiple regression analysis, in which predictor and criterion variables are analyzed to determine the relationship between and among these variables (Trochim & Donnelly, 2008). According to Hair et. al (2006), “multiple regression analysis is a general statistical technique used to analyze the relationship between single dependent variable and several independent variables” (p. 169). The challenge for the researcher is to expand upon the simple regression model by adding independent variables that have the greatest additional predictive power (Hair et al., 2006). According to Hair et al. (2006), when selecting suitable applications of multiple regression, it starts with the research problem and then proceeds through several stages: research problem, research design issues, and creating additional variables and assumptions in multiple regression. These stages are defined below:

Stage 1 – Research Problem: select objectives (prediction and explanation), select dependent and independent variables.

Stage 2 – Research Design Issues: obtain an adequate sample size to ensure statistical power and generality.

Stage 3 – Creating Additional Variables and Assumptions in Multiple Regression: Transformation to meet assumptions, dummy variables for use of non-metric
variables, polynomials for curvilinear relationships, interaction terms for moderator effects. Do the independent variables meet the assumptions of: normality, linearity, homoscedasticity, and independence or error. (Hair et al., 2006, p. 189).

According to Mertler & Vannatta (2010), multiple regression is merely an extension of simple linear regression involving more than one independent variable (IV) or predictor variable, that effects a single dependant variable (DV). Multiple regression is a technique used to predict the value of a single dependent variable from a weighted, linear combination of independent variables (Harris, 1998 as cited in Mertler & Vannatta, 2010). Hair et al., (2006) suggest one fundamental purpose of multiple regression is to predict the dependent variable with a set of independent variables, which fulfills two objectives:

1. To maximize the overall predictive power of the independent variables as represented in the variable.

2. To compare two or more sets of independent variables to ascertain the predictive power of each variable. (Hair et al., 2006, p. 190)

In meeting the objectives, the researcher must ensure that both statistical and practical significance are considered in the interpretation of the variable coefficients and the predictive power of a model (Hair et al., 2006).

Multiple regression provides prediction and explanation of the dependent variable based on a measure of the degree of influence that various independent variables may have on it. The formula is denoted below:

\[ y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \ldots + e \]
Where \( Y = \text{DV value} \), \( \beta = \text{coefficient for each IV} \), and \( X = \text{each IV} \) (Mertler & Vannatta, 2010). This formula is the mathematical calculation of all independent variables that influence the dependent variable through a constant coefficient factor.

“Multiple regression also provides an objective assessment of the degree and character of the relationship between dependent and independent variables, by forming the variable of independent variables and then examining the magnitude, sign and statistical significance of the regression coefficient for each independent variable” (Hair et al., 2006, p. 190). Furthermore, in addition to their collective prediction of the dependent variable, may also be considered for their individual contribution to the variable and its prediction (Hair et al., 2006). Finally, the interpretation of the variable may rely on any three perspectives: the importance of the independent variables, the types of relationships found, or the interrelationships among independent variables in which the researcher decides what to report (Hair et al., 2006).

The sample size used in multiple regression is perhaps the single most influential element under the control of the researcher designing the analysis (Hair et al., 2006). According to Hair et al., (2006), “the effects of sample size are seen most directly in the statistical power of the significance testing and the generalizability of the result” (p. 194). Power refers to the probability of detecting as statistically significant a specific level of \( R^2 \). Therefore, sample size plays a role in not only assessing the power of a current analysis, but also in anticipating the statistical power of a proposed analysis (Hair et al., 2006). Finally,
through proper multiple regression analysis, prediction and explanation of the independent and dependent variables are obtainable as those independent variables with larger regression coefficients make a greater contribution to the predicted values of the dependent variables.

Anticipated Findings

The anticipated findings will identify the most significant factors and variables that influence the technology integration construct. These findings will be compared to previous research to determine the level of agreement amongst the studies. It is expected, that the findings will be closely related when compared to similar groups of participants, such as K-12 teachers and faculty members outside the state and country.

Conclusion

Technology is part of our daily life and is predicted to grow and continue its’ influence on society. This technology has stumbled into the education arena with mixed results. The current administration’s National Education Technology Plan of 2010 announced that innovation and technology will be the key components in revitalizing our schools and higher education to make them more competitive, cost effective, and better prepared to teach students the necessary problem-solving, critical thinking, and technical skills in order to obtain gainful employment (Hershaf, 2010). Faculty members are the ones who are responsible for student learning, as well as, the amount of technology used in the teaching
process. The decision and burden to use technology in the teaching and learning process rests on the shoulders of the faculty. However, they cannot do it alone and need the support and resources of administrators, legislators, and industry to incorporate applicable technology in the classroom (Glazner, 2012). Findings and results from this study can provide a platform to discuss how to improve the level of technology integration in the teaching and learning process.

Timeline

A timeline for this study was developed to assist the researcher with staying on task during the research process, which is denoted in Appendix G. The timeline provides a chronological order of important dates associated with research requirements for completion.
CHAPTER FOUR

FINDINGS

The purpose of this study was to examine North Carolina community college vocational and technical faculty’s levels of technology acceptance and integration and related factors that can be used to predict technology integration, including perceived technology anxieties and barriers to technology use. This chapter will identify and provide the findings from the survey research on technology use and integration perceptions and practices of North Carolina community college full time vocational and technical faculty. In order to validate the collected data a pre-data analysis was conducted which included Cronbach’s alpha test for internal consistency and validity, along with explanatory factor analysis will be reported. The factor scales and correlations are identified and individual item factor loadings are described. Next will be the descriptive results of the demographic data which include the statistical measurements of means, standard deviations, frequencies, and percentages. Finally, the descriptions and analysis from the research objectives and questions below will be reported. The results of this study will serve as an addition to the current body of literature on technology acceptance and integration in higher education.

Research Objective One – Examined vocational and technical faculty’s’ perceptions of instructional technology usefulness and ease of use in their teaching and learning process, measured by the Technology Acceptance Model (TAM - 1996).
Research Objective Two – Described vocational and technical faculties’ level of instructional technology integration in terms of the two constructs of technology use (adoption and integration) and factors that may influence technology use such as barriers to technology and technology anxiety as measured by the Kotrlik & Redmann Technology Integration Scale (KTRIS-2005).

- Q#3 – What is the current perceived instructional technology use level (adoption or integration) of the vocational and technical faculty?
- Q#4 – What are the current perceived instructional technology barriers and anxiety levels of the vocational and technical faculty?

Research Objective Three – Examined the relationships between vocational and technical faculty’s instructional technology acceptance factors (perceived usefulness and perceived ease of use of technology) and level of technology integration with each of the two levels of technology use (adoption and integration) along with technology barriers and anxiety.
o Q#5 – Is there a correlation between the vocational and technical faculty’s technology acceptance factors of perceived usefulness and perceived ease of use and their level of technology use of adoption and integration?

o Q#6 - Is there a correlation between the vocational and technical faculty’s technology acceptance factors of perceived usefulness and perceived ease of use and their level of barriers to technology and technology anxiety?

**Research Objective Four** – Explored which technology acceptance factors, demographic variables, and technology use factors (perceived technology barriers and anxieties, sources of technology training) explained the variance in technology integration within each of the two levels of technology use (adoption and integration).

o Q#7 – Do technology acceptance factors, demographic variables, and/or technology use factors (perceptions of technology barriers and anxiety, sources of technology training) explain the variance in level of technology adoption?

o Q#8 – Do technology acceptance factors, demographic variables, and/or technology use factors (perceptions of technology barriers and anxiety, sources of technology training) explain the variance in level of technology integration?
Data Collection

An email notification, request for support and survey link (Survey Monkey) was sent via email to all 58 North Carolina community college Presidents and/or Vice Presidents. Of the 58 emails sent, three of them were undeliverable due to incorrect email addresses. These email addresses were reviewed for accuracy and corrected, then resent which were successfully delivered. From the first email sent to the 58 different community colleges 46 (79.3%) were opened. During this 1st week period, out of the possible 3,562 full time community college vocational and technical faculty 258 (7.2%) opened the survey. This survey included an optional incentive to complete the survey. In addition, two community colleges replied back and requested the researcher complete the institution’s local IRB requirement before the survey could be forwarded to their qualified faculty. The researcher completed this requirement and sent all of the paperwork accordingly.

In order to obtain additional survey results, a second email was sent thanking those who have forwarded the survey to their qualified faculty and to those who already completed the survey. In addition, the researcher requested for those individuals who have not had a chance to complete the survey to do so. All 58 community colleges were included in the second email in which all 58 (100%) opened up the email. During this second week period an additional 185 (5.1%) individuals completed the survey. The researcher was contacted by two additional community colleges requesting additional time to get the survey to their faculty due to administrator being out of the office. Therefore, the survey completion deadline was extended three more days in which an additional 17 (0.47%) individuals opened
the survey. In total, 3,562 full time community college vocational and technical faculty individuals opened the survey which was the initial return rate.

Pre-Data Analysis

In order to filter the raw data for proper statistical analysis, missing data, non-response bias, scale accuracy, and reliability and validity using Cronbach’s alpha, a preliminary data analysis was conducted. In addition, the data collection instrument factors of the TAM and KRTIS subscales were reviewed by conducting an explanatory factor analysis. This pre-data analysis allowed the researcher to work with a clean data set and provided a better understanding of how to properly analyze the data.

Missing Data

According to Hair et al. (2006), data examination is a time consuming, but necessary, initial step in any analysis that researchers often overlook. In particular, missing data are nuisance and often a result from errors in data collection or data entry, or from the omission of answers from respondents (Trochim & Donnelly, 2008). The survey consisted of 60 required and 3 optional questions. Through the Survey Monkey data analysis it was noticed of the 60 required questions not all were completely answered. The following missing data patterns were identified by the researcher; 2 (.43%) survey respondents did not answer any questions; 6 (1.3%) survey respondents did not answer questions 20-60; 9 (1.95%) survey respondents did not answer questions 29-60; 29 (6.30%) survey respondents did not answer
questions 41-60; 32 (6.95%) survey respondents did not answer questions 49-60. For the three optional questions 61, 62, and 63 there were 99 (21.52%), 186 (40.43%), and 301 (65.435) survey respondents who did not answer these questions, respectively. It appears as the participants progressed through the survey more questions went unanswered. Since two individuals opened the link, but did not answer any questions an adjustment must be made. Therefore, of the estimated 3,562 full-time vocational and technical faculty a total of 458 (12.85%) survey respondents answered some or all of the questions in the survey.

Of the 458 survey responses who provided some answers or completed the survey only 32 (6.98%) of them did not complete the entire survey which meant that 426 (93.02%) individuals did complete the survey in its entirety. According to Hair et al. (2006) missing data under 10% for an individual case or observation can generally be ignored. However, variables with as little as 15% missing data are candidates for deletion, but higher levels of missing data (20%-30%) can often be remedied.. In addition, be sure the overall decrease in missing data is large enough to justify deleting an individual variable or case. Furthermore, cases with missing data for dependent variables typically are deleted to avoid any artificial increase in relationships with independent variables (Hair et al., 2006). Therefore, since the majority, 29 out of 32, individual cases were missing approximately 33% or more of the data, which is more than more than the recommended “as little as 15% “of the data and the fact that some specific dependent variables were missing, which could negatively impact the relationship with the independent variables, the researcher decided to delete all 32 missing data cases from the data set to be used for analysis.
Non-Response Bias

According to Agresti & Finlay (2009), when some sampled subjects cannot be reached or refuse to participate or fail to answer some question it is called non-response bias. “Research has shown that late responders are often similar to non-respondents” (Miller and Smith, 1983, p. 48). Therefore, it is important to compare early and late respondents on the primary variable(s) of interest to determine if there is a significance difference between the two groups (Miller and Smith, 1983). In this study, two levels of integration, along with the factors to predict such integration were compared between respondents and non-respondents with the Analysis of Variance (ANOVA) method. This method would determine the differences between the two groups based upon the mean and standard deviation.

Early and Late Respondents

This study followed the two stage data collection method recommended by Dillman (2007). In the first stage an initial email (pre-notification letter) was sent to the sample population and then a few days later they were sent the first email with the survey link and consent acknowledgement. One week later, a second email was sent thanking those who have already completed the survey and requested those who have not please do so. In both cases, participants were encouraged to complete the survey to support technology integration in higher education research and were given an incentive with a chance to win a gift card. From these two stages, both groups were identified as early and late respondents. From a total of 426 fully completed survey responses, the early responders were identified as the first 238 participates who responded to the first email notification and survey link. The late responders
were identified as the 171 responders from the second email notification and survey, along with the 17 responders that required three more days beyond the second notice due date, which totaled 188 responders. An analysis of variance was conducted to determine the difference between the early and late responders with all applicable variables from the survey. A chi-square analysis was performed to identify the differences in the categorical variables such as; age, gender, and teaching experience.

The Analysis of Variance (ANOVA) among the early and late responders for the following variables: adoption, integration, technology anxiety, barriers, perceived usefulness, and perceived ease of use was performed and is denoted in Table 4.1 below.

Table 4.1 Analysis of Variance Comparison of Early and Late Respondents on Technology Integration with Adoption, Integration, Technology Anxiety, Barriers, Perceived Usefulness, and Perceived Ease of Use

<table>
<thead>
<tr>
<th>Variable</th>
<th>Early (n=238)</th>
<th>Late (n=188)</th>
<th>Sum of Squares</th>
<th>Df</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adoption</td>
<td>58.10 11.75</td>
<td>55.16 12.32</td>
<td>6.56</td>
<td>.011</td>
<td>945.36</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>945.36</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>60949</td>
<td>423</td>
<td>144.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>61895.2</td>
<td>424</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integration</td>
<td>10.5 4.09</td>
<td>9.62 4.07</td>
<td>5.30</td>
<td>.022</td>
<td>88.07</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>88.07</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>7702.9</td>
<td>423</td>
<td>16.60</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>7111.04</td>
<td>424</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 4.1 Continued

<table>
<thead>
<tr>
<th></th>
<th>Early (n=238)</th>
<th></th>
<th>Late (n=188)</th>
<th></th>
<th>Sum of Squares</th>
<th>Df</th>
<th>Mean</th>
<th>Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Technology Integration</strong></td>
<td>23.49</td>
<td>9.31</td>
<td>23.32</td>
<td>7.97</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.022</td>
<td>.881</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between</td>
<td>1.71</td>
<td>1</td>
<td></td>
<td>1.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.281</td>
<td>.596</td>
</tr>
<tr>
<td>Within</td>
<td>32402.4</td>
<td>423</td>
<td></td>
<td>76.60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>32404.4</td>
<td>424</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Barriers</strong></td>
<td>20.39</td>
<td>5.66</td>
<td>20.63</td>
<td>5.41</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.233</td>
<td>.630</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between</td>
<td>8.64</td>
<td>1</td>
<td></td>
<td>8.64</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.281</td>
<td>.596</td>
</tr>
<tr>
<td>Within</td>
<td>12997.5</td>
<td>424</td>
<td></td>
<td>30.727</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>13006.1</td>
<td>425</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Perceived Usefulness</strong></td>
<td>24.25</td>
<td>5.59</td>
<td>24.02</td>
<td>5.56</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.233</td>
<td>.630</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between</td>
<td>7.23</td>
<td>1</td>
<td></td>
<td>7.23</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.281</td>
<td>.596</td>
</tr>
<tr>
<td>Within</td>
<td>13152.8</td>
<td>424</td>
<td></td>
<td>31.094</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>13160.1</td>
<td>425</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Perceived Ease of Use</strong></td>
<td>22.89</td>
<td>4.47</td>
<td>23.11</td>
<td>4.30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.233</td>
<td>.630</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between</td>
<td>3.03</td>
<td>1</td>
<td></td>
<td>3.03</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.281</td>
<td>.596</td>
</tr>
<tr>
<td>Within</td>
<td>8151.6</td>
<td>424</td>
<td></td>
<td>19.27</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>8154.7</td>
<td>425</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In the comparison between the early responders (n = 238, 7.2%) and the late responders (n = 188, 5.2%) there was no significant difference in technology integration associated with the following variables; adoption (F = 6.56, p = .011), integration (F = 5.30, p = .022), technology anxiety (F = .022, p = .881), barriers (F = .281 p = .596), perceived usefulness (F = .233, p = .630), and perceived ease of use (F = .158, p = .691).

Demographic quantitative variables of age and years of teaching were analyzed to determine the differences between the early and late responders. Descriptive statistics were used to compare the differences are denoted in Table 4.2 below.

Table 4.2 Mean, Standard Deviation, Minimum, and Maximum Comparison of Early and Late Respondents by Numerical Demographic Characteristics of Age and Years of Teaching

<table>
<thead>
<tr>
<th></th>
<th>Early (n = 238)</th>
<th>Late (n = 188)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Age</td>
<td>49.89</td>
<td>11.02</td>
</tr>
</tbody>
</table>

In the comparison between the early responders (n = 238, 7.2%) and the late responders (n = 188, 5.2%) of the quantitative variables age and the numbers of year teaching there were no significant differences between the early and late respondents. In addition, categorical variables of gender and education levels were analyzed to determine the
differences between the early and late responders. A chi-square analysis was used to analyze the variables and is denoted in Table 4.3 below.

Table 4.3 Chi Square Comparison of Early and Late Respondents by Categorical Demographic Characteristics of Gender and Educational Level

<table>
<thead>
<tr>
<th></th>
<th>Early (n = 238)</th>
<th>Late (n=188)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>X2 10.23, df 1, P = .001</td>
<td></td>
</tr>
<tr>
<td>Education Level</td>
<td>X2 8.21, df 6, P = .314</td>
<td></td>
</tr>
</tbody>
</table>

In the comparison between the early responders (n = 238, 7.2%) and the late responders (n = 188, 5.2%) of the categorical factors of gender (X2 = 10.23, df = 1, p = .001) and years of teaching experience (X2 = 8.21, df = 6, p = .314) there was a low significance in gender with more early males respondents than early female respondents. However, the researcher did not believe it was significant enough to adjust or separate the groups, based upon the overall number and percentages of males and females in the study which was 219 males (51.52%) and 206 females (48.47%). Therefore, there was not a high enough statistical significance difference between the two groups of early and late responders on the variables so all responders will be examined as a complete group for this study.
Factor Analysis

To achieve efficient and applicable analyses to the research objectives and questions an exploratory factor analysis was conducted to examine the construct validity of the KRTIS and the TAM instrument sub scales. This factor analysis will help determine the strength and influence of factors that explain the variation in the stated measures of the survey. According to Green & Salkind (2011), “Factor analysis is a technique to identify factors that statistically explain the variation and co-variation among measures” (p. 313). In addition, factor analysis is typically conducted on metric variables to analyze patterns of complex, multidimensional relationships among the various factors of measurement (Hair et al., 2006). This factor analysis was conducted to assist in the grouping of items (survey questions) that may have similar meaning and to decide variable order or placement within the sub scales. The primary components of the factor analysis included the Varimax rotation method in order to simplify the factor structure and determine any possible ambiguities of interpretation (Hair et al., 2006).

By using factor analysis the structure of the four KRTIS technology integration subscales, adoption, integration, barriers and technology anxiety, along with the two TAM subscales perceived usefulness and perceived ease of use were determined. The factor analysis results are summarized in Table 4.4. All of the pre-existing KRTIS and TAM factor scales remained in place based upon the factor loadings with the exception of barrier item 6, which is discussed below.
The KRTIS scale consisted of the following subscales; adoption level contained 15 Likert scale (1-5) questions, the integration level contained 4 Likert scale (1-5) questions, the barriers rating contained 9 Likert scale (1-4) questions, and the technology anxiety level contained 12 Likert scale (1-5) questions. The TAM scale consisted of the following subscales; perceived usefulness level contained 6 Likert scale (1-5) questions and perceived ease of use level contained 6 Likert (1-5) questions. Adoption factor loadings ranged from .504 to .815. Technology Anxiety factor loadings ranged from .622 to .855. Perceived Usefulness factor loadings ranged from .815 to .867. Perceived ease of use factor loadings ranged from .671 to .787. Barriers to technology factor loadings ranged from -.110 to .771. Integration factor loadings ranged from .573 to .840. All factors but one, barrier item 6, were positive and moderate to high in factor loading, which confirms all the factors are positively loaded together. Barrier item 6 “My ability to integrate technology in the teaching/learning process” had a factor loading of -.110, which indicates the variable does not significantly influence the factor of technology use. Table 4.4 summarizes the results of the KRTIS scale items of technology anxiety and barriers to technology integration.
Table 4.4 *Factor Loadings of KRTIS Scale Items Adoption, Integration, Barriers, Technology Anxiety and TAM Scale Items Perceived Usefulness and Perceive Ease of Use*

<table>
<thead>
<tr>
<th>Component Loadings</th>
<th>Adoption</th>
<th>Technology Anxiety</th>
<th>Perceived Usefulness</th>
<th>Perceived Ease of Use</th>
<th>Barriers</th>
<th>Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adopt Item 8</td>
<td>.815</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adopt Item 3</td>
<td>.804</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adopt Item 14</td>
<td>.798</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adopt Item 7</td>
<td>.792</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adopt Item 10</td>
<td>.787</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adopt Item 11</td>
<td>.787</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adopt Item 6</td>
<td>.773</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adopt Item 9</td>
<td>.762</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adopt Item 4</td>
<td>.740</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adopt Item 12</td>
<td>.737</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adopt Item 1</td>
<td>.720</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adopt Item 13</td>
<td>.645</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adopt Item 15</td>
<td>.640</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adopt Item 2</td>
<td>.617</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adopt Item 5</td>
<td>.504</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 4.4 Continued

<table>
<thead>
<tr>
<th></th>
<th>Component Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adoption</td>
</tr>
<tr>
<td>TechAnx Item 7</td>
<td></td>
</tr>
<tr>
<td>TechAnx Item 8</td>
<td></td>
</tr>
<tr>
<td>TechAnx Item 6</td>
<td></td>
</tr>
<tr>
<td>TechAnx Item 3</td>
<td></td>
</tr>
<tr>
<td>TechAnx Item 4</td>
<td></td>
</tr>
<tr>
<td>TechAnx Item 12</td>
<td></td>
</tr>
<tr>
<td>TechAnx Item 5</td>
<td></td>
</tr>
<tr>
<td>TechAnx Item 2</td>
<td></td>
</tr>
<tr>
<td>TechAnx Item 1</td>
<td></td>
</tr>
<tr>
<td>TechAnx Item 10</td>
<td></td>
</tr>
<tr>
<td>TechAnx Item 11</td>
<td></td>
</tr>
<tr>
<td>TechAnx Item 9</td>
<td></td>
</tr>
<tr>
<td>PU Item 3</td>
<td></td>
</tr>
<tr>
<td>PU Item 2</td>
<td></td>
</tr>
<tr>
<td>PU Item 4</td>
<td></td>
</tr>
<tr>
<td>PU Item 5</td>
<td></td>
</tr>
<tr>
<td>PU Item 1</td>
<td></td>
</tr>
<tr>
<td>PU Item 6</td>
<td></td>
</tr>
</tbody>
</table>
Table 4.4 Continued

<table>
<thead>
<tr>
<th>Component Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Adoption Anxiety</td>
</tr>
<tr>
<td>PEOU Item 3</td>
</tr>
<tr>
<td>PEOU Item 1</td>
</tr>
<tr>
<td>PEOU Item 3</td>
</tr>
<tr>
<td>PEOU Item 1</td>
</tr>
<tr>
<td>PEOU Item 4</td>
</tr>
<tr>
<td>PEOU Item 6</td>
</tr>
<tr>
<td>PEOU Item 2</td>
</tr>
<tr>
<td>PEOU Item 5</td>
</tr>
<tr>
<td>Barrier Item 4</td>
</tr>
<tr>
<td>Barrier Item 5</td>
</tr>
<tr>
<td>Barrier Item 3</td>
</tr>
<tr>
<td>Barrier Item 2</td>
</tr>
<tr>
<td>Barrier Item 9</td>
</tr>
<tr>
<td>Barrier Item 1</td>
</tr>
<tr>
<td>Barrier Item 7</td>
</tr>
<tr>
<td>Barrier Item 8</td>
</tr>
<tr>
<td>Barrier Item 6</td>
</tr>
<tr>
<td>Integra Item 3</td>
</tr>
</tbody>
</table>
### Component Loadings

<table>
<thead>
<tr>
<th>Component</th>
<th>Adoption</th>
<th>Technology Anxiety</th>
<th>Perceived Usefulness</th>
<th>Perceived Ease of Use</th>
<th>Barriers</th>
<th>Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integra Item 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.827</td>
</tr>
<tr>
<td>Integra Item 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.762</td>
</tr>
<tr>
<td>Integra Item 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.573</td>
</tr>
</tbody>
</table>

### Reliability

According to Sproull (1995), reliability is defined as “the consistency of measurement; the degree to which an instrument measures the same way each time it is used under the same conditions with the same subjects” (p.74). In addition, reliability attempts to provide an assessment of the degree of consistency between multiple measurements of a variable (Hair et al., 2006). Therefore, Cronbach’s alpha was used to calculate an estimate of the reliability for all summated scales from the survey questions, which is one of the most widely used methods to measure internal consistency. According to Hair et al.(2006), The generally agreed upon lower limit of acceptance for Cronbach’s alpha for a reliability is 0.70. The reliability of the constructs ranged from .826 to .966. Table 4.5 summarizes the estimates of reliability and the total number of items in each scale for the KRTIS and TAM.
Table 4.5 Reliability and Cronbach’s Alpha of Variables for KRTIS and TAM Scales

<table>
<thead>
<tr>
<th>Items</th>
<th>α</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adoption: Adopt1-Adopt15</td>
<td>.952</td>
<td>15</td>
</tr>
<tr>
<td>Integration: Int1-Int4</td>
<td>.857</td>
<td>4</td>
</tr>
<tr>
<td>Technology Anxiety: TechAnx1-TechAnx12</td>
<td>.944</td>
<td>12</td>
</tr>
<tr>
<td>Barriers to Integration: Barr1-Barr9</td>
<td>.826</td>
<td>9</td>
</tr>
<tr>
<td>Perceived Usefulness: PU1-PU6</td>
<td>.966</td>
<td>6</td>
</tr>
<tr>
<td>Perceived Ease of Use: PEOU1-PEOU6</td>
<td>.922</td>
<td>6</td>
</tr>
</tbody>
</table>

*Note: Cronbach’s Alpha > .70 is considered acceptable (Hair, 2006).*

In table 4.5 above it is shown that all identified variables have high internal consistency and reliability as all α values are above .70, which is considered acceptable criteria of the cited experts to be used in the calculations.

Analysis of Research Objectives

This section will describe and report the results for the vocational and technical disciplines, demographic data of the respondents with the use of descriptive statistics such as means, standard deviations, frequencies and percentages. In addition, this information will then be analyzed to determine its effect on the research objectives and questions.
Descriptive Results

There were approximately 3,562 North Carolina community college vocational and technical full time faculty who were sampled in this study in which 426 (11.95%) actually participated in the survey. The respondents identified which vocational and technical discipline they represented and are as follows; Agricultural and Natural Resources Tech 12 (2.8%), Biological and Chemical Technologies 6 (1.4%), Business Technologies 102 (23.9%), Commercial & Artistic Production Tech 8 (1.9%), Construction Technologies 26 (6.1%), Engineering Technologies 51 (12.0%), Health Sciences 102 (23.9%), Industrial Technologies 43 (10.1%), Public Service Technologies 40 (9.4%), and Transport Systems Technologies 36 (8.5%). These disciplines are defined by the NCCCS as those occupational areas in which the vocational and technical faculty are authorized to provide instruction. These vocational and technical disciplines are denoted below in Table 4.6.

Table 4.6 Respondent Frequencies and Percents by Vocational and Technical Discipline

<table>
<thead>
<tr>
<th>Vocational &amp; Technical Discipline</th>
<th>f</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural Education</td>
<td>12</td>
<td>2.8</td>
</tr>
<tr>
<td>Biological and Chemical Technologies</td>
<td>6</td>
<td>1.4</td>
</tr>
<tr>
<td>Business Technologies</td>
<td>102</td>
<td>23.9</td>
</tr>
<tr>
<td>Commercial &amp; Artistic Production Technologies</td>
<td>8</td>
<td>1.9</td>
</tr>
<tr>
<td>Construction Technologies</td>
<td>48</td>
<td>6.1</td>
</tr>
<tr>
<td>Engineering Technologies</td>
<td>34</td>
<td>6.6</td>
</tr>
</tbody>
</table>
Table 4.6 Continued

<table>
<thead>
<tr>
<th>Vocational &amp; Technical Discipline</th>
<th>f</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health Sciences</td>
<td>102</td>
<td>23.9</td>
</tr>
<tr>
<td>Industrial Technologies</td>
<td>43</td>
<td>10.1</td>
</tr>
<tr>
<td>Public Service Technologies</td>
<td>40</td>
<td>9.4</td>
</tr>
<tr>
<td>Transport Systems Technologies</td>
<td>36</td>
<td>8.5</td>
</tr>
</tbody>
</table>

*Note.* Results from 426 survey respondents of the 2013 vocational and technical faculty in the NCCCS.

Even though the actual results did not meet the expected vs. actual number of respondents to satisfy the stratified sample developed in the data collection plan all of the ten different disciplines were represented. Results indicated the Biological and Chemical Technologies (expected=4, actual=6) and Construction (expected=16, actual=48) exceeded the expected number of respondents. The other eight disciplines had some representation with a range of Public Service (25%) to Transport Systems Technologies (80%) between expected vs. actual. Table 4.7 provides the number of expected vs. actual respondents for each vocational and technical discipline defined in the data collection plan and is denoted below.
Table 4.7 *Stratified Sample Difference Between the Number of Expected vs. Actual Respondents for Vocational and Technical Faculty of the NCCCS*

<table>
<thead>
<tr>
<th>NCCCS Program Area</th>
<th>Faculty per Program Discipline</th>
<th>Sample to be Collected from Each Discipline</th>
<th>Sample Actually Collected from the Survey</th>
<th>Difference Expected vs Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural/Natural Resources</td>
<td>86</td>
<td>20</td>
<td>12</td>
<td>-8</td>
</tr>
<tr>
<td>Biological/Chemical</td>
<td>17</td>
<td>4</td>
<td>6</td>
<td>+2</td>
</tr>
<tr>
<td>Business Tech</td>
<td>795</td>
<td>185</td>
<td>102</td>
<td>-83</td>
</tr>
<tr>
<td>Commercial/Artistic Production</td>
<td>56</td>
<td>13</td>
<td>8</td>
<td>-5</td>
</tr>
<tr>
<td>Construction Tech</td>
<td>65</td>
<td>16</td>
<td>48</td>
<td>+32</td>
</tr>
<tr>
<td>Engineering Tech</td>
<td>317</td>
<td>74</td>
<td>34</td>
<td>-40</td>
</tr>
<tr>
<td>Health Sciences</td>
<td>1,058</td>
<td>246</td>
<td>102</td>
<td>-144</td>
</tr>
<tr>
<td>Industrial Tech</td>
<td>282</td>
<td>66</td>
<td>43</td>
<td>-23</td>
</tr>
<tr>
<td>Public Service Tech</td>
<td>695</td>
<td>162</td>
<td>40</td>
<td>-122</td>
</tr>
<tr>
<td>Transport Systems Tech</td>
<td>191</td>
<td>45</td>
<td>36</td>
<td>-9</td>
</tr>
</tbody>
</table>

*Note. Stratified sample to be collected with expected versus actual respondent discipline category*
The demographic variables consisted of age, gender, years of teaching, and education level. Starting with gender and the education level, the respondent’s gender was 219 (51.4%) male and 207 (48.6%) female. The respondent’s education level was GED 2 (0.5%), High School 3 (0.7%), Certification 1 (0.2%), Specialized 20 (4.7%), Associates 93 (21.8%), Undergraduate 78 (18.3%), Masters 204 (47.9%), and Doctoral 25 (5.9%). Therefore, the majority of respondents were male and held a master’s degree. Table 4.8 displays frequencies and percentages of the respondent’s categorical data of gender and education level.

Table 4.8 *Frequencies and Percentages of Participants Gender and Education Level*

<table>
<thead>
<tr>
<th>Gender and Educational Levels</th>
<th>f</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>219</td>
<td>51.4</td>
</tr>
<tr>
<td>Female</td>
<td>207</td>
<td>48.6</td>
</tr>
<tr>
<td>Education Level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GED</td>
<td>2</td>
<td>0.5</td>
</tr>
<tr>
<td>High School</td>
<td>3</td>
<td>0.7</td>
</tr>
<tr>
<td>Certification</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>Specialized</td>
<td>20</td>
<td>4.7</td>
</tr>
<tr>
<td>Associates</td>
<td>93</td>
<td>21.8</td>
</tr>
<tr>
<td>Undergraduate</td>
<td>78</td>
<td>18.3</td>
</tr>
<tr>
<td>Masters</td>
<td>204</td>
<td>47.9</td>
</tr>
<tr>
<td>Doctoral</td>
<td>25</td>
<td>5.9</td>
</tr>
</tbody>
</table>

*Note.* Results from 426 survey respondents of the 2013 vocational and technical faculty in the NCCCS.
The respondent’s age ranged from 27 to 83, with a majority age in the 51-60 (n=157, P = 36.8) year old range. The number of years teaching ranged from 1 to 49, with a majority having 6-10 (n=110, P = 25.8) years of teaching experience. Table 4.9 displays the frequencies and percents of the respondents’ age and years of teaching experience categories.

Table 4.9 Frequencies and Percentages of Participants Age and Years of Teaching Experience

<table>
<thead>
<tr>
<th>Age and Teaching Experience</th>
<th>f</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-30</td>
<td>12</td>
<td>&lt; 0.0</td>
</tr>
<tr>
<td>31-40</td>
<td>85</td>
<td>19.9</td>
</tr>
<tr>
<td>41-50</td>
<td>121</td>
<td>28.4</td>
</tr>
<tr>
<td>51-60</td>
<td>157</td>
<td>36.8</td>
</tr>
<tr>
<td>61-70</td>
<td>56</td>
<td>13.1</td>
</tr>
<tr>
<td>71-80</td>
<td>6</td>
<td>&lt; 0.0</td>
</tr>
<tr>
<td>Years of Teaching</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-5</td>
<td>87</td>
<td>20.4</td>
</tr>
<tr>
<td>6-10</td>
<td>110</td>
<td>25.8</td>
</tr>
<tr>
<td>11-15</td>
<td>97</td>
<td>22.7</td>
</tr>
<tr>
<td>16-20</td>
<td>39</td>
<td>0.9</td>
</tr>
<tr>
<td>21-25</td>
<td>47</td>
<td>1.1</td>
</tr>
<tr>
<td>26-30</td>
<td>26</td>
<td>0.6</td>
</tr>
<tr>
<td>31-35</td>
<td>10</td>
<td>0.2</td>
</tr>
</tbody>
</table>

*Note.* Results from 426 survey respondents of the 2013 vocational and technical faculty in the NCCCS.
For age and years of teaching experience metric data was also collected to identify the means in order to conduct multiple regression analysis. The mean represents the average values of the respondent’s information. Table 4.10 below displays the mean, standard deviation, minimum, and maximum of the respondent’s quantitative data of age and number of years teaching.

Table 4.10 Respondents Mean, Standard Deviation, Minimum, and Maximum Age and Numbers of Years Teaching

<table>
<thead>
<tr>
<th>Age and Years of Teaching</th>
<th>M</th>
<th>SD</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>49</td>
<td>10.38</td>
<td>27</td>
<td>83</td>
</tr>
<tr>
<td>Years of Teaching</td>
<td>14.57</td>
<td>9.23</td>
<td>1</td>
<td>49</td>
</tr>
</tbody>
</table>

Note. Results from 426 survey respondents of the 2013 vocational and technical faculty in the NCCCS.

Based upon these descriptive results analyses, the average respondents’ characteristic profile was a 49 year old male with 14.5 years of teaching experience who possessed a master’s degree. However, this average respondents’ characteristics profile is only an average and not necessarily the majority representation as shown in Table 4.9.

Furthermore, vocational and technical faculty were asked to identify all the sources of technology training they have received. Approximately 90% of the vocational and technical faculty received technology training from the self-taught method (n=384, 90.1%). The next highest source was from workshops/conferences (n=370, 86.9%). Colleagues as a source technology training ranked third (n=305, 71.6%). The least preferred method was the college
courses (n=259, 60.8%) for faculty to obtain technology training. Participants were allowed to select all technology training sources that applied to them. Table 4.11 below provides the frequencies and percents of the sources of technology training.

Table 4.11 Frequencies and Percentages of Sources of Technology Training for Vocational and Technical Faculty

<table>
<thead>
<tr>
<th>Sources of Technology Training</th>
<th>f</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-Taught</td>
<td>384</td>
<td>90.1</td>
</tr>
<tr>
<td>Workshop/Conferences</td>
<td>370</td>
<td>86.9</td>
</tr>
<tr>
<td>College Courses</td>
<td>259</td>
<td>60.8</td>
</tr>
<tr>
<td>Colleagues</td>
<td>305</td>
<td>71.6</td>
</tr>
</tbody>
</table>

Note. Results from 426 survey respondents of the 2013 vocational and technical faculty in the NCCCS

In addition, faculty were asked to identify all of the types of technology they currently use in their teaching and learning process. The results are as follows: student email 393 (92.32%), instructor email 402 (94.4%), laser disc, VCR, DVD, or CD player 343 (80.5%), digital camera or video recorder 247 (58.0), was, PDA or Smartphone 180 (42.3%), instructor computer/Internet at home 368 (86.4%), instructor computer/Internet at work 401 (94.1%), wireless Internet 378 (88.7%), video conferencing 146 (34.3%), elmo or smartboard 191 (44.8%), LMS (Bb, Moodle, Other) 308 (72.3%), virtual learning communities 100 (23.5%), social media 180 (42.3%), the cloud 150 (35.2%), 3-D modeling 48 (11.35%), laptop 320 (75.1%), and other 28 (5.6%). Table 4.12 below displays the
frequencies and percents of the types of technology available for use in teaching technology by vocational and technical faculty.

Table 4.12 *Frequencies and Percentages of the Types of Technology Available for Use in Teaching Technology by Vocational and Technical Faculty*

<table>
<thead>
<tr>
<th>Types of Technology Available For Use in Teaching</th>
<th>f</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Email</td>
<td>393</td>
<td>92.3</td>
</tr>
<tr>
<td>Instructor Email</td>
<td>402</td>
<td>94.4</td>
</tr>
<tr>
<td>Laser Disc, VCR, DVD, or CD Player</td>
<td>343</td>
<td>80.5</td>
</tr>
<tr>
<td>Digital Camera or Video Recorder</td>
<td>247</td>
<td>58.0</td>
</tr>
<tr>
<td>PDA or Smartphone</td>
<td>180</td>
<td>42.3</td>
</tr>
<tr>
<td>Instructor computer/Internet home</td>
<td>368</td>
<td>86.4</td>
</tr>
<tr>
<td>Instructor computer/Internet work</td>
<td>401</td>
<td>94.1</td>
</tr>
<tr>
<td>Wireless Internet</td>
<td>378</td>
<td>88.7</td>
</tr>
<tr>
<td>Video Conferencing</td>
<td>146</td>
<td>34.3</td>
</tr>
<tr>
<td>Elmo or Smartboard</td>
<td>191</td>
<td>44.8</td>
</tr>
<tr>
<td>LMS (Bb, Moodle, Other)</td>
<td>308</td>
<td>72.3</td>
</tr>
<tr>
<td>Virtual Learning Communities</td>
<td>100</td>
<td>23.5</td>
</tr>
<tr>
<td>Social Media</td>
<td>180</td>
<td>42.3</td>
</tr>
<tr>
<td>The Cloud</td>
<td>150</td>
<td>35.2</td>
</tr>
<tr>
<td>3-D Modeling</td>
<td>48</td>
<td>11.3</td>
</tr>
<tr>
<td>Laptop</td>
<td>320</td>
<td>75.1</td>
</tr>
<tr>
<td>Other</td>
<td>28</td>
<td>5.6</td>
</tr>
</tbody>
</table>

*Note. Results from 426 survey respondents of the 2013 vocational and technical faculty in the NCCCS*
Research Objective One

Objective one described the level of vocational and technical faculties’ perceptions of technology usefulness and ease of use in their teaching and learning process measured by Venkatesh & Davis’s (1996) Technology Acceptance Model (TAM). The TAM consisted of six perceived usefulness (PU) and six perceived ease of use (PEOU) questions. In total there were 12 Likert scale type questions (1= Extremely Unlikely, 2=Not Likely, 3=Undecided 4=Likely, and 5=Extremely Unlikely) that examined PU and PEOU. The PU scale (M = 4.02, SD = .928) evaluated whether faculty perceived technology to be useful or not. Items from the PU scale included “Using technology in my job would improve my job performance” and “Using technology would make it easier to do my job” (Davis, 1989). The PEOU (M = 3.83 SD = .732) assess faculties’ perceptions on technologies perceived ease of use. Examples from the PEOU scale included “I would consider that technology would be easy to learn” and “I would find that technology is clear and understandable” (Davis, 1989). Based on the survey results, vocational and technical faculty perceived technology to be useful and easy to use in the teaching/learning process. For both PU and PEOU, vocational and technical faculty perceived it was “likely” that they perceived technology was useful and easy. This was an indication that faculty were already utilizing technology and would consider using more in the future. Table 4.13 below provides an overview of the grand means and standard deviation for the summated items of the TAM scale.
Table 4.13 *Grand Means and Standard Deviations on Summated Items for TAM Subscales of Perceived Usefulness and Perceived Ease of Use*

<table>
<thead>
<tr>
<th>Vocational and Technical Faculty</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Usefulness</td>
<td>4.02</td>
<td>.928</td>
</tr>
<tr>
<td>Perceived Ease Of Use</td>
<td>3.83</td>
<td>.732</td>
</tr>
</tbody>
</table>

Note. Scale: 1= Extremely Unlikely, 2=Not Likely, 3=Undecided 4=Likely, 5=Extremely Likely

In order to better identify the Perceived Usefulness and Perceived Ease Of Use individual scale item means and standard deviations a table of values was developed. Table 4.14 displays the means and standard deviations for each of the individual items in the TAM subscales perceived usefulness and perceived ease of use.

Table 4.14 *Means and Standard Deviations for Vocational and Technical Faculty on the Individual Items for TAM Subscales of Perceived Usefulness and Perceived Ease of Use*

<table>
<thead>
<tr>
<th>Vocational and Technical Faculty</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Usefulness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Usefulness Item 6</td>
<td>4.16</td>
<td>.886</td>
</tr>
<tr>
<td>Perceived Usefulness Item 1</td>
<td>4.05</td>
<td>1.00</td>
</tr>
<tr>
<td>Perceived Usefulness Item 4</td>
<td>4.04</td>
<td>.972</td>
</tr>
<tr>
<td>Perceived Usefulness Item 2</td>
<td>4.01</td>
<td>1.02</td>
</tr>
<tr>
<td>Perceived Usefulness Item 3</td>
<td>3.95</td>
<td>1.07</td>
</tr>
</tbody>
</table>
Table 4.14 Continued

<table>
<thead>
<tr>
<th>Vocational and Technical Faculty</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Usefulness Item 5</td>
<td>3.92</td>
<td>1.06</td>
</tr>
</tbody>
</table>

**Perceived Ease Of Use**

<table>
<thead>
<tr>
<th>Perceived Ease Of Use 5</th>
<th>4.04</th>
<th>.822</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Ease Of Use 6</td>
<td>3.91</td>
<td>.848</td>
</tr>
<tr>
<td>Perceived Ease Of Use 2</td>
<td>3.82</td>
<td>.861</td>
</tr>
<tr>
<td>Perceived Ease Of Use 1</td>
<td>3.81</td>
<td>.857</td>
</tr>
<tr>
<td>Perceived Ease of Use 4</td>
<td>3.72</td>
<td>.890</td>
</tr>
<tr>
<td>Perceived Ease Of Use 3</td>
<td>3.67</td>
<td>.902</td>
</tr>
</tbody>
</table>

*Note. Scale: 1= Extremely Unlikely, 2=Not Likely, 3=Undecided 4=Likely, 5=Extremely Likely*

Further analysis also shows the influence of each individual perceived usefulness (PU) and perceived ease of use (PEOU) item within the TAM subscales on the teaching and learning process based upon the highest and lowest frequencies and percentages of the participants of the study. Table 4.15 offers frequencies and percentages of participants responses to individual items in the TAM subscale of technology perceived usefulness (PU) and Table 4.15 provides frequencies and percentages of participants responses to individual items in the TAM subscale of technology perceived ease of use (PEOU) and are denoted below.
Table 4.15 Frequency and Percentages of Participant Responses for Individual Items for the TAM Subscale Perceived Usefulness

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><em>f</em></td>
<td><em>P</em></td>
<td><em>f</em></td>
<td><em>P</em></td>
<td><em>f</em></td>
</tr>
<tr>
<td>Perceived Usefulness Item</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>7</td>
<td>1.6</td>
<td>35</td>
<td>8.2</td>
<td>54</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>1.9</td>
<td>38</td>
<td>8.9</td>
<td>57</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
<td>2.8</td>
<td>37</td>
<td>8.7</td>
<td>70</td>
</tr>
<tr>
<td>4</td>
<td>7</td>
<td>1.6</td>
<td>27</td>
<td>6.3</td>
<td>69</td>
</tr>
<tr>
<td>5</td>
<td>8</td>
<td>1.9</td>
<td>42</td>
<td>9.9</td>
<td>84</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>1.4</td>
<td>16</td>
<td>3.8</td>
<td>54</td>
</tr>
</tbody>
</table>

*Note.* Scale: 1= Extremely Unlikely, 2=Not Likely, 3=Undecided 4=Likely, 5=Extremely Likely

Table 4.16 Frequencies and Percentages of Participant’s Responses for Individual Items for the TAM Subscale Perceived Ease of Use

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><em>f</em></td>
<td><em>P</em></td>
<td><em>f</em></td>
<td><em>P</em></td>
<td><em>f</em></td>
</tr>
<tr>
<td>Perceived Ease Of Use Item</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>0.9</td>
<td>36</td>
<td>8.5</td>
<td>71</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>1.9</td>
<td>23</td>
<td>5.4</td>
<td>84</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>1.2</td>
<td>46</td>
<td>10.8</td>
<td>98</td>
</tr>
</tbody>
</table>
Table 4.16 Continued

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>f</td>
<td>P</td>
<td>f</td>
<td>P</td>
<td>f</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>1.4</td>
<td>40</td>
<td>9.4</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>1.2</td>
<td>17</td>
<td>4.0</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>1.6</td>
<td>18</td>
<td>4.2</td>
</tr>
</tbody>
</table>

Note. Scale: 1= Extremely Unlikely, 2=Not Likely, 3=Undecided 4=Likely, 5=Extremely Likely

Research Objective Two

Objective two was to explore and describe the level of vocational and technical faculty’s technology use as measured by the two levels of technology use using the subscales of adoption and integration. The KRTIS instrument was used to measure the extent of technology they integrate into their teaching and learning process. There were 19 Likert scale questions (1= Not Like Me At All, 2=Very Little Like Me, 3=Somewhat Like Me, 4=Very Much Like Me, and 5=Just Like Me) on the KRTIS survey. The KRTIS instrument that was used in the study can be found in Appendix F. The technology use levels were calculated by summated items for each subscale and then divided by the total number of all items to produce a grand means and standard deviation for each subscale. The subscale of adoption had the highest level of technology use (M=3.79, SD=.905). Some examples of the individual items included “I use technology to encourage students to share the responsibility for their own learning” and “I incorporate technology in my teaching to such an extent that it has
become a standard learning tool for my students” (Redmann & Kotrlik, 2004). According to Redmann & Kotrlik (2004), the adoption level of technology use indicates faculty have made technology a major aspect of their teaching and learning process along with physical changes in the classroom.

The subscale of integration had a lower level (M=2.52, SD=1.22). Some examples of the individual items included “I encourage students to design their own technology-based learning activities” and “I incorporate technology in my teaching to such an extent that my students use technology to collaborate with individuals or at other locations (other classes, other schools, other states, or countries, etc.)” (Redmann & Kotrlik, 2004). According to Redmann & Kotrlik (2004), integration indicates faculty are using technology in an innovative and persuasive way in order to improve teaching. This innovation and persuasive strategy becomes part of the daily teaching and learning process for the instructor and student. Table 4.17 displays means and standard deviations of respondents’ response to individual items for the KTRIS sub scales adoption and integration which are denoted below.

Table 4.17 Means and Standard Deviations for Vocational and Technical Faculty on the Individual Items for KRTIS Subscales of Adoption and Integration

<table>
<thead>
<tr>
<th>Vocational and Technical Faculty</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adoption</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adoption Item 3</td>
<td>4.08</td>
<td>.902</td>
</tr>
<tr>
<td>Adoption Item 1</td>
<td>3.98</td>
<td>.845</td>
</tr>
</tbody>
</table>
Table 4.17 Continued

<table>
<thead>
<tr>
<th>Adoption Item</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adoption Item 7</td>
<td>3.97</td>
<td>.964</td>
</tr>
<tr>
<td>Adoption Item 8</td>
<td>3.97</td>
<td>.976</td>
</tr>
<tr>
<td>Adoption Item 6</td>
<td>3.92</td>
<td>1.00</td>
</tr>
<tr>
<td>Adoption Item 4</td>
<td>3.89</td>
<td>1.15</td>
</tr>
<tr>
<td>Adoption Item 10</td>
<td>3.88</td>
<td>.982</td>
</tr>
<tr>
<td>Adoption Item 2</td>
<td>3.88</td>
<td>.997</td>
</tr>
<tr>
<td>Adoption Item 11</td>
<td>3.88</td>
<td>.983</td>
</tr>
<tr>
<td>Adoption Item 14</td>
<td>3.78</td>
<td>1.07</td>
</tr>
<tr>
<td>Adoption Item 9</td>
<td>3.77</td>
<td>1.02</td>
</tr>
<tr>
<td>Adoption Item 12</td>
<td>3.75</td>
<td>1.05</td>
</tr>
<tr>
<td>Adoption Item 13</td>
<td>3.50</td>
<td>1.11</td>
</tr>
<tr>
<td>Adoption Item 14</td>
<td>3.42</td>
<td>1.16</td>
</tr>
<tr>
<td>Adoption Item 5</td>
<td>3.09</td>
<td>1.29</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Integration Item</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integration Item 1</td>
<td>2.88</td>
<td>1.31</td>
</tr>
<tr>
<td>Integration Item 4</td>
<td>2.42</td>
<td>1.21</td>
</tr>
<tr>
<td>Integration Item 3</td>
<td>2.41</td>
<td>1.22</td>
</tr>
<tr>
<td>Integration Item 2</td>
<td>2.40</td>
<td>1.13</td>
</tr>
</tbody>
</table>

*Note.* Scale: 1= Not Like Me At All, 2=Very Little Like Me, 3=Somewhat Like Me, 4=Very Much Like Me, and 5=Just Like Me
In order to compare the KRTIS subscales of adoption and integration scores the individual items must be calculated into a grand means and standard deviations. Table 4.18 displays the grand means and standard deviation for the summated items of the two subscales of technology use in the KRTIS which are denoted below.

<table>
<thead>
<tr>
<th>Table 4.18 Grand Means and Standard Deviations and Summated Items for KRTIS Subscales of Adoption and Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vocational and Technical Faculty</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>M</td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>Adoption</td>
</tr>
<tr>
<td>Integration</td>
</tr>
</tbody>
</table>

*Note. Scale: 1= Not Like Me At All, 2=Very Little Like Me, 3=Somewhat Like Me, 4=Very Much Like Me, and 5=Just Like Me*

Further analysis also shows the influence of each individual adoption and integration item within the KRTIS subscales on the teaching and learning process based upon the high and low frequencies and percentages. Table 4.19 offers frequencies and percentages of participants’ responses to individual items in the KRTIS subscales of adoption and integration for technology use which are listed below.
Table 4.19 Frequencies and Percentages of Participants’ Response for Individual Items for the KRTIS Subscales of Adoption and Integration

<table>
<thead>
<tr>
<th>Item</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>f</td>
<td>P</td>
<td>f</td>
<td>P</td>
<td>f</td>
</tr>
<tr>
<td>Adoption</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item 1</td>
<td>2</td>
<td>.5</td>
<td>13</td>
<td>3.1</td>
<td>105</td>
</tr>
<tr>
<td>Item 2</td>
<td>12</td>
<td>2.8</td>
<td>17</td>
<td>4.0</td>
<td>117</td>
</tr>
<tr>
<td>Item 3</td>
<td>6</td>
<td>1.4</td>
<td>14</td>
<td>3.3</td>
<td>78</td>
</tr>
<tr>
<td>Item 4</td>
<td>23</td>
<td>5.4</td>
<td>31</td>
<td>7.3</td>
<td>77</td>
</tr>
<tr>
<td>Item 5</td>
<td>67</td>
<td>15.7</td>
<td>68</td>
<td>16.0</td>
<td>119</td>
</tr>
<tr>
<td>Item 6</td>
<td>13</td>
<td>3.1</td>
<td>22</td>
<td>5.2</td>
<td>89</td>
</tr>
<tr>
<td>Item 7</td>
<td>10</td>
<td>2.3</td>
<td>20</td>
<td>4.7</td>
<td>83</td>
</tr>
<tr>
<td>Item 8</td>
<td>11</td>
<td>2.6</td>
<td>19</td>
<td>4.5</td>
<td>86</td>
</tr>
<tr>
<td>Item 9</td>
<td>17</td>
<td>4.0</td>
<td>26</td>
<td>6.1</td>
<td>103</td>
</tr>
<tr>
<td>Item 10</td>
<td>12</td>
<td>2.8</td>
<td>25</td>
<td>5.9</td>
<td>86</td>
</tr>
<tr>
<td>Item 11</td>
<td>12</td>
<td>2.8</td>
<td>24</td>
<td>5.6</td>
<td>90</td>
</tr>
<tr>
<td>Item 12</td>
<td>19</td>
<td>4.5</td>
<td>25</td>
<td>5.9</td>
<td>113</td>
</tr>
<tr>
<td>Item 13</td>
<td>23</td>
<td>5.4</td>
<td>49</td>
<td>11.5</td>
<td>136</td>
</tr>
<tr>
<td>Item 14</td>
<td>17</td>
<td>4.0</td>
<td>29</td>
<td>6.8</td>
<td>114</td>
</tr>
<tr>
<td>Item 15</td>
<td>32</td>
<td>7.5</td>
<td>55</td>
<td>12.9</td>
<td>124</td>
</tr>
<tr>
<td>Integration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item 1</td>
<td>80</td>
<td>18.8</td>
<td>95</td>
<td>22.3</td>
<td>106</td>
</tr>
<tr>
<td>Item 2</td>
<td>110</td>
<td>25.8</td>
<td>127</td>
<td>29.8</td>
<td>117</td>
</tr>
<tr>
<td>Item 3</td>
<td>128</td>
<td>30.0</td>
<td>110</td>
<td>25.8</td>
<td>106</td>
</tr>
<tr>
<td>Item 4</td>
<td>125</td>
<td>29.3</td>
<td>107</td>
<td>25.1</td>
<td>109</td>
</tr>
</tbody>
</table>

Note. Scale: 1= Not Like Me At All, 2=Very Little Like Me, 3=Somewhat Like Me, 4=Very Much Like Me, and 5=Just Like Me
In addition to adoption and integration, the KRTIS scale contained technology barriers and technology anxiety. The technology barriers and technology anxieties are some of the reasons faculty were reluctant to integrate technology into their classrooms. These sub scales examined how these factors influence the faculty’s ability and willingness to use technology in their teaching and learning process. These scales were calculated by the summation of all items and then divided by the total number of all items in order to obtain a grand means and standard deviation. Table 4.20 provides an overview of the grand means and standard deviation for the summated items of the two sub scales: barriers to technology and technology anxiety.

Table 4.20 Grand Means and Standard Deviations on Summated Items for KRTIS Subscales of Barriers to Technology Integration and Technology Anxiety

<table>
<thead>
<tr>
<th></th>
<th>Vocational and Technical Faculty</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
</tr>
<tr>
<td>Barriers to Technology Integration</td>
<td>2.27</td>
</tr>
<tr>
<td>Technology Anxiety</td>
<td>1.95</td>
</tr>
</tbody>
</table>

Note: Barriers Scale 1= Not a Barrier, 2=Minor Barrier, 3=Moderate Barrier, 4=Major Barrier and Technology Anxiety Scale 1= No Anxiety, 2=Some Anxiety, 3=Moderate Anxiety, 4=High Anxiety, 5=Very High Anxiety

The first scale evaluated was barriers to technology ($M = 2.27$, $SD = .947$). Faculty were asked to rate their magnitude that each barrier may prevent them from integrating technology into the teaching and learning process. The scale consisted of nine Likert scale statements (1= Not a Barrier, 2=Minor Barrier, 3=Moderate Barrier, 4=Major Barrier). A few
examples of the barrier items included “Enough time to develop lessons that use technology” and “Administrative support for integration of technology in the teaching and learning process” (Kotrlik & Redmann, 2004). Table 4.21 provides the means and standard deviations for the participant’s response to individual items from barriers of Technology scale of KRTIS.

Table 4.21 Means and Standard Deviation for Vocational and Technical on the Individual Items for the KRTIS Subscale of Barriers to Technology Integration

<table>
<thead>
<tr>
<th>Barier Item</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barrier Item 1</td>
<td>2.85</td>
<td>.916</td>
</tr>
<tr>
<td>Barrier Item 3</td>
<td>2.46</td>
<td>1.06</td>
</tr>
<tr>
<td>Barrier Item 2</td>
<td>2.42</td>
<td>.932</td>
</tr>
<tr>
<td>Barrier Item 4</td>
<td>2.27</td>
<td>.968</td>
</tr>
<tr>
<td>Barrier Item 9</td>
<td>2.26</td>
<td>.975</td>
</tr>
<tr>
<td>Barrier Item 7</td>
<td>2.23</td>
<td>.821</td>
</tr>
<tr>
<td>Barrier Item 5</td>
<td>2.09</td>
<td>.982</td>
</tr>
<tr>
<td>Barrier Item 8</td>
<td>1.99</td>
<td>1.02</td>
</tr>
<tr>
<td>Barrier Item 6</td>
<td>1.90</td>
<td>.857</td>
</tr>
</tbody>
</table>

*Note:* Barrier Scale 1= Not a Barrier, 2=Minor Barrier, 3=Moderate Barrier, 4=Major Barrier

From the individual subscales, overall analysis can be drawn about the influence of each individual item within the KRTIS subscales on the teaching and learning process. Table 4.22 offers frequencies and percentages of participant responses to individual items in the subscale barriers.
Table 4.22 Frequencies and Percentages of Participant Responses for Individual Items for the KRTIS Subscale Barriers

<table>
<thead>
<tr>
<th>Barriers</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>f</td>
<td>P</td>
<td>f</td>
<td>P</td>
</tr>
<tr>
<td>Item 1</td>
<td>38</td>
<td>8.9</td>
<td>100</td>
<td>23.5</td>
</tr>
<tr>
<td>Item 2</td>
<td>83</td>
<td>19.5</td>
<td>130</td>
<td>30.5</td>
</tr>
<tr>
<td>Item 3</td>
<td>101</td>
<td>23.7</td>
<td>114</td>
<td>26.8</td>
</tr>
<tr>
<td>Item 4</td>
<td>104</td>
<td>24.4</td>
<td>160</td>
<td>37.6</td>
</tr>
<tr>
<td>Item 5</td>
<td>143</td>
<td>33.6</td>
<td>144</td>
<td>33.8</td>
</tr>
<tr>
<td>Item 6</td>
<td>160</td>
<td>37.6</td>
<td>164</td>
<td>38.5</td>
</tr>
<tr>
<td>Item 7</td>
<td>78</td>
<td>18.3</td>
<td>196</td>
<td>46.0</td>
</tr>
<tr>
<td>Item 8</td>
<td>180</td>
<td>42.3</td>
<td>117</td>
<td>27.5</td>
</tr>
<tr>
<td>Item 9</td>
<td>109</td>
<td>25.6</td>
<td>149</td>
<td>35.0</td>
</tr>
</tbody>
</table>

Note. Scale: 1= Not a Barrier, 2=Minor Barrier, 3=Moderate Barrier, 4=Major Barrier.

Vocational and technical faculty were asked to rate the magnitude of anxiety towards using technology that prevented them from integrating technology into their teaching and learning process. The technology anxiety scale was comprised of 12 Likert scale questions (1= No Anxiety, 2=Some Anxiety, 3=Moderate Anxiety, 4=High Anxiety, 5=Very High Anxiety). A few examples of the items from the scale included “How anxious do you feel when you think about using technology in instruction” and “How anxious do you feel when
you try to use Technology” (Redmann & Kotrlik, 2004). The analysis of the data revealed that vocational and technical faculty feel some anxiety when thinking of integrating technology in their teaching and learning process \((M=1.95, SD = .913)\). Table 4.23 provides the mean and standard deviations for technology anxiety items.

Table 4.23 Means and Standard Deviations for Vocational and Technical on the Individual Items for the KRTIS Subscale of Technology Anxiety

<table>
<thead>
<tr>
<th>Vocational and Technical Faculty</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology Anxiety Item 11</td>
<td>2.36</td>
<td>1.05</td>
</tr>
<tr>
<td>Technology Anxiety Item 2</td>
<td>2.10</td>
<td>.877</td>
</tr>
<tr>
<td>Technology Anxiety Item 3</td>
<td>2.07</td>
<td>.904</td>
</tr>
<tr>
<td>Technology Anxiety Item 12</td>
<td>2.02</td>
<td>1.01</td>
</tr>
<tr>
<td>Technology Anxiety Item 10</td>
<td>2.00</td>
<td>.953</td>
</tr>
<tr>
<td>Technology Anxiety Item 5</td>
<td>1.92</td>
<td>.962</td>
</tr>
<tr>
<td>Technology Anxiety Item 7</td>
<td>1.89</td>
<td>.879</td>
</tr>
<tr>
<td>Technology Anxiety Item 4</td>
<td>1.87</td>
<td>.846</td>
</tr>
<tr>
<td>Technology Anxiety Item 9</td>
<td>1.84</td>
<td>.980</td>
</tr>
<tr>
<td>Technology Anxiety Item 6</td>
<td>1.83</td>
<td>.846</td>
</tr>
<tr>
<td>Technology Anxiety Item 8</td>
<td>1.82</td>
<td>.851</td>
</tr>
<tr>
<td>Technology Anxiety Item 1</td>
<td>1.66</td>
<td>.804</td>
</tr>
</tbody>
</table>

*Note. Scale: 1= No Anxiety, 2=Some Anxiety, 3=Moderate Anxiety, 4=High Anxiety, 5=Very High Anxiety*
Further analysis can be drawn about the influence of each individual item within the KRTIS subscales on the teaching and learning process. Table 4.24 offers frequencies and percentages of participant responses to individual items in the subscale of technology anxiety.

Table 4.24 Frequencies and Percentages of Participant Responses for Individual Items for the KRTIS Subscale Perceptions of Technology Anxiety

<table>
<thead>
<tr>
<th>Item</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>f</td>
<td>P</td>
<td>f</td>
<td>P</td>
<td>f</td>
</tr>
<tr>
<td>Tech Anxiety</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item 1</td>
<td>215</td>
<td>50.5</td>
<td>155</td>
<td>36.4</td>
<td>45</td>
</tr>
<tr>
<td>Item 2</td>
<td>107</td>
<td>25.1</td>
<td>200</td>
<td>46.9</td>
<td>92</td>
</tr>
<tr>
<td>Item 3</td>
<td>119</td>
<td>27.9</td>
<td>192</td>
<td>45.1</td>
<td>88</td>
</tr>
<tr>
<td>Item 4</td>
<td>182</td>
<td>42.7</td>
<td>150</td>
<td>35.2</td>
<td>68</td>
</tr>
<tr>
<td>Item 5</td>
<td>165</td>
<td>38.7</td>
<td>166</td>
<td>39.0</td>
<td>63</td>
</tr>
<tr>
<td>Item 6</td>
<td>170</td>
<td>39.9</td>
<td>175</td>
<td>41.1</td>
<td>66</td>
</tr>
<tr>
<td>Item 7</td>
<td>159</td>
<td>37.3</td>
<td>180</td>
<td>42.3</td>
<td>66</td>
</tr>
<tr>
<td>Item 9</td>
<td>197</td>
<td>46.2</td>
<td>137</td>
<td>32.2</td>
<td>62</td>
</tr>
<tr>
<td>Item 10</td>
<td>144</td>
<td>33.8</td>
<td>178</td>
<td>41.8</td>
<td>73</td>
</tr>
<tr>
<td>Item 11</td>
<td>93</td>
<td>21.8</td>
<td>166</td>
<td>39.0</td>
<td>101</td>
</tr>
<tr>
<td>Item 12</td>
<td>151</td>
<td>35.4</td>
<td>164</td>
<td>38.5</td>
<td>72</td>
</tr>
</tbody>
</table>

Note. Scale: 1= No Anxiety, 2=Some Anxiety, 3=Moderate Anxiety, 4=High Anxiety, 5=Very High Anxiety.
Research Objective Three

Objective three examined the relationships between the vocational and technical faculty’s level of technology integration with each of the two levels of technology use (adoption and integration), along with the barriers and technology anxiety, with the technology acceptance factors (perceptions of technology usefulness and ease of use). By utilizing the Pearson Correlation test, an examination of the bi-variate between each of the subscales of the KRTIS and the subscales of the TAM were compared and observed. Correlations are used to measure the degree of both positive and negative association between two given variables. In a correlations test a positive value creates a positive association and a negative value creates an inverse or negative association which can identify and help explain how close the variables are associated with each other, thus determining the strength of their relationships (Hair et. al, 2006). Table 4.25 provides cross tabulations and displays Pearson’s correlations between the various KTRIS variables and the TAM perceived usefulness scale which is denoted below.
Table 4.25 Relationship between the KTRIS Variables and the TAM’s Perceived Usefulness as Measured by Pearson’s Correlation

<table>
<thead>
<tr>
<th>KTRIS Variables</th>
<th>Perceived Usefulness</th>
<th>Interpretation</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adoption</td>
<td>.556</td>
<td>Substantial</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Integration</td>
<td>.322</td>
<td>Moderate</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Barriers</td>
<td>-.103</td>
<td>Low</td>
<td>&lt;.034</td>
</tr>
<tr>
<td>Technology Anxiety</td>
<td>-.034</td>
<td>Low</td>
<td>&lt;.482</td>
</tr>
</tbody>
</table>

Note. n = 426. Davis’s (1971) descriptors are as follows: .70 or higher = very strong association, .50 to .69 = substantial association, .30 to .49 = moderate association, .10 to .29 = low association, .01 to .09 = negligible association.

The correlation analysis revealed that adoption was statistically positive substantial relationship, while integration had a statistically positive moderate relationship with perceived usefulness based on Davis’ interpretations. Barriers had a statistically negative low relationship with perceived usefulness. Technology anxiety had a statistically negative negligible relationship with perceived usefulness as well.

A second correlation test was used to analyze the relationships between KTRIS variables and perceived ease of use in integrating technology in the teaching and learning process. Table 4.26 provides cross-tabulations and displays Pearson’s correlations between the various KTRIS variables and the TAM perceived ease of use scale which is denoted below.
Table 4.26 Relationship between the KRTIS Scale Variables and the TAM’s Perceived Ease of Use as Measured by Pearson’s Correlation

<table>
<thead>
<tr>
<th>KRTIS Variables</th>
<th>r</th>
<th>Interpretation</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adoption</td>
<td>.531</td>
<td>Substantial</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Integration</td>
<td>.376</td>
<td>Moderate</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Barriers</td>
<td>-.230</td>
<td>Low</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Technology Anxiety</td>
<td>-.401</td>
<td>Moderate</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

*Note. n = 426. Davis’s (1971) descriptors are as follows: .70 or higher = very strong association, .50 to .69 = substantial association, .30 to .49 = moderate association, .10 to .29 = low association, .01 to .09 = negligible association.*

The correlation analysis revealed that adoption had a statistically positive substantial relationship, while integration had a statistically positive relationship with perceived ease of use based on Davis’ interpretations. Barriers had a statistically negative low relationship with perceived usefulness. Technology anxiety had a statistically negative moderate relationship with perceived usefulness.

The Pearson’s correlation test revealed of the two technology use levels (adoption and integration) and the two main factors (barriers and technology anxiety) from the KRTIS, that technology adoption had the strongest (statistically substantial) relationship with the technology acceptance factors of both, perceived usefulness and ease of use from the TAM.
Research Objective Four

Objective four examined all of major variables that could identify and explain the variance in the level of vocational and technical faculty’s technology use. These variables included; various demographic variables, technology use factors, and perceptions of such factors as technology barriers and anxieties. The variables were examined to determine which ones best explained the significant proportion of the variance in technology use within the two levels of technology use of adoption and integration. A stepwise regression model was used to determine which variables were most influential on technology use and the teaching and learning process. From the stepwise regression the following independent variables were used as possible explanatory variables for the KRTIS model; the grand means of technology anxiety, the grand means of barriers, the number of technology training sources, the grand means of perceived usefulness, the grand means of perceived ease of use, age, gender, education level, and the number of years teaching.

The dependent variables were technology adoption and integration. Each one was entered into the model one at a time as adoption then integration. The model produced beta weights, which are standardized multiple regression coefficients, which were examined to determine which variables were significant in the prediction of faculty technology adoption. According to Hair et al. (2006), these beta coefficients are only guides of relative importance of independent variables.

The first regression used adoption as the dependent variable (ANOVA F = 63.8, P = <.001). Five variables explained 43.2% of the variance in the mean of the technology
adoption scale, including the grand means of perceived usefulness \((R^2 = .309)\) which accounted for the largest amount of variance. Four other variables explained the additional variance which included the following; the grand means of perceived ease of use \((R^2 = .087)\), the grand means of barriers \((R^2 = .020)\), technology training by colleagues \((R^2 = .017)\), and the education level of a Master’s degree \((R^2 = .006)\). Therefore, perceived usefulness (PU) explains 30.9% of the variance in the adoption model and has a positive effect of on vocational and technical faculty’s use of technology. However, barriers have a negative effect on technology use. The remaining variables were not included in the model because they did not explain enough of the variance. Table 4.27 below provides the results from the technology adoption regression model.

Table 4.27 Multiple Regression Analysis in Explaining the Variance to the Technology Integration Scale Adoption of the KRTIS

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>F</th>
<th>P</th>
<th>(R^2)</th>
<th>(R^2) Change</th>
<th>F Change</th>
<th>P of F Change</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adoption</td>
<td>63.8</td>
<td>&lt;.001</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Large</td>
</tr>
<tr>
<td>Perceived Usefulness</td>
<td></td>
<td></td>
<td>.309</td>
<td>.309</td>
<td>189.5</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>Perceived Ease of Use</td>
<td></td>
<td></td>
<td>.396</td>
<td>.087</td>
<td>61.2</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>Barriers</td>
<td></td>
<td></td>
<td>.415</td>
<td>.020</td>
<td>14.1</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>Technology Training (Source 4 Colleagues)</td>
<td></td>
<td></td>
<td>.425</td>
<td>.017</td>
<td>12.6</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>Education Level (Masters)</td>
<td></td>
<td></td>
<td>.432</td>
<td>.006</td>
<td>4.7</td>
<td>.031</td>
<td></td>
</tr>
</tbody>
</table>

Note. Cohen (1988): \(R^2 > .0196 = \text{small effect size}, R^2 > .13 = \text{moderate effect size}, R^2 > .26 = \text{large effect size.} \)
Additional results of the regression analysis are presented in Table 4.28 to examine the amount of variance that KRTIS variables and TAM variables explained in adoption which are denoted below.

Table 4.28 Stepwise Multiple Regression Analysis to Explore if KRTIS Variables and TAM Variables Explain a Significant Amount of Variance in Adoption

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>26787.38</td>
<td>5</td>
<td>5357.47</td>
<td>63.86</td>
<td>.000</td>
</tr>
<tr>
<td>Residual</td>
<td>35233.45</td>
<td>420</td>
<td>83.89</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>62020.82</td>
<td>425</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall-R2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>21.100</td>
<td></td>
<td>6.158</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>Beta</td>
<td>.369</td>
<td></td>
<td>8.641</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>t</td>
<td>7.104</td>
<td></td>
<td>3.423</td>
<td>.001</td>
<td></td>
</tr>
<tr>
<td>Constant (Adoption)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Usefulness</td>
<td>.800</td>
<td>.369</td>
<td>8.641</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>Perceived Ease Of Use</td>
<td>.844</td>
<td>.307</td>
<td>7.104</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>Barriers</td>
<td>-.283</td>
<td>-.130</td>
<td>3.423</td>
<td>.001</td>
<td></td>
</tr>
<tr>
<td>Technology Training:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source4 - Colleagues</td>
<td>2.494</td>
<td>.093</td>
<td>2.495</td>
<td>.013</td>
<td></td>
</tr>
<tr>
<td>Education:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Masters</td>
<td>2.031</td>
<td>.084</td>
<td>2.250</td>
<td>.025</td>
<td></td>
</tr>
<tr>
<td>Excluded Variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td>.846</td>
<td>.398</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td>-1.196</td>
<td>.232</td>
<td></td>
</tr>
<tr>
<td>Years Teaching</td>
<td></td>
<td></td>
<td>1.089</td>
<td>.277</td>
<td></td>
</tr>
<tr>
<td>Education:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GED</td>
<td></td>
<td></td>
<td>-1.834</td>
<td>.067</td>
<td></td>
</tr>
<tr>
<td>High School</td>
<td></td>
<td></td>
<td>-.595</td>
<td>.552</td>
<td></td>
</tr>
<tr>
<td>Certifications</td>
<td></td>
<td></td>
<td>.680</td>
<td>.497</td>
<td></td>
</tr>
<tr>
<td>Specialized Training</td>
<td></td>
<td></td>
<td>-1.196</td>
<td>.232</td>
<td></td>
</tr>
<tr>
<td>Associate</td>
<td></td>
<td></td>
<td>-1.020</td>
<td>.308</td>
<td></td>
</tr>
<tr>
<td>Undergraduate</td>
<td></td>
<td></td>
<td>1.543</td>
<td>.124</td>
<td></td>
</tr>
<tr>
<td>Doctoral</td>
<td></td>
<td></td>
<td>.958</td>
<td>.339</td>
<td></td>
</tr>
<tr>
<td>Technology Training:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source1 - Self-Taught</td>
<td></td>
<td></td>
<td>.904</td>
<td>.367</td>
<td></td>
</tr>
<tr>
<td>Source2 - Workshop/Conferences</td>
<td></td>
<td></td>
<td>1.409</td>
<td>.160</td>
<td></td>
</tr>
<tr>
<td>Source3 - College Courses</td>
<td></td>
<td></td>
<td>1.414</td>
<td>.158</td>
<td></td>
</tr>
<tr>
<td>Technology Anxiety</td>
<td></td>
<td></td>
<td>-1.548</td>
<td>.122</td>
<td></td>
</tr>
</tbody>
</table>

Note. *p<.05
From the five variables that were entered into the model, two variables influenced adoption more than the others. The standardized Beta coefficients for these two variables were: 1) perceived usefulness (Beta = .369, p=.000); 2) perceived ease of use (Beta =.307, p=.000). The third influential variable was education (Masters Degree) level (Beta= .124, p=.001). The only negative Beta coefficient was technology barriers (Beta= -.130, p=.001) which indicates as barriers to technology increase, faculty motivation to remain in the adoption level of technology use decreases. With one unit of change in the independent variable, the dependent variable of adoption changes by one and in the case of technology barriers, it is a negative change. The positive Beta coefficients shows influence on the dependent variable of adoption.

For the second regression integration was used as the dependent variable (ANOVA F = 24.4, P <.001). Four variables explained 18.8% of the variance in the mean of the integration scale, including the grand means of perceived ease of use (R² = .141) which accounted for the largest amount of variance. Three other variables explained the additional variance which included the following; the grand means of perceived usefulness (R²=.025), age (R²=.010), technology training through college courses (R²=.012). There were no negative Beta values that would influence faculty to not integrate technology. Therefore, perceived ease of use (PEOU) explains 14.1% of the variance in the integration model and has a positive effect of on vocational and technical faculty’s use of technology. As perceive ease of use (PEOU) perceived usefulness (PU), faculty age and technology training (college courses) increase the more likely the faculty are to engage in technology integration. Table 4.29 provides results from the integration regression model which is denoted below.
Table 4.29 *Multiple Regression Analysis in Explaining the Variance to the Technology Integration Scale Integration of the KRTIS*

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>$F$</th>
<th>$P$</th>
<th>$R^2$</th>
<th>$R$</th>
<th>$F$</th>
<th>$P$</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integration</td>
<td>24.4</td>
<td>&lt;.001</td>
<td>.141</td>
<td>.141</td>
<td>69.7</td>
<td>&lt;.001</td>
<td>Moderate</td>
</tr>
<tr>
<td>Perceived Ease of Use (PEOU)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Usefulness (PU)</td>
<td></td>
<td></td>
<td>.166</td>
<td>.025</td>
<td>12.5</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td>.176</td>
<td>.010</td>
<td>5.3</td>
<td>.022</td>
<td></td>
</tr>
<tr>
<td>Technology Training (sources3-College Courses)</td>
<td></td>
<td></td>
<td>.188</td>
<td>.012</td>
<td>6.1</td>
<td>.014</td>
<td></td>
</tr>
</tbody>
</table>

*Note. Cohen (1988): $R^2 > .0196$ = small effect size, $R^2 > .13$ = moderate effect size, $R^2 > .26$ = large effect size.*

Additional results of the regression analysis related to technology integration are presented in Table 4.30 below to examine the amount of variance that KRTIS variables and TAM variables explained in integration.
Table 4.30 *Stepwise Multiple Regression Analysis to Explore if KRTIS Variables and TAM Variables Explain a Significant Amount of Variance in Integration*

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>1342.636</td>
<td>4</td>
<td>335.659</td>
<td>24.351</td>
<td>.000</td>
</tr>
<tr>
<td>Residual</td>
<td>5803.179</td>
<td>421</td>
<td>13.784</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>7145.815</td>
<td>425</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Overall R2</th>
<th>B</th>
<th>Beta</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant (Integration)</td>
<td>18.8%</td>
<td>-1.831</td>
<td>-1.281</td>
<td>.201</td>
<td></td>
</tr>
<tr>
<td>Step 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Ease Of Use</td>
<td></td>
<td>.287</td>
<td>.308</td>
<td>5.897</td>
<td>.000</td>
</tr>
<tr>
<td>Perceived Usefulness</td>
<td></td>
<td>.134</td>
<td>.182</td>
<td>3.585</td>
<td>.000</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td>.046</td>
<td>.116</td>
<td>2.47</td>
<td>.014</td>
</tr>
<tr>
<td>Technology Training:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source3 - College Courses</td>
<td></td>
<td>0.922</td>
<td>.110</td>
<td>2.459</td>
<td>.014</td>
</tr>
<tr>
<td>Excluded Variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td>-.404</td>
<td>.686</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Years Teaching</td>
<td></td>
<td>.846</td>
<td>.398</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technology Training:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source1 - Self-Taught</td>
<td></td>
<td>-1.517</td>
<td>.130</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source2 - Workshop/Conferences</td>
<td></td>
<td>.780</td>
<td>.436</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source4 - Colleagues</td>
<td></td>
<td>-1.197</td>
<td>.232</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barriers</td>
<td></td>
<td>-1.423</td>
<td>.155</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technology Anxiety</td>
<td></td>
<td>.069</td>
<td>.945</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GED</td>
<td></td>
<td>-.752</td>
<td>.452</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High School</td>
<td></td>
<td>-.184</td>
<td>.854</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Certifications</td>
<td></td>
<td>1.184</td>
<td>.237</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specialized Training</td>
<td></td>
<td>-.179</td>
<td>.858</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Associate</td>
<td></td>
<td>-.987</td>
<td>.324</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Undergraduate</td>
<td></td>
<td>-.843</td>
<td>.400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Masters</td>
<td></td>
<td>1.390</td>
<td>.165</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doctoral</td>
<td></td>
<td>.378</td>
<td>.706</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. *p<.05

From the four variables that were entered the model, the highest standardized Beta coefficient was perceived ease of use (Beta =-.308, p=.000), which was the most influential
variable. The next three highest were; 1) perceived usefulness (Beta = .182, p =.000); 2) age (Beta = .116, p =.014); and technology training source3-college courses (Beta = .110, p = .014). The positive Beta coefficient shows the more influence of the variables on the dependent variable, the more likely participants will integrate technology in the teaching/learning process. The negative Beta coefficient of technology barriers indicates an inverse relationship with the dependent variable integration.

Summary

This chapter examined and reported the findings from the research on North Carolina community college full time vocational and technical faculty. The researcher distributed an electronic survey to faculty to determine their level of technology use. The survey sought to examine how the faculty used technology in their teaching and learning process. Through the use of descriptive statistics it was determined that the average participant was male (n=219, P = 51.4), 49 years old (SD=10.38), had 14.5 years of teaching experience (SD=9.23), and held a master’s degree (n=204, P = 47.9). However, the gender difference was minimal (male=219, P = 51.4 vs. female=207, P = 48.6), the majority age category was 51-60 (n=157, P = 36.8) and the number of years teaching was 6-10 (n=110, P = 25.8). In addition, the KRTIS survey instrument was used to examine how and what type of technology the vocational and technical faculty used in their classrooms. Descriptive statistics were utilized to examine and evaluate the level of technology integration and perceived usefulness and ease of use in research objectives one and two. For research objective three, a Pearson’s
correlation analysis was used to identify relationships among the variables. The fourth research objective utilized a stepwise multiple regression analysis to determine the variance amongst the various variables.

Research objective one utilized descriptive statistics to determine the level of the vocational and technical faculty’s’ perceptions of technology usefulness and perceptions of technology ease of use in their teaching and learning process. The statistical test findings revealed that faculty perceived technology as useful (M=4.02, SD=.928) but were undecided about the ease of use (M=3.83, SD=.732) of technology in the technology use in the classroom and their teaching and learning process.

Findings from research objective two indicated that the majority of faculty were in the adoption phase of technology use. To determine the technology use a grand means and standard deviations were calculated by a summation of all items and divided by the total number of items for each subscale of the KRTIS. Adoption – using technology on a regular basis had the highest technology use level (M=3.79, SD=.905) over integration – innovative use of technology (M=2.52, SD=1.22). Descriptive statistics also revealed and explained faculty did not experience technology anxiety (M=1.95, SD=.913) in the adoption and integration of technology in their classrooms and their teaching and learning process.

Objective three utilized Pearson’s correlations to compare the KRTIS with the TAM. All of the KRTIS subscales of adoption, integration, barriers to technology, and technology anxiety had a range of substantial, moderate, and low relationship with the TAM
The KRTIS subscales of barriers and technology anxiety showed a negative relationship in both TAM subscales of PU and PEOU.

A stepwise multiple regression analysis was conducted for objective four to determine which variables explained the variance within each technology adoption and integration model. The statistical tests revealed that the variables comprised of perceived usefulness, perceived ease of use, technology barriers, age, technology training (source3 – college courses) and (source4 – colleagues), and education level (master’s degree) all had influence on technology use. The statistical tests also revealed many variables served as obstacles to complete technology use for faculty in their teaching and learning processes.

A careful analysis of the four research objectives in this study provides a better understanding of why faculty do or do not implement technology in their teaching and learning process and their classroom. By identifying those factors that deter or limit faculty from implementing or using technology provides an opportunity to discuss and make recommendations.
CHAPTER FIVE

REVIEW, CONCLUSIONS, DISCUSSIONS, AND RECOMMENDATIONS

This chapter provides a review of the research literature, methodology, survey results, and discussion of significant findings. In addition, recommendations for application, policy considerations, and further research will be presented.

Review and Conclusions

Today’s technical workforce is required to possess specific and current skills sets in order to be employed and remain competitive in the twenty-first century (Purdue, 2012). Computers, machinery, and informational technologies are an integral component of those required technical skill sets (Grey & Herr, 1998). Much of the technical workforce obtained their technical training from formal education institutions such as the community college, university, and trade schools (Stone et al., 2009). In fact, the U.S. National Education Technology Plan of 2010 calls for more innovation and technology to meet the challenges of higher education and to improve efficiencies and effectiveness for training the future workforce (Hershaft, 2011). Therefore, if higher education is going to be successful in preparing their students for the technical 21st century workforce, they must embrace, understand, and utilize instructional technologies in order to be most efficient and effective in their teaching and learning process. In particular, the vocational and technical faculty who provide instruction in many of the community college technical and trade related programs are required to teach current industry specific technology skills along with utilizing current
instructional technology for their students (DeLacey & Leonard, 2002). According to Kotrlik & Redmann (2004) today’s educators have more access to instructional technology and know how important it is to their teaching and learning process. In fact, the North Carolina community college’s vocational and technical programs are often referred to as the answer to meeting the technical labor needs of many employers of various industries (Purdue 2011). In addition, through the correct implementation and application and of instructional technology, community college administrators will be able to meet or improve the challenges they face such as; budgetary, competition, student demand, regulation, and other related sources (Shelton, 2012).

It is crucial that vocational and technical faculty possess the desire, knowledge, and skills to utilize and implement technology in the teaching and learning process. However, the literature revealed that even though higher education faculty do consider using technology, they often do not use it at all or limit their capabilities of doing so (Redmann & Kotrlik, 2004). Little research has been conducted on why faculty do not utilize technology because it was more focused on the impact of the technology on learners or the technology itself (Zhao & CZiko, 2001; Thirunarayanan & Perez-Prado, 2005; Kotrlik & Redmann, 2005). Therefore, the purpose of this study was to examine North Carolina community college vocational and technical faculty levels of technology use/integration and related factors and demographic variables used to predict technology use along with perceived technology barriers and anxieties. The research findings will provide an insight to the level that vocational and technical faculty are using and integrating technology into their teaching and learning process and the classroom. In addition, vocational and technical faculty attributes
and profiles will be better identified and understood in order to develop strategies to improve instructional technology use and integration.

The research study started off with an introduction of the problem, purpose of the study, research objectives, and its significance in higher education and its environment. Next was the literature review which was anchored and focused on understanding why vocational and technical faculty do and do not utilize or integrate technology in their teaching and learning process. First, a historical review of technology in higher education was discussed. The second section provided an overview of the differences and similarities between technology adoption and technology integration. The third section introduced and discussed Fred Davis’s Technology Acceptance Model (TAM), which provided the theoretical framework for this study. The fourth section introduced and discussed Kotrlik & Redmann’s Technology Integration Scale (KRTIS). The fifth section examined the constructs that influenced technology use/integration such as; demographic factors (age, gender, experience, and education); technology barriers and anxieties, and perceptions of usefulness and ease of use. The final section discussed some higher education facts that identify growing trends in the higher education instructional technology sector.

Discussion of Findings

In the 21st century there is an abundance of available instructional technology and educators know just how important technology integration is in their teaching and learning process (Kotrlik & Redmann, 2005; Keengwe & Onchwari, 2008; Su, 2009). Without the
proper support and implementation of such instructional technologies faculty may not properly train and educate their students to fulfill the demand of a well-educated technical workforce that is required by industry (Stone, Kaminski, & Gloeckner, 2009). When instructional technology is used in the classroom it often creates a learning environment similar to the workplace (Davis, 1987; Plank et al., 2005; Keengwe et al., 2008; Resiser, 2001). In addition, technology use and integration supports the efforts of higher education institutions and administrators to meet many of the challenges they face such as costs, competition, regulation, and quality instruction (Blumenstyk et al., 2008). This study included four research objectives and associated questions to serve as a framework and provide a better understanding and knowledge of vocational and technical faculty technology use and integration in their teaching and learning process.

Demographic Information

This research study captured both personal and professional related demographic information of the participants who agreed to complete the survey. The data collected from the survey results included; frequencies, percents, means and standard deviations of various factors and variables that contained both categorical and continuous data. The target population of this study was vocational and technical fulltime faculty who worked at one of the 58 community colleges within the North Carolina community college system. The respondents (N = 426, P = 11.9%) were faculty who provided instruction in one of ten different occupational disciplines of the community college.
Some of the personal factors were age, gender, and level of education. The average respondent was male (n = 219, P = 51.4), 49 years of age, and held a master’s degree (n = 204, P = 47.9). Professional related factors consisted of the number of years teaching and technology training sources. The average respondent possessed 14.5 years of teaching experience and identified themselves as being self-taught (n = 384, P = 90.1) as their source of technology training followed by workshops/conferences (n = 370, P = 86.9) and then colleagues (n = 302, P = 71.6) to round out the top three variables. The least likely source of technology training was college courses (n = 259, P = 60.8). However, the gender difference was minimal (male=219 vs. female=207), the majority age category was 51-60 (n=157, P = 36.8) and the number of years teaching was 6-10 (n=110, P = 25.8).

The findings of the demographic factors suggest the possibility that a majority of vocational and technical faculty are in their second career being male at age 51-60 with 14.5 years of teaching experience and possess a master’s degree. In addition, over 90% of the faculty stated their source of technology training was self-taught, followed by a close second of workshops/conferences at almost 87%. These findings suggest most faculty are collaborating with each other and attend workshops/conferences which require less time and commitment than college courses.

Research Objective One

Research objective one intended to describe the level of vocational and technical faculty’s perceptions of both technology usefulness and ease of use in their teaching and learning process measured by the Technology Acceptance Model (TAM). Faculty perceived
technology as useful with the grand means and standard deviations (M = 4.02, SD = .928) and perceived technology as ease of use (M =3.83, SD = .886).

Research question #1 - Do vocational and technical faculty who perceive instructional technology as useful more likely to integrate technology into their teaching and learning process?

Research answer #1 – The decision of an individual to either accept or reject technology use/integration can be based upon many different reasons. Perceived usefulness is defined as the extent in which an individual feels the technology will be useful and help them perform their job duties and responsibilities (Davis, 1989; Venkatesh, 2000). The findings revealed that respondents do perceive technology as useful and it would assist them in performing their job duties. This was supported by faculty who responded to the survey statements “Using technology would enhance my effectiveness on the job” with the grand means and standard deviations (M = 4.04, SD = .972) and “Using technology in my job would improve my job performance” (M = 4.01, SD = 1.02) as likely on the scale. Davis (1989) found similar results when he measured perceived usefulness with a computer system.

Research question #2 - Do vocational and technical faculty who perceive instructional technology as easy to use more likely to integrate technology into their teaching and learning process?

Research answer #2 – Even though an individual can perceive technology as useful it does not necessarily mean they perceive it as easy to use which could lead to a rejection of
technology use. According to Davis (1989) individuals who perceive the performance benefits are outweighed by the effort and time to learn the technology is referred to as the perceived ease of use. The findings revealed that most respondents rated themselves in the “undecided” category and not in the “not likely” or “likely” category for the construct of perceived ease of use for technology. The faculty were mostly undecided on the survey statements “I would find that technology is clear and understandable” with the grand means and standard deviations (M = 3.67, SD = .902) and “I would find technology easy to use” (M = 3.91, SD = .848). Davis (1989) found similar results when he measured perceived ease of use with a computer system.

Research Objective Two

Research objective two sought to describe the level of the vocational and technical faculties’ level of instructional technology integration in terms of the two constructs of technology use (adoption and integration) and factors that may influence technology use such as barriers to technology and technology anxiety as measured by the Kotrlik & Redmann Technology Integration Scale (KRTIS-2005).

Research question #3 – What is the current perceived instructional technology use level (adoption or integration) of the vocational and technical faculty?

Research answer #3 - The study found the respondents reported their adoption subscale was in the “some like me” with the grand means and standard deviations (M = 3.79, SD = .905). This was followed by the integration subscale which was reported in the “very
little like me” (M = 2.52, SD = 1.22). Therefore, even though instructional technology is readily available and faculty report they seek out various technology training sources, they are still in the adoption phase of technology use/integration. Faculty are still not at the integration level in which they are integrating technology in their teaching and learning process, along with utilizing it in their classroom on a daily basis. Previous research by Redmann & Kotrlik (2004) revealed similar results with teachers still only in the adoption phase of the KRTIS scale.

According to Spotts (1999) digital computers, the Internet, and informational technologies have been on college campuses for several decades or more with the expectation that new instructional technologies would revolutionize teaching and learning in American higher education. However, even with all of these available technologies in every two and four year college, not all faculty have implemented or actually utilized these instructional technologies in their curriculum, classroom, and teaching/learning process (Thirunarayanan & Perez-Prado, 2005).

Research question #4 - What are the current perceived instructional technology barriers and anxiety levels of the vocational and technical faculty?

Research answer #4 - The study found the respondents reported their barriers to technology use was “a minor barrier” with the grand means and standard deviations (M = 2.27, SD = .947). Barriers to technology use do effect the adoption and integration of technology use in their teaching and learning process. There were nine barriers to technology items on the survey. Participants responded to the following statement “Availability of
technical support to effectively use instructional technology in the teaching/learning process” and “Availability of technology for the number of students in my classes” as the greatest minor barriers. Research supports this barrier as the lack of technical support increases, the number of faculty who want to use technology decreases (Abrahams, 2010; Keengwe, Onchwari, & Wachira, 2008; Wachira & Keengee, 2011). Another reported barrier to technology use was the time factor as participants responded to the statement “Enough time to develop lessons that use technology” and “Scheduling enough time for students to use the Internet, computers, or other technology in the teaching/learning process” as the second greatest barrier. Most faculty realize they need additional time beyond their normal teaching duties to learn and properly implement instructional technology (Rogers, 2000; Pajo & Wallace, 2007). Prior research supports this finding as time becomes a problem for the individual and institution (Rogers, 2000; Redmann & Kotrlik, 2004/2005; Peluchette & Rust, 2005).

The study also found the respondents reported their technology anxiety to technology use subscale was some anxiety with the grand means and standard deviations (M = 2.52, SD = 1.22). Technology anxiety does impact faculty’s decision on technology use. There were twelve technology anxiety items on the survey. Out of all of the respondents, 23.7% had some anxiety when they could not keep up with technology advances. Furthermore this is supported by the faculty reporting to the statements “How anxious do you feel when you try to use new technology?” and “How anxious do you feel when you are faced with using new technology?” as having some anxiety. Otherwise, participants expressed no to some
technology anxiety to using technology on the other subscale items. Similar results were reported by Redmann & Kotrlik (2004/2005) and Pajo & Wallace (2007).

These findings suggest most vocational and technical faculty have been exposed and have progressed throughout the years as technology has been commonplace in higher education for several decades and appears to experience little to some barriers to technology and technology anxiety. These results have improved over prior research when technology barriers and anxiety were at higher levels and had a stronger influence on technology adoption and integration by previous faculty members (Butler & Sellborn, 2002; Conrad & Munro, 2008; Kotrlik & Redmann, 2004/2005).

Research Objective Three

Research objective three examined the relationships between vocational and technical faculty’s instructional technology acceptance factors (perceived usefulness and perceived ease of use of technology) and levels of technology integration with each of the two levels of technology use (adoption and integration) along with barriers and anxiety. The fundamental concepts and constructs of perceived usefulness (PU) and perceived ease of use (PEOU) from the Technology Acceptance Model (TAM) are applicable across many disciplines that make decisions to use technology (Davis, 1989). Throughout the educational literature PU and PEOU are the primary determinants of technology use decisions (Ertmer, 2005; Bagozzi, 2007; Chutter 2009). This objective used the Pearson Correlation test to explore the relationships between each of the KTRIS subscales and the TAM subscales to determine the strength and influences they had on each other. The correlation test is useful for comparing
associations for variables having different units in which the larger the absolute value of r, the stronger the linear association (Agresti & Finlay, 2009).

Research question #5 – Is there a correlation between the vocational and technical faculty’s technology acceptance factors of perceived usefulness and perceived ease of use and their level of technology use of adoption and integration?

Research answer #5 – The KRTIS scale contained a total of four subscales in which adoption had a substantial positive relationship ($r = .556, p = <.001$) and integration had a moderate positive relationship ($r = .332, p = <.001$) with perceived usefulness. These findings mean that faculty who are in the adoption phase of technology use, strongly believe technology is useful. Also, faculty who are in the integration phase of technology use, moderately believe technology is useful. Therefore, as perceived usefulness increased, faculty were more likely to score in the adoption and integration subscales of technology use as they believed it would assist them in their job duties.

According to Davis (1989) perceived usefulness is defined “as the degree to which a person believes a particular system would enhance his or her job performance” (p. 320) and defined usefulness as “capable of being used advantageously” (p. 320). The assumption is when a user is faced with the decision to either accept or reject technology (to use a work related system) and their perceived usefulness is positive to the degree that they understand how the technology will be useful and benefit them in accomplishing required job related tasks, they will be more likely to use the technology. In fact, if users believe the technology is useful and advantageous then a repeat performance is more likely (Davis, 1989;
Venkatesh, 1999; Jacobsen, 2000). Therefore, the two subscales of adoption and integration from the KRTIS are influenced by the faculty perceived usefulness in which those faculty who found technology adoption useful, they would continue into the technology integration phase of technology use.

The KRTIS scale contained a total of four subscales in which adoption had a substantial positive relationship ($r = .531, p = <.001$) and integration had a moderate positive relationship ($r = .376, p = <.001$) with perceived ease of use. These findings suggest that faculty who are in the adoption phase of technology use strongly believe technology is easy to use. Also, faculty who are in the integration phase of technology use moderately believe technology is easy to use. Therefore, as perceived ease of use increased, faculty were more likely to score in the adoption and integration subscales of technology use as they believed it would assist them in their job duties. According to (Davis, 1989) educators who perceived technology was easy to use were more likely to regularly integrate technology into their classrooms.

Research question #6 - Is there a correlation between the vocational and technical faculty’s technology acceptance factors of perceived usefulness and perceived ease of use and their level of barriers to technology and technology anxiety?

Research answer #6 - The KRTIS scale contained a total of four subscales in which barriers to technology had a low negative relationship ($r = -.103, p = <.034$) and technology anxiety integration had a low negative relationship ($r = -.034, p = <.482$) with perceived usefulness. These findings mean as faculty barriers to technology increase their perceived
usefulness of technology decreases. In other words, the more barriers to technology faculty experience, the less likely they are to view technology as being useful because they will have to overcome the various barriers that prevent them to use technology. Similarly, as faculty technology anxieties increase their perceived usefulness decreases. In other words, as faculty members encounter more technology anxieties the less likely they are to view technology as useful. According to (Davis, 1989) educators who perceived technology was useful were more likely to perceive they had fewer barriers to technology and less technology anxiety.

The KRTIS scale contained a total of four subscales in which barriers to technology had a low negative relationship ($r = -.230, p < .001$) and technology anxieties had a moderate negative relationship ($r = -.401, p < .001$) with perceived ease of use. These findings mean as faculty barriers to technology increase their perceived ease of use for technology use decreases. In other words, the more barriers to technology a faculty member experiences, the more likely they are to view technology as being hard to use because they will have to overcome the various barriers that prevent them to use technology. Similarly, as faculty technology anxieties increase their perceived ease of use decreases. This finding suggests as faculty members encounter more technology anxieties the more likely they are to view technology as being hard to use.

Research Objective Four

Research objective four explored which technology acceptance factors, demographic variables, and technology use factors (perceived technology barriers and anxieties, sources of technology training) explained the variance in technology integration within each of the two
levels of technology use (adoption and integration). If specific variables and factors could be identified that explained a significant amount of variance it would enable the researcher to make effective recommendations to improve, increase, and promote technology use by more faculty members. A stepwise regression model was used to determine which variables and factors were most influential on technology integration in the teaching and learning process. Two regression models were conducted to examine and analyze which variables explained the most variance of each subscale of adoption and exploration.

Research question #7 – Do technology acceptance factors, demographic variables, and/or technology use factors (perceptions of technology barriers and anxiety, sources of technology training) explain the variance in level of technology adoption?

Research answer #7 – Of all the possible factors and variables consisting of technology acceptance factors (perceived usefulness and perceived ease of use), demographic variables (age, gender, years of teaching experience, and education level), and/or technology use factors (perceptions of technology barriers and anxiety, sources of technology training) only five explained a significant amount of the variance within the adoption subscale. These five factors and variables explained 43.2% of the variance which included: perceived usefulness, perceived ease of use, barriers, technology training: colleagues, and education level: masters. Perceived usefulness explained the most variance at 30.9% and perceived ease of use explained an additional 8.7%. These finding mean as faculty adopted technology their perceived usefulness increased and when barriers increased, faculty technology use decreased. This study found that faculty who received their primary technology training from
colleagues and possessed a master’s degree and as their perceived usefulness and perceived ease of use increased and barriers decreased, they were more likely to adopt technology. According to Redmann & Kotrlik (2004/2005) technology adoption is influenced by many factors which if identified could be used to improve technology adoption.

Research question #8 – Do technology acceptance factors, demographic variables, and/or technology use factors (perceptions of technology barriers and anxiety, sources of technology training) explain the variance in level of technology integration?

Research answer #8 - Of all the possible factors and variables consisting of; technology acceptance factors (perceived usefulness and perceived ease of use), demographic variables (age, gender, years of teaching experience, and education level), and/or technology use factors (perceptions of technology barriers and anxiety, sources of technology training) only four explained a significant amount of the variance within the integration subscale. These four factors and variables explained 18.8% of the variance which included perceived ease of use, perceived usefulness, age, and technology training: college courses. Perceived ease of use explained the most variance at 14.1% and perceived usefulness explained an additional 2.5%. These findings suggest as faculty integrated technology their perceived ease of use and barriers were not significant and their technology use increased. This study found that faculty who received their primary technology training from college courses, were of a certain age (M = 49), as their perceived ease of use, and perceived usefulness increased, they were more likely to integrate technology. According to Redmann & Kotrlik (2004 and 2005)
technology integration is the highest form of technology use in which many factors must be satisfied if faculty are willing to participate.

Summary

In this study, the participants consisted of North Carolina community college fulltime vocational and technical faculty who responded to the email survey in the Fall 2013 semester. The majority of the faculty respondents’ were male, between 51 – 60 years old, had 6-10 years of teaching experience, and held a Master’s degree. In addition, the majority of the participants were in the adoption level of technology integration/use in their teaching and learning process. In addition, over 90% of them learned their technology skills from a self-taught method with workshops/conference as a close second. Similar results were reported in other studies conducted by Redmann & Kotrlik in 2004/2005.

Perceived usefulness, perceived ease of use, technology training, age, and education level influence faculty and their decisions to integrate/use technology in their teaching and learning process. As the study suggests perceived usefulness and perceived ease of use are significant positive predictors of faculty technology integration/use and increases as faculty move from adoption to full integration. However, barriers to technology and technology anxiety are negative predictors of technology integration/use in the faculty teaching and learning process. The findings of this study support the literature review and previous studies conducted by Redmann & Kotrlik (2003, 2004, 2005).
Contrary to the literature, faculty in this study did not experience a high level of barriers to technology or technology anxiety. This might be explained by the rapid pace of instructional technology itself coupled with the fact this study’s primary focus was on the community college (higher education) versus other studies conducted in previous years and mostly in K-12 institutions. Perhaps community college vocational and technical faculty might face lower barriers and anxieties to technology since they teach adults and teach in specialized industries and occupational programs.

Faculty in the study use various sources of technology training including the self-taught method and attend workshops/conferences, colleagues, and college courses. The majority of faculty used the self-taught technology training. This conclusion supports the research from Kotrlik & Harrision (2000) of self-directed learning, but contradicts Redmanns & Kotrlik’s (2004) research findings of the majority using workshops/conferences for their technology training.

This study has revealed similar findings to previous research as denoted above but at the same time has discovered the fact that fulltime community college vocational and technical faculty seem to have less barriers to technology and technology anxiety than other educators such as K-12 teachers. In addition, as the rapid pace of technology infiltrates these institutions, coupled with the demands of students, administration, and industry, and the nature of the teaching disciplines (vocational and technical faculty usually have to learn and teach specific and current types of technologies based upon their areas of expertise) in the community colleges, faculty realized technology is required. Perhaps more community
college faculty are influenced by and make their decision to utilize technology based upon their high levels of perceived usefulness and ease of use, along with their age, teaching experience, technology training, and education levels. The faculty see and understand the various benefits of technology use and are more likely to adopt and integrated technology in the classroom and their teaching and learning process.

Recommendations

Instructional technology, in the traditional sense, has been around since the early 20th century with film, radio, and television as the primary technologies utilized by educators. However, not all educators utilized the technology due to a lack of comfort levels, training and support (Gagne, 1970).

Now that educators are practicing their craft in the in the 21st century, instructional technology is no longer an option, but is required by all on a daily basis by students, administration, regulators, and industry (Shelton, 2012). Computers were introduced into higher education in the early 1980s and were used for administrative work, crunching numbers, and specialized programs (Resiser, 2001). In today’s higher education classroom, computers are seen as a basic necessity and are considered to be a fundamental piece of instructional technology equipment (Keengwe, 2008). As instructional technology continued to grow and became controversial in terms of adding value or not for student learning, educators have shifted the focus of instructional technology tools to student learning and outcomes (Keengwe, Onchwari & Onchwari, 2009). As this pedagogical and andragogical
shift found its way into higher education, new types of learner centered technologies emerged or were reshaped such as the Internet, email, distance learning, laptops, wireless, and mobile learning. Since this new educational philosophy and technological advances were growing it was crucial for educators to embrace and prepare themselves to adopt and integrate these instructional technologies into their classrooms and teaching and learning process (Koehler & Mishra, 2009). According to the National Education Technology Plan of 2010, technology has to become the major component of choice to improve student learning, national student scores, and meet the challenge of preparing students for employment in technical industries that are lacking workers with the required technical skills (Shelton, 2012). Therefore, it is imperative that the community college faculty be prepared and willing to utilize technology in the classrooms and in their teaching and learning process. The findings of this study reveal how vocational and technical faculty are currently using and integrating technology in their classrooms and teaching and learning process by using the KRTIS instrument and scales. With the identification and understanding of how and what determines or influences faculty decisions to integrate/use technology could provide insight and guidance on improving or increasing technology integration/use of the faculty.

Recommendation One

All vocational and technical faculty should have access to professional development and related resources specifically designed for them to keep current on existing and emerging instructional technology on a frequent and regular basis. As denoted in objective four, both regression models include technology training, one of the independent variables, was part of
the significant variance in determining technology use, which was the dependent variable. The participants stated their sources of technology training were self-taught at 90% and workshop/conferences attendance at 87%, it would be imperative to continue providing and adding additional self-taught and workshop/conference opportunities for the faculty in order to remain current on existing technologies and explore new instructional technologies. A lack of faculty confidence and training in how to integrate training into their teaching and learning process is one of the major barriers that prevent technology use in the classroom (Brinkerhoff, 2006; Jacobsen, 2001; Keengwee, Onchwari & Wachira, 2008; Redmann & Kotrlik, 2004). Even though education has spent large amounts of money on technology for instruction, perhaps education has not kept pace with the use of technology in our schools (Allen, 2008). In particular, not much emphasis has been placed in the effort to assist educators to transition into a technology centered learning environment (Kotrlik & Redmann, 2009).

To achieve a successful technology integration initiative faculty must possess the required skills that are related and relevant to the type of technology at hand (Kotrlik & Redmann, 2009). Therefore, technology training should be designed for vocational and technical faculty as it related to their specific disciplines needs and wants. In addition, faculty should have a voice in the type of instructional technology training they receive. Previous research supports this recommendation in terms of those educators who receive adequate and relevant training are more likely to be more confident and effective in their implementation of technology in their teaching and learning process (Cuban, 2001; Moser, 2007, Redmann & Kotrlik, 2004).
Recommendation Two

This research study found the majority of participants were male, 51-60 years old, with 6-10 years of teaching experience, were self-taught and attended workshops/conferences for their technology training and held a masters degree. This suggests that vocational and technical faculty are in their second career. As a result, many of them would participate in some type of formal education (degree or certification) to obtain the specific credentials to be an instructor in the community college. Therefore, these formal education programs should teach and include how to use and integrate technology in their teaching and learning process. According to Knowles (1973), adult learners look for the most effective means of learning and are mostly interested in only the material that is pertinent and applicable to further their desired skill set. This technology centered learning philosophy and practical application should include those technologies that assist the instructor to effectively achieve their instructional goals, which in turn, allows students to achieve their educational goals.

Furthermore, if faculty are expected to learn and implement various types of instructional and administrative technologies they must be given adequate amount of time to do so. According to Kotrlik & Redmann (2009), many faculty perceive a lack of time as a major barrier to effectively implement technology in their classrooms or who teach online. Perhaps release time or an incentive such as a stipend could be offered to compensate those faculty members who put in the time to learn and implement such technology.

Another aspect of successful new faculty deployment should include the proper preparation of those who are entering the community college technology culture for the first
time. All new faculty should have to demonstrate their ability to embrace, understand and utilize technology in the classroom. The administration is responsible for hiring new faculty and therefore should ensure a good match between the abilities and skills of the new faculty and the required technology to support effective and successful instruction. According to Cohen (2008), most community colleges operate independently of each other and create their own policies and guidelines, within the governing body framework, which includes hiring practices. For those new faculty members, mandatory training and credentials for using technology must become standard practice and constant throughout the NCCCS.

Recommendation Three

This research study found that in all of the regression models and analysis, perceived usefulness and perceived ease of use were very influential on faculty decisions about using and integrating technology into their teaching and learning process. If perceived usefulness and ease of use is high and can be increased the more likely faculty will adopt and integrate instructional technology. One way to increase these perceptions is to practice and communicate the advantages and benefits of technology in and outside of the classroom. The more faculty learn, use, and hear about such technologies the more they become familiar with it and realize its usefulness and ease use. This recommendation is similar to the professional development and specific training, but goes beyond and seeks enhanced communications about technology benefits and collaboration, as well as, using technology outside of the classroom in one’s personal or home life, which adds to increasing the comfort and familiarity levels. The communication and collaboration concept acts as a central and
structured point of exchange of technology information and practice. According to Green, Alejandro & Brown (2009) a central location for collaboration, training, and practice is becoming essential to meet the challenges of the rapid growth and changes of technology, student demands, and the diverse backgrounds and skill levels of the community college faculty.

This concept is growing and has materialized in some of the larger and progressive community colleges. The Center for Teaching, Learning, and Leadership at Tallahassee community college is a good example of where faculty can visit to obtain all of the training and resources they need to be effective in the classroom with their use of technology (www.tcc.fl.edu). One aspect of the center is highly accessible technology training and development for faculty and staff. It is a training and resource school within the community college itself. The concept is simple whereas, faculty can do one stop shopping by selecting specific training, getting questions answered by experts, get to test out new technologies or just collaborate with others who are interested in instructional technology. The participants of this study did state even though they did not have a lot of technology barriers and anxiety, they could use more types of training, technical support (after normal hours), and collaboration. Therefore, if North Carolina community colleges could plan for and develop a center for faculty to have access to and obtain the necessary resources, they will be more likely to adopt and integrate technology in their teaching and learning process. In addition, administrators can consider the identified demographic factors when developing training opportunities and making hiring decisions of those faulty that are more likely to utilize technology in their teaching and learning process.
Limitations

This study was limited by the narrow research literature within the community college system that often generated similar results from the same authors in various studies. Due to the narrow research available for community colleges, K-12 references were often used to include teachers. Even though there were similarities, there were some subtle differences as well, which were denoted. Another limitation was the fact only a sample of the entire population of the fulltime vocational and technical faculty participated in the study. In addition, it was limited by the self-reported responses of the faculty who participated.

The researcher did explain the intent of the study and defined many of the terms that were included on the electronic survey. However, some participants may have not read or followed the directions or definitions. All participants completed the survey on their own perceptions, which is based upon their own knowledge and experiences with technology. Also, with the self-reporting format not all faculty may have had ample time to thoroughly answer the questions, answered honestly, or lacked information or clarification, which could limit the study overall findings. Finally, the study was limited to the actual sample size of participants and the generalized perceptions of those who did participate.

Recommendations for Further Research

Much of the existing research was based upon K-12 environments with a focus on computers in the classroom. This study utilized the KRTIS instrument that included various
subscales which one consisted of a list of various types of instructional technologies that a faculty member might use, which provided additional information to the researcher. As future research is conducted, these additional instructional technologies could be examined to determine the next phase and its associated uses and values in student learning, as well as, how it impacts faculty technology integration. This study also supported previous portions of research by Redmann & Kotrlik (2004) in which they have found the majority of educators were in the exploration and adoption phase, but this study found vocational and technical faculty members were in both the adoption and integration phases of technology integration/use because now that most all educators are beyond the exploration and experimentation phases, there are really only to two phases to be considered. (Personal communication with Dr. Kotrlik 9-12-2012). This is also supported by the fact that educators and institutions have been submersed in instructional technology and somehow have been able to “get-by” and adapt to the basic requirements.

This study also included the Technology Acceptance Model (TAM) which provides additional insight on why faculty accept or reject technology in terms of their perceived usefulness and perceived ease of use. This model added to the list of factors and variables that contribute to the why faculty integrate and use technology. Future research should explore the possibility of other or additional reasons or thoughts for adopting or integrating technology.
Recommendation One

This study’s findings were based upon only those North Carolina community college fulltime vocational and technical faculty members who participated in the voluntary study. The researcher recommends further research to capture additional community college vocational and technical faculty in order to strengthen the findings in terms of an additional study at a different point in time. In addition, further research should be conducted in several different states and then eventually across the country to look for similarities and differences.

Recommendation Two

Since technology changes at such a fast and broad rate it is recommended that new instructional technologies should be included in future research on the instruments used to collect data which might provide better explanations of such adoption and integration based upon the specific types of technologies such as; stationary versus mobile technology, virtual versus real time applications, and video versus digital. The KRTIS might need to be updated to include such new technologies.

Recommendation Three

This study revealed participants were in both the adoption and integration phase of technology integration/use, with the adoption phase being more likely according to the KRTIS scale. Perhaps, a qualitative research study could be developed to better understand and collect additional data and insight to support and add to the quantitative findings.
Recommendation Four

In order to capture a broader and total number of the target population additional formats of data collection methods should be utilized in or to research a larger audience. Due to the difficulties of obtaining an accurate list of just vocational and technical email address along with relying on administrators at each community college to disseminate and support such a study, not all faculty may have had the same opportunity to participate as expected. Obtaining an accurate list and emailing directly or mailing out survey using published addresses may increase the overall participation or the return rate.
REFERENCES


Ferguson, P. (2004). Faculty Beliefs about Teaching with Technology. Association for Educational Communications and Technology.


Green, T., Alejandro, J., & Brown, A. H. (2009). The retention of experienced faculty in online distance education programs: Understanding factors that impact their involvement. The International Review of Research in Open and Distance Learning, 10(3).


Johnson, D. L. & Liu, L. (2000). First Steps Toward a Statisticall Generated Information Technology Integration Model. *Computers in the schools*, 16(2) p. 3-12.


Pajo, K., & Wallace, C. (2007). Barriers to the uptake of web-based technology by university teachers. The Journal of Distance Education/Revue de l'Éducation à Distance, 16(1), 70-84.


Wilson, C. (2001). Faculty Attitudes about Distance Learning. A study of distance learning in Kentucky’s higher education system revealed faculty willing to use the technology but needing more institutional support. Educause Quarterly, November 2, 2001.


APPENDICES
APPENDIX A

Request to use the KRTIS and Scales

NC STATE UNIVERSITY

Shawn Russell <smrusse2@ncsu.edu>

Request Permission to use the KRTIS model/scale
3 messages

Shawn Russell <smrusse2@ncsu.edu> Fri, Sep 8, 2012 at 11:27 AM
To: kotrlik@lsu.edu

Joe W. Kotrlik,
J. C. Atherton Alumni Professor
LSU School of Human Resource Education & Workforce Development
129 Old Forestry Bldg., S. Stadium Dr.
Baton Rouge, LA 70803-5477

Hello Dr. Kotrlik,

My name is Shawn M. Russell and I am a doctoral student in the Higher Education program at NCSU. I am currently working on my dissertation and am seeking your permission to use your Technology Integration scale (KRTIS) for part of my theoretical framework and to collect data for my study.

Your Technology Integration research interests me because I am interested in examining technology integration of vocational and technical community college faculty in North Carolina. My committee chair, Dr. James Bartlett, indicated your KRTIS might benefit my study.

I look forward to hearing from you. Thank you for your consideration.

Respectfully,

Shawn M. Russell
APPENDIX B

Permission to use the KRTIS and Scales

Shawn Russell <smrusse2@ncsu.edu>

Permission to use the KRTIS model/ scale

3 messages

Joe W Kotrlik <kotrlik@lsu.edu> Tue, Sep 11, 2012 at 12:34 PM
To: Shawn Russell <smrusse2@ncsu.edu>
Cc: Joe W Kotrlik <kotrlik@lsu.edu>, "Donna & Steve Redmann (dhredmann@cox.net)"

Shawn, you have my permission to use our scale. I have attached the latest version that we used in our 2005-2007 studies. All scales in the instrument are very solid (face validity, content validity, internal consistency, factor analysis). In earlier studies, we had used three other sub-scales (exploration, experimentation, integration) in addition to the technology use (adoption) scale that is included in the attached file. I have attached the TIS 2005 instrument. Although factor analysis and other measures documented the quality of all four scales, we have found that most educators are now beyond the first two levels (exploration and experimentation) and few are really operating at what we consider an innovative level. So, we no longer use the other three scales in our research. I realize you are planning to conduct your study with NC community college faculty. However, based on my experience with both community and major university faculty, I think the technology adoption scale may fit best.

Since you are using this scale with community college faculty, you have my permission to modify some items as needed; however, please secure my written approval via email for any changes you make to the scale. I will simply want to make sure that the items will still function well based on my experience using this scale. In fact, my research group has just launched 7 additional studies using this scale.

Drs. Joe W. Kotrlik and Donna H. Redmann still retain ownership of the scale.

Be sure to reference our work as part of your study. The scale should be referenced as the Kotrlik/Redmann Technology Integration ©2005.


Please send me a copy of your final dissertation. We will waive the fee for use of our scale since this is for your dissertation research.

Best of luck with your study and have fun!

Joe W. Kotrlik, J. C. Atherton Alumni Professor,

LSU School of Human Resource Education & Workforce Development
129 Old Forestry Bldg., S. Stadium Dr., Baton Rouge, LA 70803-5477
225-578-5753 / SHREWD Office: 225-578-5748
APPENDIX C

KRTIS Scale Instrument

Technology Use in the Teaching-Learning Process (KRTIS©2005)

This survey is designed to determine how you use technology in the teaching/learning process. Three terms used in the survey are defined as follows:

- **TEACHING/LEARNING PROCESS** - IMPLEMENTATION OF INSTRUCTIONAL ACTIVITIES THAT ARE DESIGNED TO RESULT IN STUDENT LEARNING.
- **TECHNOLOGY** - HIGH-TECH MEDIA UTILIZED IN INSTRUCTION, SUCH AS COMPUTERS (E-MAIL, INTERNET, LISTSERVS, CD-ROMS, SOFTWARE, LASER DISC PLAYERS, INTERACTIVE CDS, ETC.) AND DIGITAL IMAGING (DIGITAL CAMERAS, SCANNERS, DIGITAL CAMCORDERs, ETC.).
- **TECHNOLOGY INTEGRATION** - EMPLOYING TECHNOLOGY TO SUPPORT, ENHANCE, INSPIRE, AND CREATE LEARNING.

This is not a test. There are no correct answers. Your answers will be kept confidential. The code number is for tracking purposes only. The list matching the code number with instructor names will be destroyed after the surveys are returned.

By completing and returning this survey, you are agreeing to participate in this study. We appreciate your cooperation!
**Technology Use in Teaching/Learning.** Please circle the response that indicates how much each statement describes you and your efforts to integrate technology in the teaching/learning process.

<table>
<thead>
<tr>
<th></th>
<th>Not Like Me</th>
<th>Very Little Like Me</th>
<th>Some Like Me</th>
<th>Very Much Like Me</th>
<th>Just Like Me</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I discuss with students how they can use technology as a learning tool.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. I have made physical changes to accommodate technology in my classroom or laboratory.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. I emphasize the use of technology as a learning tool in my classroom or laboratory.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. I assign students to use the computer to do content related activities on a regular basis.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. I use technology based games or simulations on a regular basis in my classroom or laboratory.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. I use technology to encourage students to share the responsibility for their own learning.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. I expect my students to use technology to enable them to be self-directed learners.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. I expect my students to use technology so they can take on new challenges beyond traditional assignments and activities.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. I regularly pursue innovative ways to incorporate technology into the learning process for my students.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. I expect my students to fully understand the unique role that technology plays in their education.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. I design learning activities that result in my students being comfortable using technology in their learning.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Technology Use in Teaching/Learning. Please circle the response that indicates how much each statement describes you and your efforts to integrate technology in the teaching/learning process.

<table>
<thead>
<tr>
<th></th>
<th>Not Like Me</th>
<th>Very Little Like Me</th>
<th>Some Like Me</th>
<th>Very Much Like Me</th>
<th>Just Like Me</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.</td>
<td>I expect students to use technology to such an extent that they develop projects that are of a higher quality level than would be possible without them using technology.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>I am more of a facilitator of learning than the source of all information because my students use technology.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>I incorporate technology in my teaching to such an extent that it has become a standard learning tool for my students.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>I incorporate technology in my teaching to such an extent that my students use technology to collaborate with other students in my class during the learning process.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>I often require my students to use e-mail to complete their assignments.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>I encourage students to design their own technology-based learning activities.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td>I incorporate technology in my teaching to such an extent that my students use technology to collaborate with individuals or at other locations (other classes, other schools, other states or countries, etc.).</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19.</td>
<td>I incorporate technology in my teaching to such an extent that my students use technology to collaborate with individuals in other disciplines.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barriers to the Integration of Technology in the Teaching/Learning Process</td>
<td>Not A Barrier</td>
<td>Minor Barrier</td>
<td>Moderate Barrier</td>
<td>Major Barrier</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>20. Enough time to develop lessons that use technology.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. Scheduling enough time for students to use the Internet, computers, or other technology in the teaching/learning process.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. Availability of technology for the number of students in my classes.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. Availability of technical support to effectively use instructional technology in the teaching/learning process.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25. My ability to integrate technology in the teaching/learning process.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26. My students’ ability to use technology in the teaching/learning process.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27. Type of courses I teach.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28. Availability of effective instructional software for the courses I teach.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Technology Anxiety.</strong> Circle the response that best represents your level of technology anxiety for each statement.</td>
<td>No Anxiety</td>
<td>Some Anxiety</td>
<td>Moderate Anxiety</td>
<td>High Anxiety</td>
<td>Very High Anxiety</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>29. How anxious do you feel when you think about using technology in instruction?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30. How anxious do you feel when you are not certain what the options on various technologies will do?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31. How anxious do you feel when you are faced with using new technology?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32. How anxious do you feel when you think about your technology skills compared to the skills of other teachers?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33. How anxious do you feel when someone uses a technology term that you do not understand?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34. How anxious do you feel when you try to learn technology related skills?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35. How anxious do you feel when you try to understand new technology?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36. How anxious do you feel when you try to use technology?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37. How anxious do you feel when you fear you may break or damage the technology you are using?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38. How anxious do you feel when you avoid using unfamiliar technology?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>39. How anxious do you feel when you cannot keep up with important technological advances?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40. How anxious do you feel when you hesitate to use technology for fear of making mistakes you cannot correct?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**OTHER INFORMATION. PLEASE PROVIDE THE INFORMATION REQUESTED BY WRITING IT IN THE COLUMN TO THE RIGHT OF EACH QUESTION OR PLACING A CHECK MARK (Y) IN THE BLANK.**

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>41. YOUR AGE (IN YEARS):</td>
<td></td>
</tr>
<tr>
<td>42. YOUR GENDER (M FOR MALE OR F FOR FEMALE):</td>
<td></td>
</tr>
<tr>
<td>43. YEARS TEACHING EXPERIENCE:</td>
<td></td>
</tr>
<tr>
<td>SOURCES OF TECHNOLOGY TRAINING YOU HAVE USED?  <strong>(FOR THE NEXT FOUR ITEMS, PLACE A CHECK MARK (Y) IN THE COLUMN TO THE RIGHT FOR EACH TECHNOLOGY TRAINING SOURCE YOU HAVE USED.)</strong></td>
<td>Y</td>
</tr>
<tr>
<td>44. SELF-TAUGHT</td>
<td></td>
</tr>
<tr>
<td>45. WORKSHOPS/CONFERENCES</td>
<td></td>
</tr>
<tr>
<td>46. COLLEGE COURSES</td>
<td></td>
</tr>
<tr>
<td>47. COLLEAGUES</td>
<td></td>
</tr>
<tr>
<td>Types of Technology Available for Use In Teaching. <strong>(For the items below, place a check mark (Y) in the column to the right for each type of technology you have available for use in teaching.)</strong></td>
<td>Y</td>
</tr>
<tr>
<td>48. TEACHER HAS A SCHOOL E-MAIL ACCOUNT</td>
<td></td>
</tr>
<tr>
<td>49. STUDENTS HAVE A SCHOOL E-MAIL ACCOUNT</td>
<td></td>
</tr>
<tr>
<td>50. INTERACTIVE DVDS OR CDS</td>
<td></td>
</tr>
<tr>
<td>51. LASER DISC PLAYER OR STANDALONE DVD OR CD PLAYERS</td>
<td></td>
</tr>
<tr>
<td>52. DIGITAL VIDEO CAMERA</td>
<td></td>
</tr>
<tr>
<td>53. DIGITAL PHOTO CAMERA</td>
<td></td>
</tr>
<tr>
<td>54. VIDEO CASSETTE /CD OR DVD RECORDER</td>
<td></td>
</tr>
<tr>
<td>55. PERSONAL DIGITAL ASSISTANT (E.G., PALM, IPAQ, BLACKBERRY)</td>
<td></td>
</tr>
<tr>
<td>56. GPS (GLOBAL POSITIONING SYSTEM)</td>
<td></td>
</tr>
</tbody>
</table>
57. **TEACHER HAS COMPUTER WITH INTERNET CONNECTION AT HOME**

58. **TEACHER HAS COMPUTER WITH INTERNET CONNECTION AT SCHOOL**

59. **TEACHER HAS ACCESS TO ENOUGH COMPUTERS IN A CLASSROOM OR LAB FOR ALL STUDENTS TO WORK BY THEMSELVES OR WITH ONE OTHER STUDENT**

60. **CHECK THIS RESPONSE IF MOST OF THE COMPUTERS LISTED IN ITEM 59 HAVE INTERNET ACCESS.**

Write any comments you have about your use of technology in your instruction in the space below.

Comments:

THANK YOU FOR RESPONDING!
APPENDIX D

Request to use the TAM and Scales

Shawn Russell <smrusse2@ncsu.edu>

Request to use the TAM model/scale
3 messages

Shawn Russell <smrusse2@ncsu.edu> Wed, Sep 12, 2012 at 10:50 AM
To: fdavis@walton.uark.edu

Fred D. Davis
Distinguished Professor
David D. Glass Chair of Information Systems
Sam M. Walton College of Business, University of Arkansas
Information Systems Department
301 Business Building
Office Location: WCOb216
Fayetteville, AR 72701

Hello Dr. Davis,

My name is Shawn M. Russell and I am a doctoral student in the Higher Education program at NCSU. I am currently working on my dissertation and am seeking your permission to use your TAM, as my theoretical framework and your Measurement Scales titled "Perceived Usefulness and Perceived Ease of Use and User Acceptance of Information Technology as an instrument to collect data for my study.

Your TAM research interests me because I am interested in examining technology integration and user acceptance of a system for vocational and technical community college faculty in North Carolina. My committee chair, Dr. James Bartlett, indicated your TAM may be of interest for my study.

I look forward to hearing from you. Thank you for your consideration.

Respectfully,

Shawn M. Russell
APPENDIX E

Permission to use the TAM and Scales

Shawn Russell <smrusse2@ncsu.edu>

Permission to use the TAM model/scale

Fred Davis <FDavis@walton.uark.edu>  
To: Shawn Russell <smrusse2@ncsu.edu>

Wed, Sep 12, 2012 at 11:25 AM

Shawn

You have my permission to use TAM and adapt its scales for your research. Please reference source publications in your dissertation resulting from your study. I look forward to receiving a copy when it is published.

Best wishes

Fred Davis
APPENDIX F

The TAM Instrument
Perceived Usefulness (PU)

1. Using technology in my job would enable me to accomplish tasks more quickly

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Extremely Unlikely</td>
<td>Not Likely</td>
<td>Undecided</td>
<td>Likely</td>
<td>Extremely Likely</td>
</tr>
</tbody>
</table>

2. Using technology in my job would improve my job performance

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Extremely Unlikely</td>
<td>Not Likely</td>
<td>Undecided</td>
<td>Likely</td>
<td>Extremely Likely</td>
</tr>
</tbody>
</table>

3. Using technology in my job would increase my productivity

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Extremely Unlikely</td>
<td>Not Likely</td>
<td>Undecided</td>
<td>Likely</td>
<td>Extremely Likely</td>
</tr>
</tbody>
</table>

4. Using technology would enhance my effectiveness on the job

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Extremely Unlikely</td>
<td>Not Likely</td>
<td>Undecided</td>
<td>Likely</td>
<td>Extremely Likely</td>
</tr>
</tbody>
</table>

5. Using technology would make it easier to do my job

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Extremely Unlikely</td>
<td>Not Likely</td>
<td>Undecided</td>
<td>Likely</td>
<td>Extremely Likely</td>
</tr>
</tbody>
</table>

6. Implementing Technology on the job would be useful

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Extremely Unlikely</td>
<td>Not Likely</td>
<td>Undecided</td>
<td>Likely</td>
<td>Extremely Likely</td>
</tr>
</tbody>
</table>

Perceived Ease Of Use (PEOU)

1. I would consider that technology would be easy to learn

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Extremely Unlikely</td>
<td>Not Likely</td>
<td>Undecided</td>
<td>Likely</td>
<td>Extremely Likely</td>
</tr>
</tbody>
</table>

2. I would believe technology is controllable

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Extremely Unlikely</td>
<td>Not Likely</td>
<td>Undecided</td>
<td>Likely</td>
<td>Extremely Likely</td>
</tr>
</tbody>
</table>

3. I would find that technology is clear and understandable

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Extremely Unlikely</td>
<td>Not Likely</td>
<td>Undecided</td>
<td>Likely</td>
<td>Extremely Likely</td>
</tr>
</tbody>
</table>

4. I would find technology to be flexible to interact with

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Extremely Unlikely</td>
<td>Not Likely</td>
<td>Undecided</td>
<td>Likely</td>
<td>Extremely Likely</td>
</tr>
</tbody>
</table>

5. It would be easy for me to become skillful at using technology

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Extremely Unlikely</td>
<td>Not Likely</td>
<td>Undecided</td>
<td>Likely</td>
<td>Extremely Likely</td>
</tr>
</tbody>
</table>

6. I would find technology easy to use.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Extremely Unlikely</td>
<td>Not Likely</td>
<td>Undecided</td>
<td>Likely</td>
<td>Extremely Likely</td>
</tr>
</tbody>
</table>
APPENDIX G

BUDGET

<table>
<thead>
<tr>
<th>Qty</th>
<th>Item</th>
<th>Unit Cost</th>
<th>Total Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Survey Monkey Cost</td>
<td>$150.00</td>
<td>$150.00</td>
</tr>
<tr>
<td>2</td>
<td>Survey Incentives</td>
<td>$100.00</td>
<td>$200.00</td>
</tr>
<tr>
<td>1</td>
<td>Paper</td>
<td>$50.00</td>
<td>$50.00</td>
</tr>
<tr>
<td>3</td>
<td>Printer Ink</td>
<td>$29.00</td>
<td>$87.00</td>
</tr>
<tr>
<td>5</td>
<td>Travel (gas, oil, etc.)</td>
<td>$65.00</td>
<td>$325.00</td>
</tr>
<tr>
<td>1</td>
<td>SPSS Software</td>
<td>$199.00</td>
<td>$199.00</td>
</tr>
<tr>
<td>1</td>
<td>Printing services/binding</td>
<td>$125.00</td>
<td>$125.00</td>
</tr>
<tr>
<td>1</td>
<td>Editor</td>
<td>$200.00</td>
<td>$200.00</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td></td>
<td>$1,286.00</td>
</tr>
</tbody>
</table>
# APPENDIX H

## TIMELINE

<table>
<thead>
<tr>
<th>Event or Action</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Select and confirm committee members</td>
<td>3/20/2012</td>
</tr>
<tr>
<td>2 Send committee list for approval under the plan of work</td>
<td>5/15/2012</td>
</tr>
<tr>
<td>3 Align the EAC-803 (proposal writing) class with my topic</td>
<td>8/7/2012</td>
</tr>
<tr>
<td>4 Complete written comprehensive exams</td>
<td>12/5/2012</td>
</tr>
<tr>
<td>5 Meet with committee chair to discuss progress/ask questions</td>
<td>2/5/2012</td>
</tr>
<tr>
<td>6 Send completed draft to committee chair for review</td>
<td>5/27/2013</td>
</tr>
<tr>
<td>7 Obtain feedback and make revisions</td>
<td>6/10/2013</td>
</tr>
<tr>
<td>8 Schedule proposal defense</td>
<td>6/5/2013</td>
</tr>
<tr>
<td>9 Send final proposal to committee members</td>
<td>6/17/2013</td>
</tr>
<tr>
<td>10 Complete proposal defense</td>
<td>6/28/2013</td>
</tr>
<tr>
<td>11 Complete and send requests to IRB (need sample consent form)</td>
<td>7/8/2013</td>
</tr>
<tr>
<td>12 Prepare for participants - obtain 58 VP email addresses</td>
<td>7/15/2013</td>
</tr>
<tr>
<td>13 Finalize the survey instrument and related forms</td>
<td>7/15-21/2013</td>
</tr>
<tr>
<td>14 Make initial contact with VP of instruction</td>
<td>7/22/2013</td>
</tr>
<tr>
<td>15 Start the data collection- release the faculty surveys</td>
<td>8/19/2013</td>
</tr>
<tr>
<td>16 Final Edits to chapter 1-3</td>
<td>9/2/2013</td>
</tr>
<tr>
<td>17 Enter and analyze the collected data</td>
<td>9/9/2013</td>
</tr>
<tr>
<td>18 Write chapter 4</td>
<td>9/16/2013</td>
</tr>
<tr>
<td>19 Submit to committee chair</td>
<td>10/7/2013</td>
</tr>
<tr>
<td>20 Obtain feedback from chair</td>
<td>10/17/2013</td>
</tr>
<tr>
<td>21 Make corrections and revisions</td>
<td>11/4/2013</td>
</tr>
<tr>
<td>22 Submit to Committee</td>
<td>11/5/2013</td>
</tr>
<tr>
<td>23 Obtain feedback from Committee</td>
<td>11/15/2013</td>
</tr>
<tr>
<td>24 Make final corrections and revisions</td>
<td>11/25/2013</td>
</tr>
<tr>
<td>25 Complete defense</td>
<td>12/9/2013</td>
</tr>
<tr>
<td>26 Send to graduate school</td>
<td>1/15/2014</td>
</tr>
</tbody>
</table>
From: Jennifer Ofstein, IRB Coordinator
North Carolina State University
Institutional Review Board
Date: August 19, 2013

Title: Technology Integration for Vocational and Technical Faculty in North Carolina Community Colleges

IRB#: 3433

Dear Shawn,

The research proposal named above has received administrative review and has been approved as exempt from the policy as outlined in the Code of Federal Regulations (Exemption: 46.101.b.2). Provided that the only participation of the subjects is as described in the proposal narrative, this project is exempt from further review. This approval does not expire, but any changes must be approved by the IRB prior to implementation.

NOTE:

1. This committee complies with requirements found in Title 45 part 46 of The Code of Federal Regulations. For NCSU projects, the Assurance Number is: FWA00003429.
2. Any changes to the research must be submitted and approved by the IRB prior to implementation.
3. If any unanticipated problems occur, they must be reported to the IRB office within 5 business days.

   Please forward a copy of this letter to your faculty sponsor, if applicable.

Thank you.

Sincerely, Jennifer Ofstein
APPENDIX J

DATA COLLECTION

Initial Email to NCCCS Presidents sent on 9-9-13

Hello fellow vocational and technical faculty or administrator members. My name is Shawn M. Russell and I am a Business Administration instructor at CFCC. In addition, I am a NCSU doctoral candidate who is conducting research on technology integration of North Carolina community college full-time vocational and technical faculty. I am requesting your support and assistance by having all of your institution’s qualifying faculty complete this survey in order to better understand and contribute to the body of research of technology integration in the teaching and learning process for NC community college faculty.

This survey is intended to include all 58 of the NC community colleges in order to obtain a representative sample of the entire full-time vocational or technical faculty population. All responses will be anonymous and used to support the findings of this research. The survey will take approximately 8-10 minutes to complete. In addition, participants have the option of entering a drawing for a $50 gift card for their efforts of completing the survey.

Please make sure this email and survey link are routed to the proper individual(s) so it reaches the qualifying faculty population. The survey completion date is set for September 16, 2013, so please take the survey before this date if possible. A second email will be sent as a reminder to complete the survey for those who may have not had a chance the first time around.

Feel free to contact me if you have any questions at smrusse2@ncsu.edu or 910.471.6455. Thank you in advance for your valuable input and time in this research that supports our community college faculty.
Good Morning North Carolina Community College President or designated Administrator,

Thank you for all of those who have already responded to this Technology4Faculty survey.

I have heard back from several institutions who asked if the deadline could be extended due to having a slight delay with getting the original email notification/survey link in the hands of the appropriate faculty, issues of local IRB requirements, and other related situations. Therefore, the deadline for survey completion has been extended to 9/23/13, which is next Monday!

Please pass this along to those who might not have had a chance to participate in the survey and/or as reminder to others about the extended completion date. I really appreciate everybody's effort and hope to obtain the minimum amount of responses to satisfy the statistical significance requirement.

https://www.surveymonkey.com/s/Technology4Faculty

Thanks again for your support and participation.

Shawn M. Russell
APPENDIX K

LIST OF NORTH CAROLINA COMMUNITY COLLEGES (58)

Alamance Community College    Pitt Community College
Beaufort County Community College    Randolph Community College
Bladen Community College    Richmond Community College
Blue Ridge Community College    Roanoke-Chowan Community College
Brunswick Community College    Robeson Community College
Caldwell Community College &    Rockingham Community College
Technical Institute    Rowan-Cabarrus Community College
Cape Fear Community College    Sampson Community College
Catawba Valley Community College    Sandhills Community College
Central Carolina Community College    South Piedmont Community College
Central Piedmont Community College    Southeastern Community College
Cleveland Community College    Southwestern Community College
Coastal Carolina Community College    Stanly Community College
College of The Albemarle    Surry Community College
Craven Community College    Tri-County Community College
Davidson County Community College    Vance-Granville Community College
Durham Technical Community College    Wake Technical Community College
Edgecombe Community College    Wayne Community College
Fayetteville Technical Community College    Western Piedmont Community College
Forsyth Technical Community College    Wilkes Community College
Gaston College    Wilson Community College
Guilford Technical Community College
Halifax Community College
Haywood Community College
Isothermal Community College
James Sprunt Community College
Johnston Community College
Martin Community College
Mayland Community College
McDowell Technical Community College
Mitchell Community College
Montgomery Community College
Nash Community College
Pamlico Community College
Piedmont Community College
APPENDIX L

VOCATIONAL AND TECHNICAL OCCUPATIONAL AREAS, AAS, DIPLOMA, AND CERTIFICATE PROGRAMS AND ASSOCIATED CODES

15 Agricultural and Natural Resources Technologies
20 Biological and Chemical Technologies
25 Business Technologies
30 Commercial & Artistic Production Technologies
35 Construction Technologies
40 Engineering Technologies
45 Health Sciences
50 Industrial Technologies
55 Public Service Technologies
60 Transport Systems Technologies

15 Agricultural and Natural Resources Technologies
Agribusiness Technology (A15100)
Applied Animal Science Technology (A15280)
Aquaculture Technology (A15120)
Equine Business Technology (A15170)
Equine Training Technology (A15190)
Fish and Wildlife Management Technology (A15160)
Forestry Management Technology (A15200)
Golf Course Management Technology (A15230)
Golf Equipment Technician (Diploma)(D15210)
Greenhouse and Grounds Maintenance (Certificate)(C15220)
Horticulture Technology (A15240)
Landscape Gardening (A15260)
Marine Sciences (A15310)
Marine Technology (A15320)
Sustainable Agriculture (A15410)
Swine Management Technology (A15150)
Turfgrass Management Technology (A15420)
Viticulture and Enology Technology (A15430)

20 Biological and Chemical Technologies
Agricultural Biotechnology (A20110)
Alternative Energy Technology: Biofuels (A20130)
Aquarium Science Technology (A20260)
Biopharmaceutical Technology (A20260)
Biotechnology (A20100)
Chemical Technology (A20120)
Environmental Management Technology (A20230)
Environmental Science Technology (A20140)
Invasive Species Management Technology (A20240)
Laboratory Technology (A20160)
Nanotechnology (A20190)
Zoological Science Technology (A20250)

25 Business Technologies
Accounting (A25100)
Business Administration (A25120)
Business Administration/Banking & Finance (A2512A)
Business Administration/Customer Service (A2512B)
Business Administration/Electronic Commerce (A2512I)
Business Administration/Human Resources Mgt (A2512C)
Business Administration/Import Export Compliance (A2512K)
Business Administration/International Bus. (A2512D)
Business Administration/Logistics Management (A2512E)
Business Administration/Marketing & Retailing (A2512F)
Business Administration/Operations Mgt (A2512G)
Business Administration/Public Administration (A2512H)
Business Administration/Shooting & Hunting Sports Mgt (A2512J)
Computer Information Technology (A25260)
Computer Programming (A25130)
Computer Technology Integration (A25500)
Court Reporting and Captioning (A25140)
Database Management (A25150)
Data Entry (Certificate) (C25160)
Digital Media Technology (A25210)
Entertainment Technologies (A25190)
Entrepreneurship (A25490)
Financial Services (A25330)
Gaming Management (A25250)
Global Logistics Technology (A25170)
Healthcare Business Informatics (A25510)
Healthcare Management Technology (A25200)
Health Unit Coordinator (Certificate) (C25220)
High Performance Computing (A25230)
Hospitality Management (A25110)
Information Systems Security (A25270)
Information Systems Security/Security Hardware (A2527B)
Insurance (Certificate) (C25280)
Medical Office Administration (A25310)
Medical Transcription (Diploma) (D25320)
Networking Technology (A25340)
Nonprofit Leadership and Management (A25410)
Office Administration (A25370)
Office Administration/Legal (A2537A)
Office Administration/Virtual Office Assistance (A2537B)
Paralegal Technology (A25380)
Project Management Technology (A25390)
Real Estate (A25400)
Real Estate Appraisal (A25420)
Real Estate Licensing (Certificate) (C25480)
Simulation and Game Development (A25450)
Travel and Tourism Technology (A25440)
Voice Writing Realtime Reporting (A25460)
Web Technologies (A25290)

30 Commercial & Artistic Production Technologies
Advertising and Graphic Design (A30100)
Broadcasting and Production Technology (A30120)
Digital Effects and Animation Technology (A30130)
Film and Video Production Technology (A30140)
Fine and Creative Woodworking (A30160)
Graphic Arts and Imaging Technology (A30180)
Graphic Arts and Imaging Technology/Flexography (A3018A)
Gunsmithing (A30200)
Gunsmithing (Diploma) (D30210)
Interior Design (A30220)
Metal Engraving (Diploma) (D30240)
Photographic Technology (A30280)
Photographic Technology/Biocommunications Photography (A3028A)
Photographic Technology/Commercial Photography (A3028B)
Photographic Technology/Photojournalism (A3028C)
Photographic Technology/Portrait Studio Mgt (A3028D)
Professional Arts and Crafts: Sculpture (A30290)
Professional Crafts: Clay (A30300)
Professional Crafts: Fiber (A30320)
Professional Crafts: Jewelry (A30340)
Professional Crafts: Wood (A30360)
Taxidermy (Diploma) (D30380)

35 Construction Technologies
Air Conditioning, Heating, and Refrigeration Technology (A35100)
Boat Building (Diploma)(D35120)
Building Construction Technology (A35140)
Cabinetmaking (Diploma) (D35160)
Carpentry (Diploma) (D35180)
Commercial Refrigeration Technology (A35200)
Construction Management Technology (A35190)
Electric Line Construction Technology (A35230)
Electrical Systems Technology (A35130)
Heavy Equipment Operator (Diploma) (D35240)
Historic Preservation Technology (A35110)
Masonry (Diploma)(D35280)
Plumbing (Diploma)(D35300)
40 Engineering Technologies
Applied Engineering Technology (A40130)
Architectural Technology (A40100)
Automation Engineering Technology (A40120)
Civil Engineering Technology (A40140)
Computer Engineering Technology (A40160)
Electrical Engineering Technology (A40180)
Electronics Engineering Technology (A40200)
Environmental Engineering Technology (A40150)
Geomatics Technology (A40420)
Geospatial Mapping Technology (A40110)
Geospatial Technology (A40220)
Industrial Engineering Technology (A40240)
Landscape Architecture Technology (A40260)
Laser and Photonics Technology (A40280)
Low Impact Development (A40290)
Mechanical Engineering Technology (A40320)
Mechatronics Engineering Technology (A40350)
Sustainability Technologies (A40370)
Telecommunications and Network Engineering Technology (A40400)

45 Health Sciences
Associate Degree Nursing (A45110)
Cancer Information Management (A45130)
Cardiovascular/Vascular Interventional Technology (Diploma)(D45140)
Cardiovascular Sonography (A45160)
Cardiovascular Technology (Invasive and Non-Invasive) (A45170)
Central Sterile Processing (Certificate)(C45180)
Clinical Trials Research Associate (A45190)
Computed Tomography & Magnetic Resonance Imaging Technology (Diploma)(D45200)
Cytotechnology (Certificate)(C45220)
Dental Assisting (Diploma)(D45240)
Dental Hygiene (A45260)
Dental Laboratory Technology (A45280)
Dialysis Technology (Diploma)(D45300)
Dietetic Technician (A45310)
Electroneurodiagnostic Technology (A45320)
Emergency Medical Science (A45340)
Health and Fitness Science (A45630)
Health Care Technology (Certificate)(C45350)
Health Information Technology (A45360)
Healthcare Interpreting (A45430)
Histotechnology (A45370)
Human Services Technology (A45380)
Human Services Technology/Animal Assisted Interactions (A4538F)
Human Services Technology/Developmental Disabilities (A4538A)
Human Services Technology/Gerontology (A4538B)
Human Services Technology/Mental Health (A4538C)
Human Services Technology/Social Services (A4538D)
Human Services Technology/Substance Abuse (A4538E)
Interventional Cardiac and Vascular Technology (A45410)
Licensed Practical Nurse Refresher (Certificate)(C45390)
Magnetic Resonance Imaging (A45800)
Medical Assisting (A45400)
Medical Dosimetry (Diploma) (D45450)
Medical Laboratory Technology (A45420)
Medical Sonography (A45440)
Nuclear Medicine Technology (A45460)
Nursing Assistant (Certificate)(C45480)
Occupational Therapy Assistant (A45500)
Optical Apprentice (Certificate)(C45520)
Optical Laboratory Mechanics (Certificate)(C45540)
Opticianry (A45560)
Pharmacy Technology (A45580)
Phlebotomy (Certificate)(C45600)
Physical Therapist Assistant (2-year program)(A45620)
Physical Therapist Assistant (1+1)(A45640)
Polysomnography (C45650)
Polysomnography (A45670)
Positron Emission Tomography (Diploma) (D45820)
Practical Nursing (Diploma)(D45660)
Radiation Therapy Technology (A45680)
Radiography (A45700)
Respiratory Therapy (A45720)
Speech-Language Pathology Assistant (A45730)
Surgical Technology (A45740)
Therapeutic Massage (A45750)
Therapeutic Recreation Assistant (A45770)
Veterinary Medical Technology (A45780)

50 Industrial Technologies
Aerostructure Manufacturing and Repair (A50450)
Biomedical Equipment Technology (A50100)
Bioprocess Technology (A50440)
Computer-Aided Drafting Technology (A50150)
Computer-Integrated Machining (A50210)
Electric Utility Substation and Relay Technology (A50510)
Electrical Power Production Technology (A50130)
Environment, Health, and Safety Technology (A50160)
Facility Maintenance Technology (A50190)
Facility Maintenance Worker (Diploma)(D50170)
Furniture Production Technology (A50180)
Furniture Production Technology/Design and Product Development (A5018A)
Furniture Upholstery (Diploma)(D50220)
Industrial Management Technology (A50260)
Industrial Systems Technology (A50240)
Manufacturing Technology (A50320)
Mechanical Drafting Technology (A50340)
Nondestructive Examination Technology (A50350)
Nuclear Technology (A50460)
Pulp and Paper Technology (A50430)
Quality Assurance and Continuous Improvement (A50550)
Telecommunications Installation and Maintenance (Diploma)(D50380)
Welding Technology (A50420)

55 Public Service Technologies
Animal Care and Management Technology (A55100)
Baking and Pastry Arts (A55130)
Barbering (D55110)
Basic Law Enforcement Training(Certificate)(C55120)
Community Spanish Interpreter (A55370)
Cosmetology (A55140)
Cosmetology Instructor (Certificate)(C55160)
Criminal Justice Technology (A55180)
Criminal Justice Technology/Financial Crime/Computer Fraud (A5518B)
Criminal Justice Technology/Latent Evidence (A5518A)
Culinary Arts (A55150)
Cyber Crime Technology (A55210)
Early Childhood Education (A55220)
Emergency Preparedness Technology (A55420)
Esthetics Instructor (Certificate) (C55270)
Esthetics Technology (C55230)
Fire Protection Technology (A55240)
Food Service Technology (Diploma) (D55250)
Funeral Service Education (A55260)
General Occupational Technology (A55280)
Infant/Toddler Care (Certificate) (C55290)
Interpreter Education (A55300)
Lateral Entry (Certificate) (C55430)
Library and Information Technology (A55310)
Manicuring Instructor (Certificate)(C55380)
Manicuring/Nail Technology (Certificate)(C55400)
Occupational Education Associate (A55320)
Outdoor Leadership (A55330)
Recreation and Leisure Studies (A55360)
Resort and Spa Management (A55410)
School-Age Care (Certificate) (C55450)
School Age Education (A55440)

60 Transport Systems Technologies
Agricultural Systems Technology (A60410)
Automotive Customizing Technology (A60190)
Automotive Management (A60320)
Automotive Restoration Technology (Diploma)(D60140)
Automotive Systems Technology (A60160)
Automotive Systems Technology/Race Car Performance (A6016A)
Aviation Electronics (Avionics) Technology (A60150)
Aviation Management and Career Pilot Technology (A60180)
Aviation Systems Technology (A60200)
Boat Manufacture and Service (Diploma) (D60330)
Collision Repair and Refinishing Technology (A60130)
Diesel and Heavy Equipment Technology (A60460)
Construction Equipment Systems Technology (A60450)
Marine Propulsion Systems (Diploma)(D60220)
Motorcycle Mechanics (Diploma)(D60260)
Motorsports Management Technology (A60270)
Race Car Technology (A60400)
Recreational Vehicle Maintenance and Repair Technology (D60310)
Small Engine and Equipment Repair (Diploma)(D60280)
Truck Driver Training (Certificate)(C60300)