

The Relationship between Organizational Culture, Usability, and Instructional  
Technology Acceptance

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## ABSTRACT

The advent of technology has put a number of institutions in a state of reform (Wolcott, 1997). In fact, it was predicted that technology would completely transform higher education by the end of the twentieth century (Sculley, 1989). Aside from the demographic make-up of the majority of current students (Howe & Strauss, 2000), moving away from the traditional lecture-format to one with the integration of instructional technology can enhance the teaching/learning environment (Bolger & Sprow, 2002). However, instructional technology has still not been completely integrated into the higher education curriculum and students reported that only about 20 % of instructors were found to use technology effectively (“How Students Rate Instructors' Use of Information Technology in Courses”, 2011). Educators continue to face a number of barriers to adoption and many institutions are still investigating ways to provide a more effective learning and teaching environment using efficient use of instructional technology. This research used the College of Engineering at Virginia Tech as a test bed and conducted a set of three studies following a mixed methodology. The first study elicited both quantitative and qualitative data from faculty members who used instructional technology in the classroom. Structural equation modeling was used to examine the relationships between organizational culture, usability, and instructional technology acceptance and found a significant, positive relationship

between usability and instructional technology acceptance, and a positive relationship between organizational culture and instructional technology acceptance. The second study gained more insight into the relationship by collecting qualitative data in the form of focus group interviews. Results of Study 2 indicated that collaborative and innovative organizational cultures, coupled with instructional technologies that have low learnability, high efficiency, high effectiveness, and high satisfaction can facilitate instructional technology acceptance. Based on the results, a set of recommendations to facilitate instructional technology acceptance were developed. The third and final study consisted of a summative evaluation of the recommendations by a panel of experts using the Delphi technique. The overall outcome of this research effort was the development of recommendations and guidelines to facilitate instructional technology acceptance and the description of a comprehensive framework for effective instructional technology use.

## DEDICATION

I would like to dedicate this dissertation to my darling Amba, because of whom my childhood was filled entirely with love, music, and silly nicknames.

Amba, thank you for loving me, scolding me, encouraging me, and most of all, for being the best grandmother there is.

-Your Chachumani

## ACKNOWLEDGEMENTS

As I start to write this section, I can't help but think about how surreal this journey has been. I vividly remember being a tantrum-throwing five year old who didn't want to go to school. Suddenly, I'm at this point where I will never have to go to school anymore and I feel a familiar urge to throw a tantrum because I don't want this to end. What I'm feeling can be best described as bittersweet; bitter because it signifies the end of an era; sweet because I got to meet fabulous people along the way. This section is for all those people to whom I'm forever indebted.

First, I would like to thank my committee for being a constant source of inspiration. Dr. Scales, thank you for your continuous encouragement and for making me feel like I was never alone. Thank you for not only taking the time to provide me with constructive criticism, but for never failing to praise me. I hope that one day I am at least half the advisor and leader that you are. Dr. Smith-Jackson, thank you for the constant motivation and for also making research so *fun* to discuss. Your infinite repertoire of knowledge continues to leave me in a state of awe. Thank you also for teaching all the classes in such a way that it inspired me to do research in those areas. You truly have a gift of making theories and dull equations come alive. Dr. Kleiner, thank you for being the calm voice of reason through all the chaos that is brought on by a dissertation. In spite of having such a busy schedule, thank you, especially, for taking the time to respond to my trivial questions promptly. Knowing that I could always depend on you for guidance helped so much along the way. Dr. Winchester, thank you for being such a source of encouragement and for always entertaining *all* my ideas with enthusiasm. Thank you for introducing me to the *Idea Log*, which I still continue to use to this day. You are a great instructor, a great committee member and a true inspiration.

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I am grateful for both sets of my friends; my friends back home who I miss every day, and my friends here who gave me a home away from home. Thank you for always encouraging me, bringing in the element of humor when I needed it the most, and for listening to me vent when you had no idea what I was talking about. Meeting all of you was the best thing that could have happened to me.

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Finally, I would like to thank my family who are the true reason behind my being here today. I will always be indebted to you. Papa, thank you for teaching me the power of humility. You are the *smartest* and the *niciest* person I know. Ma, thank you for teaching me the power of hard work. I don't know anyone else who could have been a Principal of a high school, managed two pre-schools, taken care of her mother, brought up a daughter, taken care of several pets, and done it all at once *and* with such grace. Papa and Ma, thank you for letting me go so far away and for always encouraging me to follow my dreams. I love you and can't wait to finally pamper you like you deserve. You are a constant inspiration and I'm so proud to be your daughter.

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## **CHAPTER 1. INTRODUCTION**

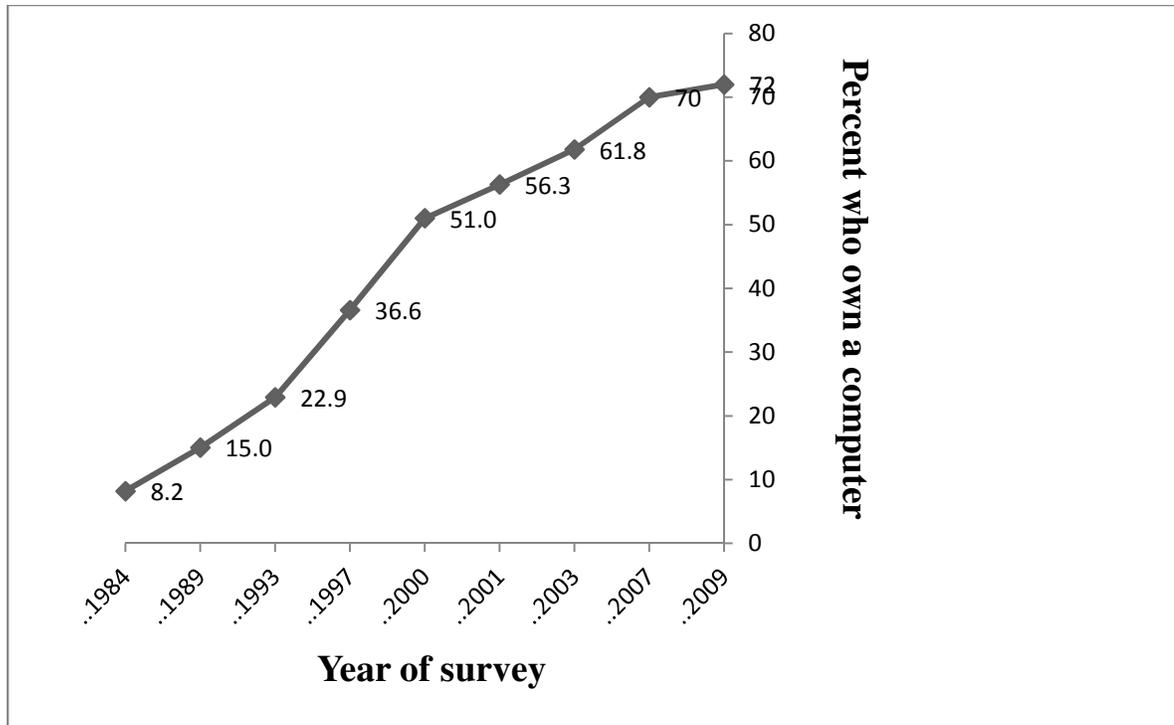
### **1.1 Background**

The advent of technology has put a number of institutions in a state of reform (Wolcott, 1997). In fact, it was predicted that technology would completely transform higher education by the end of the twentieth century (Sculley, 1989). Technology has a wide variety of definitions, but in general, it has been defined as the application of knowledge in a particular area (“Technology”, 2012). For instance, information technology is one type of technology that involves the development and use of computer based systems to process various types of data (“Information Technology”, 2012). In particular, instructional technology has been defined as the study and practice of facilitating learning by using appropriate technological processes and tools (Januszewski & Molenda, 2008). This research effort will focus on a subset of this definition of instructional technology that refers to any computer-based technology used for instruction in the classroom.

Research has shown that instructional technology has still not been completely integrated into the higher education curriculum and students reported that only about 20 % of instructors were found to use technology effectively (“How Students Rate Instructors' Use of Information Technology in Courses”, 2011). Several researchers (Anderson et al., 1998; Beggs, 2000; Beaudin, 2002; Bariso, 2003) have also shown that there have many barriers to instructional technology acceptance. Lack of access to technology, poor quality software, lack of time, technical trouble, poor attitudes, lack of monetary support, low confidence, lack of institutional support, and lack of training have been found to be some of them. Researchers have also identified specific barriers in the higher education domain. For instance, reliability of technology, lack of time, and institutional support were found to be some of the barriers that hinder instructional technology acceptance in Ball State University (Butler & Selbom, 2002).

Similarly, lack of institutional support, lack of monetary support, and lack of time were found to be barriers to instructional technology acceptance at Illinois State University (Chizmar & Williams, 2001). This research effort supports those findings as well as provides additional barriers that existed in a technology-oriented research-one university.

Educational institutions face the impact of the rise in instructional technologies for a variety of reasons. Instructional technology has a number of advantages ranging from better communication to efficiency, mobility (Scott, 2012) and improved student performance (Mann, Shakeshaft, Becker, & Kottkamp, 1999). One important reason is that the current student population in higher education is starting to mainly comprise of a group known as the '*Millennials*' (or Generation Y). They are those born on or after 1982 and they are characterized by their affinity to new technologies (Howe & Strauss, 2000). They tend to perceive technology as a natural component of their environment and have been found to be disappointed with the use of technology in schools (Oblinger, 2003). This could be a natural result of their environment as most households have access to a computer. As shown in figure 1, in 2009, about 72% of the populations are reported to own a computer, in contrast with an 8.4% who owned one in 1984 (U.S. Census Bureau, 2009).



*Figure 1.* Percent of households who own a computer, 1984-2009 (adapted from U.S. Census Bureau, 2009)

Additionally, three out of five respondents in a survey of undergraduate students across 99 higher education institutions believed that using information technology in their courses improved their learning (Salaway, Caruso, & Nelson, 2007). As shown in figure 2, undergraduate students in the study believed that information technology had a positive aspect on different aspects related to learning (Salaway, Caruso, & Nelson, 2007). Another reason why educational institutions, particularly those in the higher education domain, must adapt to these changes is due to the increasing need to produce graduates that can effectively react to future demands of technology (Chubin, Donaldson, Olds, & Fleming, 2008). This especially puts pressure on engineering colleges to adequately train students in a technology-rich environment,

so that they become skilled enough to react to unanticipated, technology-based problems (Walker, 2010).

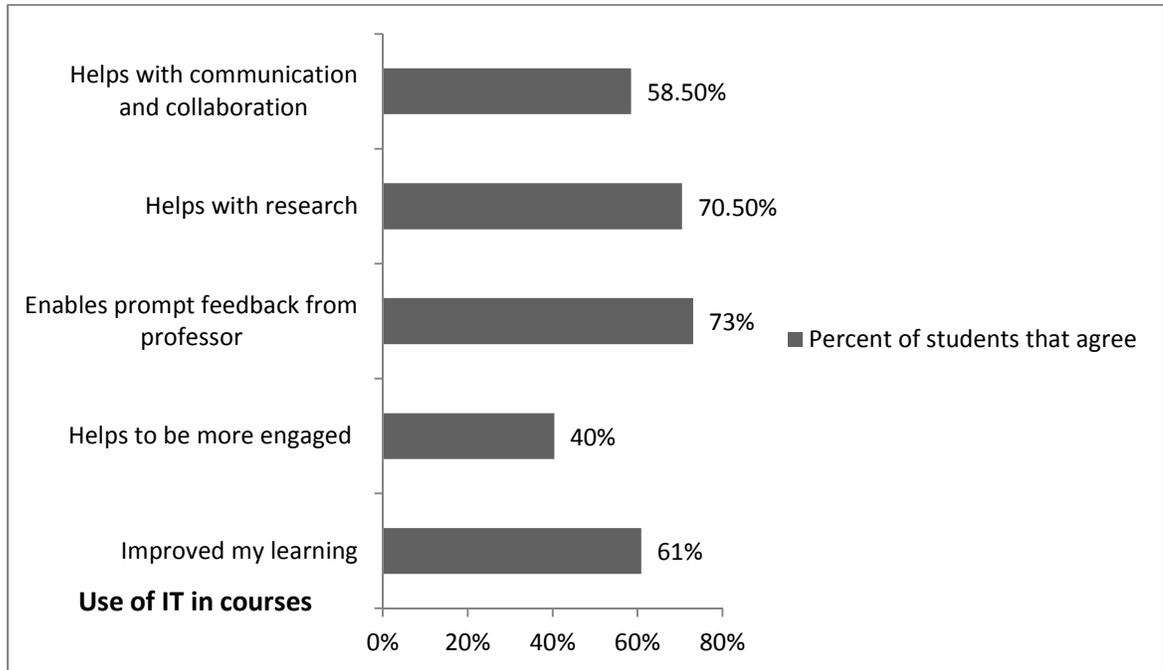


Figure 2. Percentage of undergraduate students in study of 103 institutions in 2007, who agree with the various uses of IT in courses (adapted from ECAR, 2007).

Outside higher education, organizational culture has been found to be influential on incorporating new technology. While there has been a slight surge in examining organizational culture in universities (Berrio, 2003; Fralinger, Olson, Pinto-Zipp, & DiCorcia, 2010), most of the focus on organizational culture has been outside the realm of higher educational universities (Lewis, Marginson, Snyder, 2005). It is important to acknowledge that educational institutions are also organizations and it is necessary to view processes within a university using the same lens as what one would use to examine an organization. Only a few researchers have attempted to examine the relationship of organizational culture and instructional technology acceptance. For instance, Stansberry & Harris (2005) found that congruency between cultural identities of

faculty members and that of the college influenced instructional technology implementation in a veterinary medical college. This research effort aimed to extend those findings by suggesting that specific types of organizational cultures could facilitate instructional technology acceptance. Based on those findings, this research effort also identified a framework that could facilitate instructional technology acceptance.

Higher education institutions must be willing to invest in an environment that supports technology-based learning (Green & Gilbert, 1995). Unfortunately, higher education institutions are believed to have an inflexible infrastructure that was not designed to adapt to the learning styles of new generations (Oblinger, 2003). This has serious implications for educational institutions because they will be required to adjust to these technologies. The importance of using technology in education has also been recognized by the U.S. Department of Education, who presented the National Education Technology plan in 2010, to apply advanced technologies to the educational system to improve student learning (“National Educational Technology Plan”, 2010). This has also been felt by higher educational universities who are starting to adopt various instructional technologies to help improve the learning experience of the technology-savvy student. For instance, the College of Engineering at Virginia Tech is frequently looking for ways to make the teaching and learning environment more effective (Tront, 2007). In 2002, they were one of the few universities who initiated a laptop drive. After promising results from a previous pilot study, Virginia Tech started the Tablet PC Initiative in 2006, which required all incoming engineering students to purchase a tablet PC for use in class. Unfortunately, research done at Virginia Tech suggests that engineering departments at Virginia Tech vary greatly in their acceptance and adoption level of instructional technology (Horton, Kim, Kothaneth, & Amelink, 2011), implying that there is a need to understand what facilities such type of

technology adoption. Studies have found that misreading or presuming the wrong organizational culture has led to failures in technology implementations (Kurmbholtz & Maiden, 2001; Pliskin, Romm, Lee, & Weber, 1993). Technological innovation coupled with the suitable organizational culture is important for success in this competitive market (Claver, Llopis, Garcia, & Molina, 1998).

It is predicted that colleges within higher education will continue to see newer instructional technology trends as it tries to improve the teaching and learning environment (Barber, 2012). However none of these instructional technology trends will have a positive effect unless there is a complete understanding of what could facilitate instructional technology acceptance in higher education. This research was designed to gain an understanding of the interrelationships between organizational culture, usability, and instructional technology acceptance. Based on results from the findings of this research effort, necessary recommendations and guidelines were developed to facilitate instructional technology adoption in an institution.

### **1.2 Problem Statement**

It is apparent that it is important to adopt technology to make some processes more efficient. Educational institutions, in particular, are faced with a number of additional costs to adopt instructional technology. Approximately \$66 billion was spent in 2003 on technology in schools (Quality Education Data, 2004) and some of the costs associated with instructional technology include national infrastructure costs, hardware costs, software costs, technical support costs, training costs, student access costs, course redesign costs, administrative costs, and legal costs (Taylor & Schmidlein, 2000). All these costs are incurred without any benefits if the technology is not accepted by members of the institution. Thus, it is very crucial for the entire

institution to readily accept and make use of the technology effectively. The aim of this research effort was to understand the relationship between organizational culture, usability, and instructional technology acceptance and then to develop recommendations and guidelines to facilitate instructional technology acceptance.

### **1.2.1. Virginia Tech's College of Engineering (COE) and Instructional Technology Adoption**

Virginia Tech's College of Engineering (COE) has 12 departments, two schools, more than 300 faculty members and close to 6000 undergraduate students. It was the first state-funded institution to make a personal computer requirement for engineering students in 1984. In 2002, the requirement changed to that of a laptop for engineering students so that they could communicate and collaborate better in a total mobile environment (Tront, 2007). To enable this, wireless routers were incorporated into the existing infrastructure to provide high speed internet access from any location. In 2002, some faculty members also began pilot studies to check if the tablet PC and its ability to provide digital inking could be effective in the engineering education domain (Tront, 2007). After promising results from pilot studies, Virginia Tech started the Tablet PC initiative in 2006 which required all incoming engineering freshman students to purchase and use a tablet PC in class. They are now investigating the use of slates in education. The College of Engineering (COE) develops and maintains several strategic alliances, both internally and externally to the organization (Scales, Kothaneth, Pokorski, Bailey, & Amelink, 2010) to support their technology initiatives. The college also maintains alliances with the University Bookstore on campus which allows parents and students the convenience of purchasing their computer at the campus bookstore. They maintain internal alliances with the Communication Network Services (CNS) which allows them to maintain the wireless capability in the classrooms. The also maintain internal alliances with the Faculty Development Institute (FDI) who conduct free

training on various instructional technology. The COE also has an Instructional Technology team who provides in-class assistance for faculty members who use interactive classroom software in class. The team also provides one-on-one training for faculty members to use different instructional technologies. Thus, it is evident that the College of Engineering attempts to maintain an organizational culture that facilitates technology adoption. In spite of all the efforts taken by the College of Engineering to promote and facilitate instructional technology use, there has been a vast difference in attitudes towards adopting the technology among departments and faculty members within the College of Engineering. Studies found that this disparity in technology acceptance by faculty members was noticed by students who revealed through focus groups that they were very disappointed by the amount of technology use in the classroom. This especially has very important implications for an educational institution that is attempting to effectively educate a future engineer to cope in this technology-savvy world.

The College of Engineering (COE) at Virginia Tech served as a good example of an organization that was not only on a constant look-out for new technology to make them more efficient, but also undertook various efforts to make the acceptance of the technology as smooth as possible. This research effort used the COE at Virginia Tech as a test bed to understand the relationship between organizational culture, usability, and overall technology acceptance. This research aimed to understand why there were varied rates of instructional technology adoption. Previous research suggested that organizational culture could have an impact on how technology is accepted. Separate studies also suggested that usability of a technology is extremely important for a technology to be readily accepted (Norman, 2002). This research effort was designed to understand the relationship between organizational culture, usability and instructional technology acceptance. In addition, this research effort was also designed to understand the role that job-

related and personal factors played in this domain. Based on results from the studies within this research effort, expert-evaluated recommendations were developed to facilitate instructional technology acceptance within an educational institution. Thus, this research was important because it not only bridged a gap in the current research body, but it also provided necessary recommendations to help facilitate instructional technology acceptance within a higher education institution.

### **1.3. Conceptual Model**

The comprehensive framework that guided this research was based on previous research on organizational culture, usability, and instructional technology acceptance. The framework added to existing research, by suggesting that there was a relationship between organizational culture, usability, and instructional technology acceptance (as shown in Figure 3). Based on findings of previous research, this research also suggested personal factors and job-related factors would act as indirect factors and influence instructional technology acceptance.

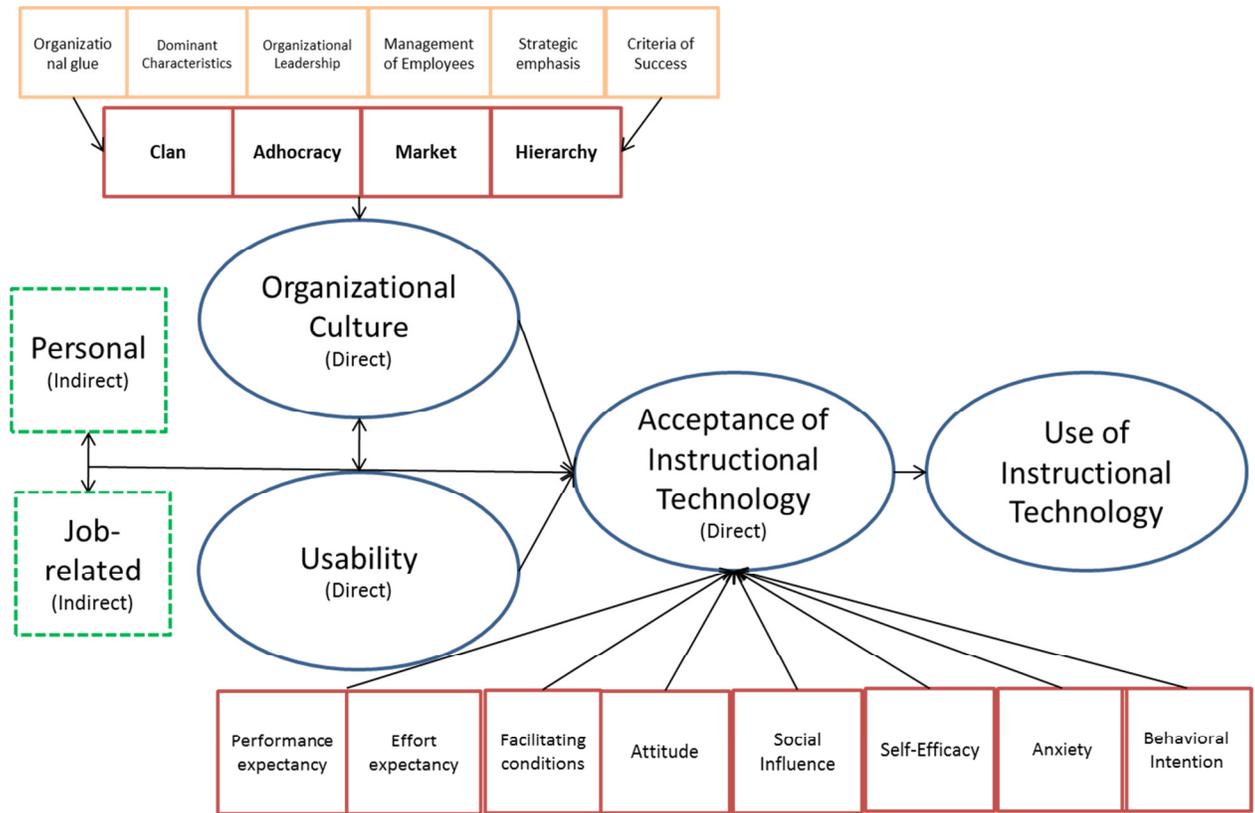


Figure 3. Conceptual framework depicting scope of proposed research

#### 1.4. Research Purpose

This research study was founded on the belief that there is a relationship between organization culture, usability, and instructional technology acceptance. In the extant literature reviewed, there were studies that determined national cultural differences on technology acceptance and separate studies that have determined national cultural differences on usability. There were also studies done on the impact of usability on technology acceptance, but so far, there was no study done to combine the three domains. The goal of this research was to provide an understanding into the concept of organizational culture from an educational perspective and thus determine the relationship between organizational culture, usability, and instructional technology acceptance.

#### **1.4.1. Scope of the Study**

The main purpose of this research was to develop recommendations and guidelines to facilitate instructional technology acceptance in an educational institution. For the scope of this research, recommendations were defined as general suggestions to facilitate instructional technology acceptance and guidelines were defined as those specific to design. As described, instructional technology was defined as computer-based technology used for instruction in the classroom. This research was designed to develop overall recommendations to facilitate instructional technology acceptance in a higher educational environment. However, design guidelines to improve the overall design of instructional technologies were developed based on feedback from participants within this research.

#### **1.5. Research Objectives and Questions**

As explained, this study was designed to explore the relationship between organizational culture and usability on instructional technology acceptance. In addition, it also explored the relationship between job-related factors, personal factors and instructional technology acceptance. This research developed recommendations and guidelines to facilitate instructional technology acceptance and described a comprehensive framework for instructional technology acceptance in an organization.

The following research questions and hypotheses were developed to guide this research:

RQ 1: What are the factors that facilitate technology acceptance in an organization?

*H1: Technology acceptance in an organization will be dependent on organizational culture, usability, job related factors and personal factors*

RQ 2: How does organizational culture relate to technology acceptance?

*H 2: Organizational culture will influence technology acceptance*

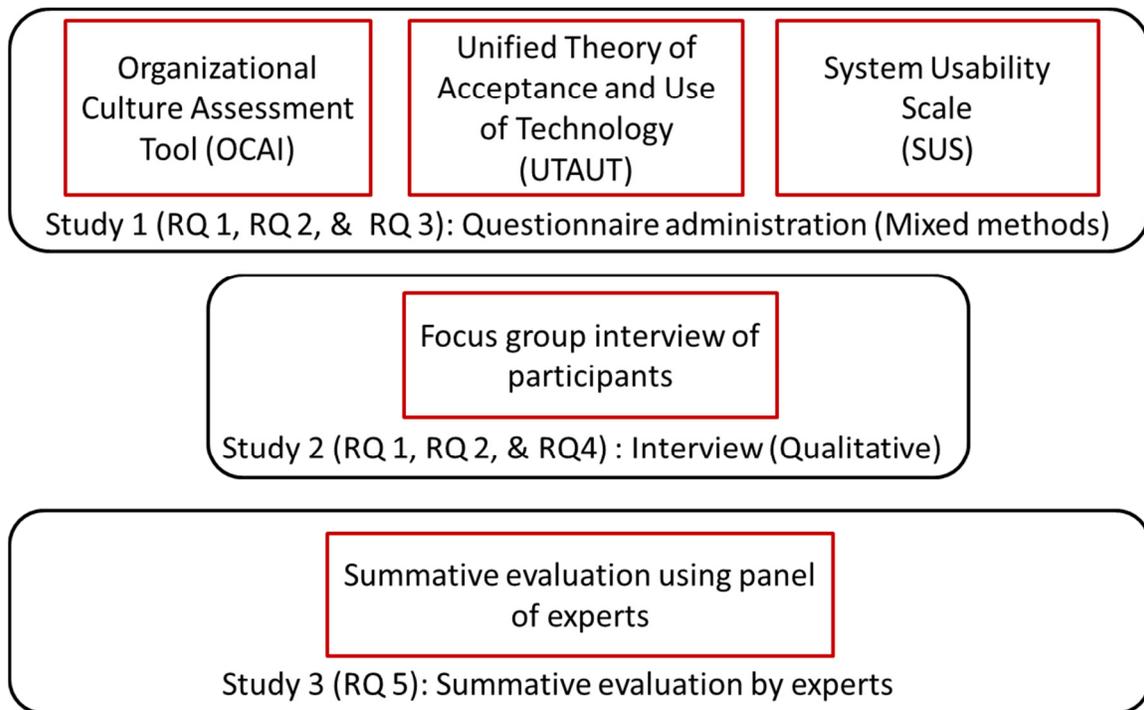
RQ 3: What are the differences and similarities across departments within an organization, regarding technology acceptance?

*H 3: Departments with adhocracy and clan cultures will be more likely to accept technology than those with hierarchical and market cultures*

RQ 4: What is the relationship between organization culture, usability, and technology acceptance?

RQ 5: What can an organization do to facilitate technology acceptance?

This research effort was implemented using three studies and the goal was achieved using a mixed methodology approach (as shown in Figure 4).



*Figure 4.* Conceptual framework of proposed approach

The purpose of study 1 was to gain an understanding of the perceptions of the participants regarding organizational culture, usability and acceptance of instructional technology. It was designed to answer research questions 1, 2, and 3 (RQ1, RQ 2, and RQ 3). A questionnaire comprising of questions from the Organization Culture Assessment Instrument (OCAI), Unified Theory of Acceptance and Use of Technology (UTAUT) and System Usability Scale (SUS), was administered to all the participants (as shown in Figure 2). The OCAI was used to understand the organizational culture of the College of Engineering from the perspectives of faculty members within Virginia Tech. The UTAUT questions helped us understand differences and similarities regarding instructional technology usage and the SUS scale determined how usable participants found their instructional technology. In addition, the questionnaire included questions that elicited job-related factors and personal factors that influenced technology adoption as well as a demographic section. Study 1 provides a basic mixed method

understanding of the overall perceptions of the participants and highlighted key factors of instructional technology acceptance. In turn, the results from this first study were used to guide the design of the subsequent study that focuses on adding qualitative in-depth interview information to those basic results obtained by the questionnaire.

Study 2 was designed to answer research questions 1 and 2, and 4 (RQ 1, RQ 2 and RQ 4). In this study, a purposeful sample of participants was chosen using maximum variation sampling, for an in-depth focus group interview. This allowed for the collection of valuable qualitative open-responses which were analyzed in conjunction with the standardized quantitative instruments mentioned in study 1. The outcome of study 2 was the development of recommendations that could facilitate technology acceptance in the organizational environment as well as the description of a comprehensive framework describing the relationship between organizational culture, usability and instructional technology acceptance. These recommendations were evaluated by a panel of experts in study 3.

The purpose of study 3 was to conduct a summative evaluation of the recommendations based on findings from study 1 and 2 by a panel of experts. It was designed to answer research question 5 (RQ 5). In this study, a panel of experts reviewed all the recommendations using the Delphi Technique. The results of this study included a list of recommendations that were considered important by a panel of experts to facilitate instructional technology acceptance in an institution.

## **1.6. Summary of Outcomes and Contributions**

This research effort contributed in the following ways:

- Provided a description of the relationship between organizational culture, usability, and instructional technology acceptance in the education domain
- Provided a description of the relationship between job-related factors, personal factors and instructional technology acceptance
- Developed a comprehensive framework that could facilitate instructional technology acceptance in an organization
- Provided recommendations to facilitate technology acceptance in an organization
- Provided design guidelines to facilitate instructional technology acceptance in an organization

## **CHAPTER 2. LITERATURE REVIEW**

### **2.1. Organizational Culture**

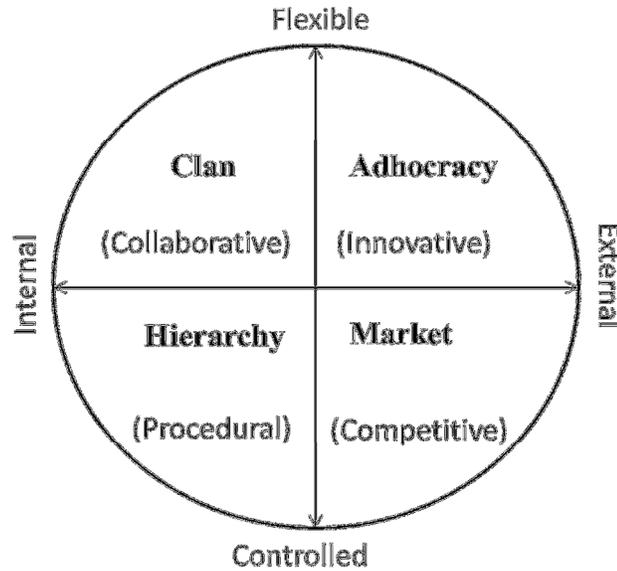
Organizational culture refers to underlying values and assumptions which are characteristics of organizations and their members (Cameron & Ettington, 1988; Schein, 1996). At the university level, organizational culture can be defined as *the values and ideas held by the various stakeholders of the university, that are transferred to each other both verbally and nonverbally* (Deal & Kennedy, 1982; Bartell 2003; Fralinger & Olsen, 2007). Since this definition is applicable to a university setting, it was used as the basis of this research effort as well.

Organizational culture has been a popular topic since the 1960's (Wallace, Hunt, & Richards, 1999). One of the first operational definitions was made by Pettigrew (1979) who asserted that organizational culture comprised of cognitive systems that describe how people feel, reason, and decide on various things. Most definitions of culture can be broadly categorized into two types: an approach that suggests that culture stems from collective behavior and the other that suggests that culture exists in individual cognitions (Wallace, Hunt, & Richards, 1999). However, most researchers agree that organizational culture refers to the underlying values that are traits of the particular organization in question (Cameron & Ettington, 1988; Schein, 1996). They are believed to affect the way individual members feel and act.

Additionally, Sackmann (1991) differentiates the visible aspects of organizational culture with the analogy of an iceberg. The observable portions such as behavior can be considered to be the tip of the iceberg whereas central components which are hidden from view (or the base of the iceberg) include values and beliefs (Sackmann, 1991). It is important to acknowledge that organizational culture is different from organizational climate which deals with observable practices and behavior of the members of the organization (Amabile, Conti, Coon, Lazenby, &

Herron, 1996). Previous research has also differentiated between various types of cultures. Deal & Kennedy (1982) were one of the first researchers who distinguished between 'strong' and 'weak' cultures and they were of the opinion that organizations with stronger cultures were more likely to be more successful. Roger Harrison (1972) developed a four-culture model linking organizational structure to culture and depicted culture as 'power', 'role', 'achievement', or 'support'. Charles Handy (1985) adapted this idea and named the four cultures 'Club', 'role', 'task' or 'existential'. Another version of this model is one by Cox & Hopkins (1996) with the four cultures named as 'Role', 'Control', 'Goal' and 'Soul'. The premises of each these versions remain the same. One culture revolves around the boss, the other around rules, another around achievements, and finally another around people. The model of the Competing Values Framework was developed by professors at University of Michigan to understand the underlying values that affect organizational culture as well as to understand what makes organizations effective (Cameron & Quinn, 1999). The framework comprised of 4 competing values that relate to 4 types of organizational culture. The combination of the four types is unique to each organization, but studies have found that most organizations have a dominating organizational culture (Cameron & Quinn, 1999). This model has also been recognized as one of the 40 most important frameworks in the domain of business literature and has been used successfully in higher educational institutions (Cameron, 2004), which is why it was used as the basis of this research effort. While it is often used to assess leadership, it has also been applied to a variety of different domains, such as personal style, organizational culture, decision making, etc. The CVF acts like a map to make sense of an organization. The CVF framework consists of two dimensions, a vertical axis and a horizontal one, resulting in a figure with four quadrants (as shown in figure 5). One dimension ranges from flexibility, discretion, and dynamism, to stability, order, and control.

The other dimension ranges from a focus on internal preference with importance given to integration, collaboration, and unity, to an external preference, with importance given to differentiation, competition, and rivalry. Each quadrant represents a type of culture; Clan, Hierarchy, Adhocracy, and Market (Cameron & Quinn, 2006). The clan culture is all about sharing values and goals. Information Technology thrives in an environment of collaboration and mutual assistance. This type of culture emphasizes empowerment of employees. The adhocracy culture focuses on the task at hand and dissolves the minute it is done, only to resurface when there is a new task. This type of culture is seen in film industries, consultants, etc. The market culture deals with contracts external to the organization instead of internally. The main aim of this type of culture is to make profits through competition. Finally, the hierarchy culture has a more firm structure, with rules and regulations, and well defined roles and responsibilities (Yu, 2009). Based on the CVF, the Organizational Culture Assessment Instrument (OCAI) was developed, which will be described later in this document.



*Figure 5.* The Competency Values Framework (as adapted from Quinn & Rohrbaugh, 1983)

Organizational culture has been found to play an important role in the study of organizational behavior (Claver, Llopis, Garcia, & Molina, 1998; Barley, Meyer & Gash, 1988). Traditionally, organizations were perceived as a system with four interrelating variables; tasks, structure, technology, and people (Leavitt, 1964). Culture is now considered to be a completely separate factor that can significantly affect the efficiency of the organization as well as the four factors in the traditional model (Deshpande & Webster, 1989). Introduction of new technologies in certain organizations may lead to disputes and rejection by workers, especially when the introduction forces them to change their work practices, suggesting that organizational cultures are not internalized by all units of the organization (Claver et al., 1998). It has been recommended that organization culture should be viewed as diverse and different and not shared and harmonious, since it is evident that organizational culture is disjointed with all the subcultures and various group community practices within an organization (Iivari, 2006).

Organizational culture should also start to be acknowledged as one that's constantly evolving, due to the fact that employees are constantly changing their work routines (Orlikowski, 1996).

## **2.2. Organizational Culture and Technology Acceptance**

Organizational culture has been found to be an important factor when it comes to various change efforts. Organizations with a 'group culture' were found to facilitate telecommuting (Harrington & Ruppel, 1999) whereas adhocracy and hierarchy cultures have been found to correlate to early acceptance of internets (Ruppel & Harrington, 2001). Organizational politics and intra-department conflicts (within the same organization) can also hinder the acceptance of a change agent. Lack of support from the senior management was found to affect the amount of user-designer relationship in a product-development organization (Axtell, Holman, & Wall, 1997; Bloomer & Croft, 1997; Cavaye, 1995). The staff of an organization was also found to play an important role in the acceptance of an innovation (Claver et al., 1998). For instance, the CEO or head of smaller firms tend to have a bigger impact on the successful adoption of Information Technology (Thong & Yap, 1995). In addition, smaller firms were found to have different adoption rates than larger ones (Iacovou, Benbasat, & Dexter, 1995). This can have important implications for adoption of instructional technology within departments of an institution. A study that focused on small and medium enterprises found that the most important factors affecting IT adoption were that of benefits from adopting the technology, organizational culture, availability of the technology, and in-house knowledge on how to use the technology. Secondary factors were found to be the environment external to the firm, resources available internally, external support, and outside resources (Fink, 1998). These studies imply that organizational culture can not only have a huge impact on technology acceptance but the size of

the organization is important as well. This is especially important in the education domain where instructional technology is often adopted by the departments within different colleges.

## **2.3. Organizational Culture Assessment Tools**

### **2.3.1. Organizational Culture Assessment Instrument**

There are a number of methods designed to assess organizational culture. One of the more popular methods, based on the Competing Values Framework, is the Organizational Culture Assessment Instrument (OCAI). It is a quick, validated, and reliable instrument to assess organizational culture (Cameron & Freeman, 1991; Quinn & Spreitzer, 1991). It has been used in over 10,000 organizations, across all domains, including education (Cameron, 2004). The initial statistical analysis revealed that 2 dimensions were found to impact organizational culture and its success. The two dimensions include; to be internally or externally focused, and to aim for stability or to aim for flexibility. Based on these dimensions, Cameron & Quinn (1999) suggested that organizations can have 4 culture types; Clan culture, Hierarchical culture, Adhocracy culture, and a Market Culture. The instrument establishes the organization's dominant culture by measuring six dimensions; Dominant Characteristics, Organizational Leadership, Management of Employees, Organizational Glue, Strategic Emphasis, and Criteria for Success. This instrument was successfully used to understand the dominant culture type of Ohio State University Extension (Berrio, 2003) as well as in a national study of organizational effectiveness of colleges and universities (Smart & John, 1996). This tool was also successfully used in a university setting to understand how organizational culture influences student attitudes (Fralinger & Olson, 2007). Since this instrument has been found to be reliable and valid in a university setting, it was used as one of the instruments in this research effort.

This popular instrument is a questionnaire that elicits information regarding six items (Dominant Characteristics, Organizational Leadership, Management of Employees, Organizational Glue, Strategic Emphases, and Criteria of Success). Each question has four alternatives (A =Clan, B= Adhocracy, C= Market, and D = Hierarchy) which are based on the Competing Values Framework (Quinn & Rohrbaugh, 1983). This instrument also detects what members of the organization think the culture should be in order to effectively achieve future goals of the organization (Quinn & Cameron, 2006). Quinn & Spreitzer (1991) studied 796 employees from 86 different firms using the OCAI and found that the study had reliability coefficients ranging from 0.71 to 0.79 for each culture. Another study found that this tool exhibited reliability coefficients ranging from 0.76 to 0.80 for each culture (Yeung, Brockbank, & Ulrich, 1991). Validity of the OCAI was verified by the study of 334 higher educational institutions (Cameron & Freeman, 1991). Evidence for validity of the tool was obtained by matching the culture type with the domain that the organization shined in. Institutions that exhibited clan-type cultures were found to excel in areas that dealt with communication and support. Those who exhibited adhocracy-type culture were found to excel in areas related to innovation and openness of the system. Market-type culture institutions were found to excel in acquiring resources and foresight. Hierarchical culture institutions were not found to excel in anything as the CVF framework suggested (Cameron & Freeman, 2006).

#### **2.4. Usability**

The International Organization for Standardization or ISO, as it is commonly known, has developed various standards on usability although two distinct classifications can be seen: product-oriented standards and process-oriented standards (ISO/IEC 9241-18, 1998). Process-oriented standards will be reviewed here, and specifically, *ISO-9241-11*, which provides a set of

guidelines and definitions on usability. Usability has been defined as the amount by which a product can be used by certain users to attain their goals with *effectiveness, efficiency, and satisfaction* in a certain context (ISO/IEC 9241-14, 1998). The definition has also been extended to include learnability, memorability, and errors (Nielsen, 1993), but for the purpose of this research effort, the ISO/IEC (1998) definition will be used as the operational definition. In particular, According to this standard, usability has three measurable attributes (ISO/IEC 9241-14, 1998).

1. Effectiveness: This is defined as the “*accuracy and completeness with which users achieve specified goals*” (ISO/IEC 9241-14, 1998). In other words, how competently do the users of the system attain their goals, by using the system (Abran, Khelifi, Suryn & Seffah, 2003)? For instance, if the user’s goal is to re-create a two-page document in a certain format, accuracy can be defined or measured by the number of spelling errors and the number of variations from the original format, and, completeness by the number of words in the reproduced document divided by the number of words in the original one (ISO, 1998).
2. Efficiency: This is defined as the “resources expended in relation to the accuracy and completeness with which users achieve goals” (ISO, 1998). In other words, what resources are made use of to accomplish their goals (Abran et al., 2003)? For instance, if the user’s goal is to print duplicates of a document, then efficiency could be measured by the number of usable copies printed divided by the resources like time, cost, materials, exhausted on the job (ISO, 1998).
3. Satisfaction: This is defined as the “freedom from discomfort, and positive attitudes towards the use of the product” (ISO, 1998). In other words, how do the users feel about

using the system (Wixon & Wilson, 1997, Abran et al., 2003)? Satisfaction can be measured using subjective rating scales. Other methods of measurements include the number of positive and negative remarks that were recorded during use (ISO, 1998).

The methodology used in ISO 9241-11 has received acclaim for quite a few reasons (Abran et al. 2003) including the fact that this model recognizes the context-of-use perspective of usability and considers it during specification and evaluation of design and usability. A system that has been considered usable in one context might be considered extremely difficult to use in another (Morris & Dillon, 1996). The fact that user performance and satisfaction can be measured directly and that it provides a foundation for comparing usability between features in the same context, has also been looked at as advantage (Abran et al., 2003). Due to these advantages, the operationalized definition of usability in this research effort was based on the ISO definition.

### **2.5. Usability and Culture**

There has been plenty of usability research done in the cross-cultural domain; however, it is important to note that many of these studies deal with *national culture* and not organizational culture, however, there has been limited research done on usability and organizational culture. Thus, this dissertation will fill a necessary gap in the current literature.

### **2.6. Methods to Assess Usability**

There have been various methods that have been developed to assess usability. For the scope of this research, the researcher has focused on survey based methods to assess usability of an interactive system.

### **2.6.1. System Usability Scale**

The System Usability Scale (SUS) was developed by Digital Equipment Corporation in 1986 to provide a low-cost, reliable scale to assess system usability (Brooke, 1996). It is a 10-item scale which elicits Likert scale responses with anchors 1 being *Strongly disagree* and anchor 5 being *Strongly agree*. The reliability of the SUS based on 77 cases was found to be 0.85 (Lucey, 1991). Another study of 2324 cases found that SUS had a coefficient alpha of 0.91 (Bangor, Kortum, & Miller, 2008). The 10 questions cover a number of crucial aspects like, complexity of system, and the need for support and training and thus the scale has high face validity.

A comparison of SUS along with two other usability methods, to evaluate the usability of two websites found that while all questionnaires showed that one particular website was significantly preferred, SUS yielded the most reliable results (Tullis & Stetson, 2004). SUS was found to address various aspects of the participant's reaction to the website as a whole and its accuracy jumped to around 75% when the sample size was increased to 8, which is significantly higher than any of the other scales. Since SUS is not only simple and cost effective, and it has also been found to be more efficient in addressing various aspects of usability (Tullis & Stetson, 2004), it was used to assess usability of instructional technology for Study 1 of this research. The reader is referred to Chapter 3 for a more detailed description of use.

### **2.7. Technology Acceptance**

There have been several studies conducted to understand technology acceptance, both from an individual standpoint and from an organizational standpoint. These studies have led to several theories. Some of the predominant theories include Diffusion of Innovations Theory and

Unified Theory of Acceptance and Use of Technology and are discussed in the subsequent sections.

### **2.7.1. Diffusion of Innovations theory**

Everett Rogers (1995) developed one of the most notable theories on diffusion of innovations. He defined the innovation-decision process as the process through which individuals go from gaining basic knowledge of the innovation, to developing an opinion about it, to finally deciding whether to accept or reject the innovation (Rogers, 1995). His current model of the innovation-decision process consists of 5 steps: *Knowledge, Persuasion, Decision, Implementation, and Confirmation*. Rogers also classified five attributes of innovations. He was of the opinion that attributes help describe an innovation and help predict rate of adoption depending on the individuals' opinion of the innovation. According to him, they are: *Relative Advantage, Compatibility, Complexity, Trialability and Observability*. Relative Advantage which is the amount to which an innovation is considered to be better than an older idea. In a way, it indicates the intensity of the award or punishment resulting from adopting the innovation. Compatibility is the amount to which an innovation is considered to be consistent with current values, prior experiences, and needs of likely adopters. The more compatible the innovation appears the certainty of adoption increases. Complexity is the amount to which an innovation is considered as difficult to comprehend and use. It is usually considered as a negative aspect. The more complex an innovation appears, the less likely that it will be adopted. Trialability is the amount to which an innovation may be tested on a limited basis. An innovation that can be tested by the user has better chances of adoption than one that has no trialability. Observability is the amount to which the outcomes and results of an innovation are noticeable to others. The more

noticeable the results of an innovation are, the more likely that the innovation will be adopted (Rogers, 1995).

Rogers also was of the opinion that personalities of users themselves influenced rate of adoption. According to him, there are five types of users; Innovators, Early adopters, early majority, late majority, and laggards. Innovators are described as being “venturesome”, and they try out new gadgets with enthusiasm. Early adopters are not as venturesome as innovators, but their opinions on the new products are respected by their peers. The early majority hesitates before deciding to adopt an innovation, but they stand between those who adopt very early and those who adopt late. The late majority is described as being ‘skeptical’ and usually adopts a technology due to peer pressure and/or necessity. They usually have scarce resources so it is absolutely necessary that the technology works very well before they decide to adopt it. The final category is that of the laggards who the last to adopt a technology. They do not trust new innovations as well as opinions of peers. They have to be absolutely sure that the innovation will be successful before they adopt it (Rogers, 1995). This suggests that personalities of an individual influence technology acceptance and adoption.

### **2.7.2. Unified Theory of Acceptance and Use of Technology (UTAUT)**

The UTAUT was a result of an empirical comparison of eight specific models of the predictors of intention and computer usage( TRA, TAM, Motivational Model (MM), TPB, Combined TAM-TBP, Model of PC Utilization, Innovation Diffusion Theory (IDT), Social Cognitive Theory (SCT))(Venkatesh, Morris, Davis, & Davis, 2003). According to this theory, performance expectancy, effort expectancy, and social influence are direct predictors of intention to use and intention, facilitating conditions are two direct predictors of usage behavior (as shown

in Figure 6). Performance expectancy refers to how useful users perceive a product to be, when it comes to achieving their goals. It is believed to be the strongest predictor of intention to use. Effort expectancy refers to how easy people expect the technology to be, in terms of adopting and using the system for achieving their goals. Social influence refers to the impact of others' attitudes towards adopting the system. Social influence has been found to depend on the environment as well, like if it was mandatory or voluntary adoption (Karahanna, Straub, & Chervany, 1999; Anderson & Schwager, 2003). Facilitating conditions refer to the amount that users believe that the existing conditions will enable them to use the technology. Experience, voluntariness, gender, and age were also found to play a role in predicting intention and usage behavior. This model was empirically validated with six longitudinal studies in six organizations. A pretested questionnaire with items measuring constructs from all the eight models was administered three times; once after training, second time a month after implementation, and finally, three months after implementation. Usage behavior was measured over 6 months after the training period. Likert-type scales with anchors set as 1-Strongly disagree and 7- Strongly agree, were used for all the measurements. The tenses of the verbs were changed based on the time of administration. 'Attitude' from TRA/TBP, 'perceived usefulness' from TAM, 'extrinsic motivation' from MM, relative advantage from IDT, and 'outcome expectations' from SCT were found to be significant across all the time periods. Mandatory vs. voluntary use was found to have an impact on the constructs related to social influence. Reliability measured using partial least squares was found to be greater than 0.70. The model reported a 70% variance (adjusted  $R^2$ ) which was higher than any of the original eight models (Venkatesh et al, 2003). This model is gaining popularity because it was created so that it could be adjusted to various technologies (Venkatesh et al, 2003).

The UTAUT has been found to be robust enough to withstand minor changes (Oshlyansky, Cairns, & Thimbleby, 2007). This model will be used as part of this research study's theoretical framework due to its extensive use in an organizational setting.

## **2.8. Barriers against Technology Acceptance**

There have been a number of studies that have focused on the barriers to adoption of technology. A study of 348 faculty members found that the main barriers included lack of interest, job relevance, and personal contribution (Beggs, 2000). Another study found that lack of organizational support, lack of monetary support, and lack of time were the main barriers to adopting technology (Chizmar & Williams, 2001). Cost, legality, time, fear, usefulness, and complexity were found to be the main barriers towards adopting technology in rural hospitals (Garrett, Brown, Hart-Hester, Hamadain, Dixon, Pierce, & Rudman, 2006). For instance, physicians were found to be reluctant to readily adopt technology due to 11 reasons, some of them including lack of support, lack of user friendly technology, and inadequate training provided (Treister, 1998). A study on technology adoption on K-12 institutions found that barriers could be divided into internal and external ones. Internal barriers included teachers' attitudes and perceptions while external barriers included accessibility and support (Rogers, 2000). Factors influencing teachers' adoption of technology were found to include access to technology, schedule, efficacy, content requirements and pedagogical values (Becker, 2000). All these studies suggest that barriers to technology adoption in an organization can be personal as well as job-related. This was also evident in a study conducted at Virginia Tech with faculty members of a department that readily adopted instructional technology (Kothaneth, Amelink & Scales, 2011).

### CHAPTER 3: METHODOLOGY

This research was designed to explore the impact of organizational culture and usability on technology acceptance. This research used Virginia Tech’s College of Engineering as a test bed to understand how faculty members accepted instructional technology. For the scope of this research, instructional technology was defined as those that are computer-based, such as laptops and tablet PCs. Faculty members included those who had instructed a course and thus utilized technology for instructional purposes. Graduate teaching assistants who had instructed a course were included in the population. However, research faculty (those who focused on research and not instruction) were not included in this research. This research was conducted using three studies. A summary of the studies is shown in Figure 7 and explained in Table 1.

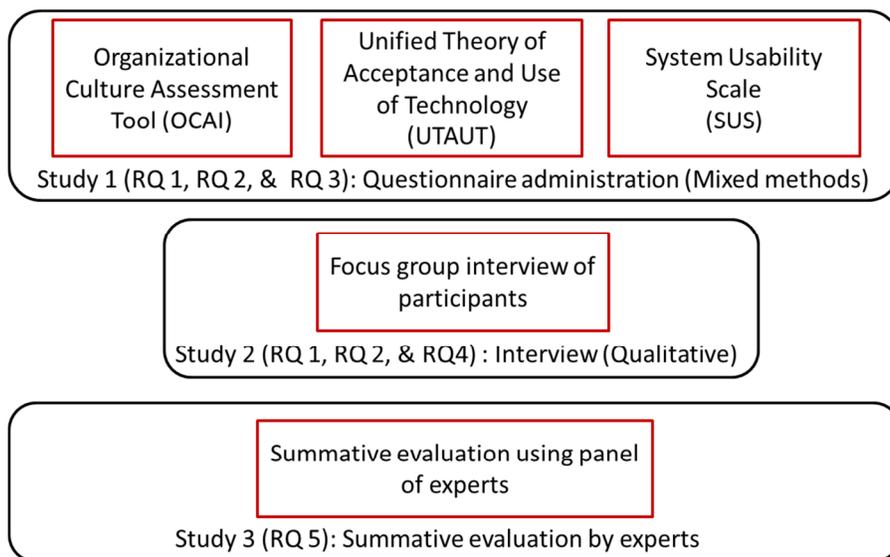


Figure 6. Conceptual framework depicting scope of proposed research

Table 1

*Summary of studies, data analyses methods, and outcomes*

Research Studies	Data Analysis Methods	Research Questions	Outcomes
1. Mixed Method questionnaire design	<ul style="list-style-type: none"> <li>• Structural Equation Modeling</li> <li>• Linear Regression</li> <li>• Kruskal-Wallis</li> </ul>	RQ 1 RQ 2 RQ 3	<ul style="list-style-type: none"> <li>• Description of perceived organizational culture</li> <li>• Description of preferred organizational culture</li> <li>• Description of perceived usability of technology</li> <li>• Description of instructional technology acceptance</li> <li>• Recommendations for instructional technology acceptance</li> </ul>
2. Focus group interview	<ul style="list-style-type: none"> <li>• Thematic coding</li> <li>• Frequency counts</li> </ul>	RQ 1 RQ 2 RQ 4	<ul style="list-style-type: none"> <li>• Description of job-related factors</li> <li>• Description of personal factors</li> <li>• Recommendations for instructional technology acceptance</li> </ul>
3. Summative evaluation by experts	<ul style="list-style-type: none"> <li>• Thematic coding</li> <li>• Frequency counts</li> </ul>	RQ 5	<ul style="list-style-type: none"> <li>• Evaluation of proposed framework</li> <li>• Recommendations and design guidelines to facilitate technology acceptance in an organization</li> </ul>

### **3.1. Study 1: Mixed Method Questionnaire Design**

#### **3.1.1. Research Design**

This study was designed to answer the following research questions:

RQ 1: What are the factors that facilitate technology acceptance in an organization? \*

*H1: Technology acceptance in an organization will be dependent on organizational culture, usability, job related factors and personal factors*

RQ 2: How does organizational culture relate to technology acceptance?

*H 2: Organizational culture will influence technology acceptance*

RQ 3: What are the differences and similarities across departments within an organization, regarding technology acceptance?

*H 3: Departments with adhocracy and clan cultures will be more likely to accept technology than those with hierarchical and market cultures*

Studies 1 and 2 were designed to answer Research question 1. Study 1 was designed to explore the relationship between organizational culture, usability, and instructional technology acceptance, from a quantitative perspective whereas Study 2 was designed to add to the findings of Study 1 and explore the relationship organizational culture, usability, and instructional technology acceptance as well as job related factors and personal factors from a qualitative perspective.

### **3.1.2. Participants**

To gain an understanding of the relationship between organizational culture, usability, and instructional technology acceptance, participants in this study were sought using a sampling strategy suggested by Patton (1980) to create a purposeful sample. Criterion sampling strategies are useful to identify participants who can provide rich information and then study them in detail (Patton, 1980).

The following criteria were used to select participants for this study:

- Must be faculty members teaching in the College of Engineering, at Virginia Tech.
- Must be at least 18 years of age;

For the scope of this study, ‘faculty members’ was defined as faculty members and graduate teaching assistants who have taught one or more courses.

These criteria were deliberately developed to understand the impact of organizational culture on the use and adoption of technology by faculty members. This research used the College of Engineering at Virginia Tech as a test bed because like many higher educational institutions, it faced the challenge of trying to integrate instructional technology acceptance into the curriculum.

A total of 76 respondents participated in this study, indicating a 22% response rate. Of the 76 respondents, 1% were Department Heads, 25% were Professors, 11% were Assistant Professors, 34 % were Associate Professors, 9% were Instructors, 13 % were graduate teaching

assistants and 7% declined to reveal their position. Additional demographics characteristics are included in Table 3.

Table 2.

*Additional demographic characteristics of respondents*

	N	%
<b>Department</b>		
AOE	9	11.8
BSE	1	1.3
Chem	4	5.3
CEE	8	10.5
CS	13	17.1
ECE	12	15.8
ENGE	11	14.5
ESM	3	3.9
ISE	4	5.3
MSE	1	1.3
ME	7	9.2
Mining	1	1.3
No Answer	2	2.6
<b>Number of courses taught in past two academic years</b>		
2	15	19.7
3	34	44.7
4	27	35.5

### 3.1.3. Procedure

Prior to any data collection, Institutional Review Board (IRB) approval was obtained. In study 1, all participants completed an online questionnaire (Appendix F) comprised of questions from Organization Culture Assessment Instrument (OCAI) (Appendix A), Unified Theory of Acceptance and Use of Technology (UTAUT) (Appendix B), System Usability Scale (Appendix C), a demographic questionnaire (Appendix D), as well as a few open-ended questions that elicited job related and personal factors (Appendix E). The entire survey took about twenty five

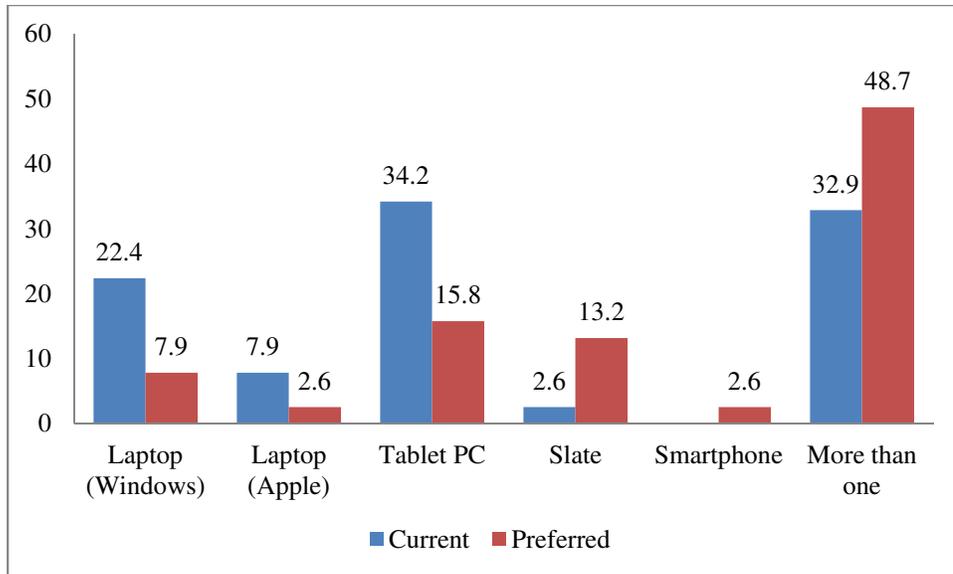
minutes to complete and an email with the link to the online survey was sent to the listserv of engineering faculty members. To ensure that only those who used the instructional technology defined in this research effort (any computer based technology, such as laptop or tablet PC) took part in this study; respondents were asked if they used a laptop/tablet PC to teach during the past academic year. Only those respondents that answered in the affirmative could proceed with the survey. Instructions as well as information regarding the purpose of the research were included within the online survey. The survey was left available for four weeks to give enough time to get responses from faculty members who often have very busy schedules. The questionnaire was anonymous but there was an optional additional contact information field for faculty members who wanted to be contacted for follow-up interviews.

#### **3.1.4. Questionnaires**

There were a total of four questionnaires that were administered to the participants using the online survey tool, Qualtrics. The questionnaires are described in detail below.

##### **3.1.4.1. Demographics questionnaire**

The demographics questionnaire (Appendix D) was used to elicit information about participants' department, number of courses that they taught in the past two academic years (as shown in Table 3) as well as a list of technologies that they currently used and a list of technologies that they would prefer to use for instructional purposes. There was also space provided for contact information if participants were interested in a follow up interview for Study 2. Figure 8 below depicts the instructional technology that participants currently use as well those that they would like prefer to use in the future.

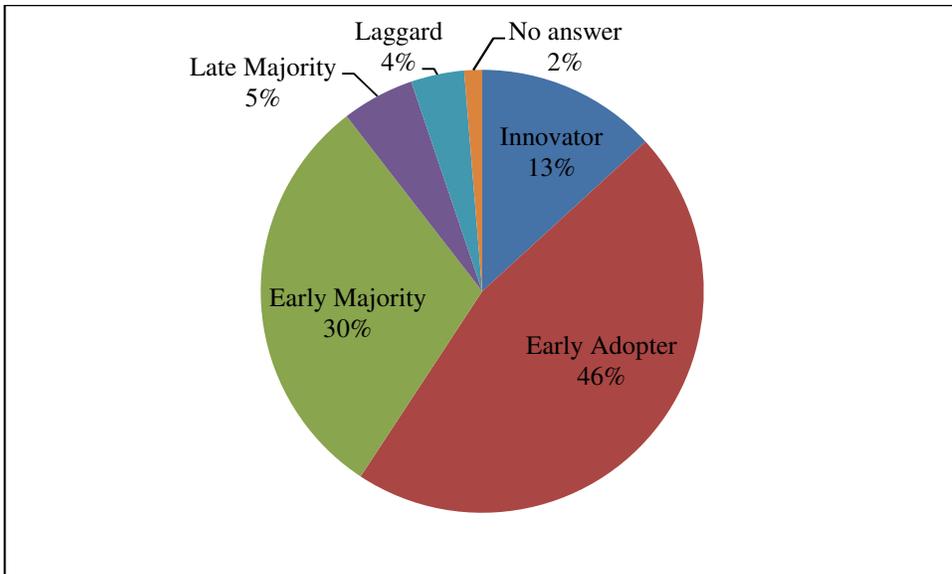


*Figure 7: Bar graph depicting current and preferred instructional technology*

### **3.1.4.2. Job Related Factors and Personal Factors**

Open-ended questions (Appendix E) were developed to elicit job related factors and factors related to their individual personalities that could impact instructional technology use.

To elicit personal characteristics, participants were asked to categorize themselves as Innovators (defined to be 'venturesome' and enjoy trying new innovations with enthusiasm), Early Adopters (defined to be 'opinion leaders' and try innovations with caution), Early Majority (defined to be 'deliberate' and hesitate before adopting innovation ), Late Majority (defined to be 'skeptical' and usually adopt innovation under peer pressure), and Laggard (defined to be 'traditional'; usually adopt innovation when it has become mainstream ). These categories were based on Rogers' (1995) adopter categories and the reader is referred to the original work to get more insight in the different categories.



*Figure 8:* Pie chart of current adopter categories. Participants were asked to classify themselves into Rogers' (1995) adopter categories.

As shown in the figure 10, participants were also asked to classify themselves on what they would like to be in the future .using the same categories as above.

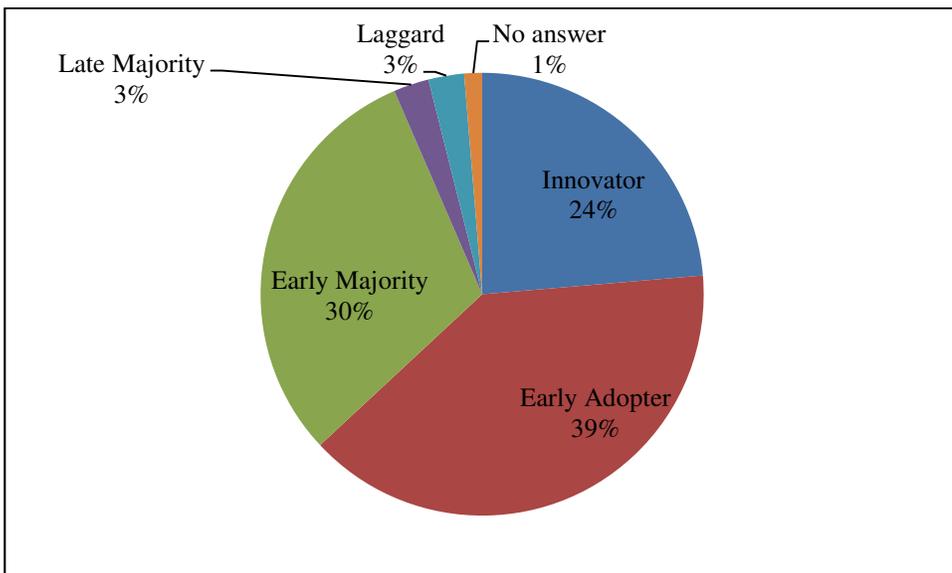


Figure 9. Pie chart of future adopter categories. Participants were asked to classify themselves into Rogers' (1995) adopter categories, based on future preferences.

**3.1.4.3. Organizational Culture Assessment Index (OCAI):**

The OCAI (Cameron & Freeman, 1991) was used to understand the perceived organizational culture of the College of Engineering at Virginia Tech. As explained in Chapter 2 of this document, this instrument has been found to be reliable and valid (Cameron & Freeman, 1991; Quinn & Spreitzer, 1991). The questionnaire has a series of questions related to Dominant Characteristics (DC), Organizational Leadership (OL), Management of Employees (ME), Organizational Glue (OG), Strategic Emphases (SE), and Criteria of Success (CE) of their individual departments. Each question in turn, has four alternatives (A =Clan, B= Adhocracy, C= Market, and D = Hierarchy) which are based on the Competing Values Framework (Quinn & Rohrbaugh, 1983). An example of the questions relating to *Dominant Characteristics* of the OCAI is shown below.

Table 3

*Example of OCAI questionnaire*

Dominant Characteristics	Now	Preferred
A. The organization is a very personal place. It is like an extended family. People seem to share a lot of themselves.		
B. The organization is a very dynamic entrepreneurial place. People are willing to stick their necks out and take risks.		
C. The organization is very results oriented. A major concern is with getting the job done. People are very competitive and achievement oriented.		

D. The organization is a very controlled and structured place. Formal procedures generally govern what people do.		
Total	100	100

Based on instructions set by the questionnaire developers, respondents in this study answered the questionnaires twice, once keeping the “current” situation of the College of Engineering in mind and again, keeping the “preferred” (what they would prefer the College of Engineering to be in five years ) situation in mind, as shown in Table 3. Final results of the OCAI were calculated according to pre-set instructions. Equation 1 below shows that the Clan culture score was calculated by taking the average of choice A across all six dimensions. Results were also plotted on a graph, as per suggestions by the developers of the questionnaire.

$$\text{Clan score} = (DC_A + OL_A + ME_A + OG_A + SE_A + CE_A) / 6 \quad (1)$$

Summary statistics for the organizational culture construct are presented in Table 4. Cronbach’s alpha values ranged from 0.84 to 0.92 indicating that the measures had acceptable reliability (Nunnally, 1978).

Table 4

*Descriptive statistics for organizational culture*

Measure	N	Score Range	Mean	Standard Deviation	Cronbach’s Alpha
Clan	76	0-600	122.96	81.25	0.84

Adhocracy	76	0-600	110.56	62.44	0.87
Market	76	0-600	192.90	107.55	0.91
Hierarchy	76	0-600	173.57	115.385	0.92

The organizational culture assessment index revealed that the dominant current culture of the College of Engineering at Virginia Tech, as perceived by faculty members is the *market* culture, followed by the *hierarchy* culture. As described in Chapter 2, the *market* culture is indicative of an organization that is extremely competitive and is focused on the outside environment instead of the internal matters. The *hierarchy culture* is indicative of an organization that is very policy and procedure oriented. However, the preferred culture profile showed a completely different trend. The preferred cultures were the *adhocracy* and the *clan* cultures. *Adhocracy* cultures place high value on innovation and getting new resources while *Clan* cultures place high value on people within the organization and teamwork. As per recommendations from the developers of the OCAI, the profiles were plotted on a quadrant (as shown in Figure 11, with a solid line indicating the current profile and dotted line indicating the preferred profile).

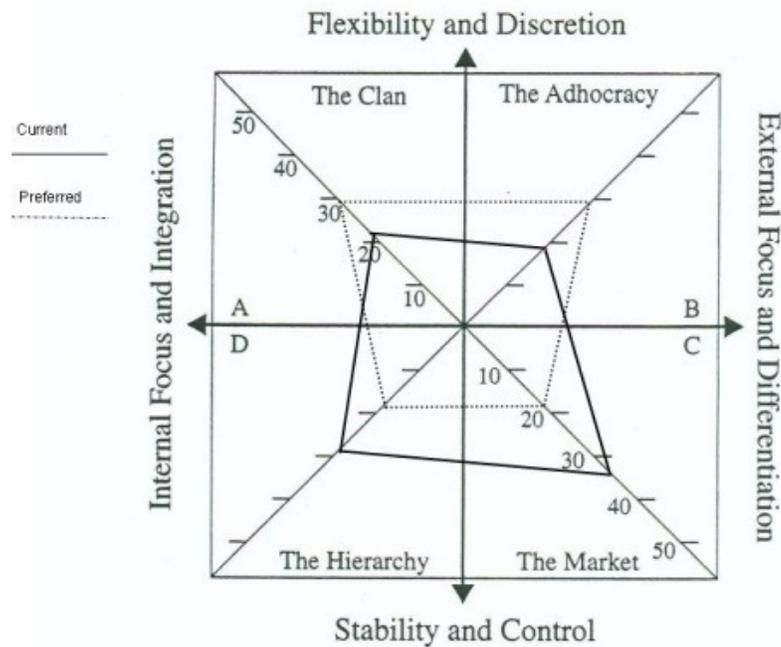


Figure 10. Quadrant (adapted from Cameron & Quinn, 2006) depicting current and preferred organizational culture as perceived by participants in this study.

In addition, developers of the OCAI suggested paying special attention to differences between the now and preferred cultures of over 10 points (Cameron & Quinn, 2006). Higher differences between the two indicate employee dissatisfaction. Results of this study indicate that high differences between the current and preferred cultures existed across all the four cultures as shown in Table 5.

Table 5

*Results of 'Now' and 'Preferred' Culture profiles as perceived by participants in this study*

	Now	Preferred	Difference
Clan (focus on collaboration and support)	20.55	30.51	+9.96
Adhocracy (focus on innovation)	18.51	31.35	+12.84
Market (focus on competition)	32.05	18.63	-13.42
Hierarchy (focus on policies)	28.77	17.92	-10.85

As shown in Table 1, the largest differences were found in the market culture, with a decrease of 31.42 points indicating a desire of less focus on competition. It was closely followed by a difference in the adhocracy culture, with an increase of 12.51 points which indicates an increased desired focus on innovation. The hierarchy culture profiles showed a decrease of 10.85 points indicating desire of less focus on formal policies and procedures and the clan culture profile showed an increase of 9.96 points, indicating a desire of higher focus on teamwork.

#### **3.1.4.4. Unified Theory of Acceptance and Use of Technology (UTAUT)**

The UTAUT is a reliable and valid scale used to understand acceptance of information technology (Venkatesh et al, 2003), as explained in Chapter 2 of this document. The UTAUT has eight measures which are Performance Expectancy (PE), Effort Expectancy (EE), Attitude (ATT), Social Influence (SI), Facilitating Conditions (FC), Self-Efficacy (SE), Anxiety (ANX), and Behavioral Intention (BI) (as shown in Table 6). PE refers to the amount that an individual believes that using a particular system would improve their performance. EE refers to the amount

of perceived effort to use a system. ATT refers to the amount that an individual believes they should use a particular system. SI refers to the amount that an individual perceives that others believe they should use a particular system. FC refers to the amount that an individual believes there are resources to support the use of a particular system. SE refers to the amount that an individual judges their own ability to use a particular system. ANX refers to the amount that an individual is anxious about using a system. BI refers to the amount that an individual intends to use a system in the future.

Table 6

*UTAUT Measures*

Construct	Number of Measures
Performance Expectancy	4
Effort Expectancy	4
Attitude	4
Facilitating Conditions	4
Self-Efficacy	4
Anxiety	4
Social Influence	4
Behavioral Intention to Use Technology	3

The questionnaire in this study had a total of 31 Likert questions with anchors 1 being *Strongly Disagree* and 5 being *Strongly Agree*. This was a change from the original scale which was a 7-point Likert scale. Similar changes to this scale have been replicated in previous studies (Curtis, Edwards, Fraser, Gudelsky, Holmquist, Thornton, & Sweetser, 2010; Debuse, Lawley, & Shibl, 2008) and 5-point scales were found to be more robust (Carlsson, Carlsson, Hyvonen, Puhakainen, & Walden, 2006). The original questionnaire also measured voluntariness of use and that was dropped from this study because of its irrelevance.

Table 7 summarizes the descriptive statistics of these six measures. Cronbach's alpha values ranged from 0.31 to 0.97. The construct that displayed the lowest reliability score was dropped from future analysis.

Table 7

*Descriptive statistics and reliability analysis of UTAUT items.*

Measure	N	Score Range	Mean	Standard Deviation	Cronbach's Alpha
<b>Technology Acceptance</b>					
Performance Expectancy	76	0-5	3.54	0.78	0.75
Effort Expectancy	76	0-5	4.03	0.82	0.95
Attitude	76	0-5	3.67	0.88	0.90
Social Influence	76	0-5	3.37	0.79	0.75
Facilitating Conditions	76	0-5	3.82	0.67	0.31
Self-Efficacy	76	0-5	3.76	0.77	0.76
Anxiety	76	0-5	1.75	0.82	0.91
Behavioral Intention	76	0-5	4.37	0.81	0.97

Measures were coded so that a high score on PE, indicated high performance expectancy; on EE, indicated low effort expectancy; on ATT, high (good) attitude; on SI, high social influences; on FC, high facilitating conditions; on SE, high self-efficacy; and on ANX, high anxiety. There was one case of incomplete values and the missing values were replaced by the

column mean. FC3 (as shown in Appendix C) was reverse coded so that higher scores indicated higher compatibility.

As shown in table 8, correlational analysis revealed that Performance Expectancy (PE) , Effort Expectancy (EE), Attitude (ATT), Facilitating conditions (FC), Self- Efficacy (SE) were positively correlated to Behavioral Intention (BI) indicating that as performance expectancy increased, effort expectance lowered (due to coding),attitude increased, facilitating conditions increased, self-efficacy increased, behavioral intention to use technology increased as well. Anxiety (ANX) was found to negatively correlate with BI indicating that as anxiety increased, intention to use technology decreased. PE, EE, ATT, FC were also found to positively correlate with each other and negatively with ANX, similar to the results found by Venkatesh et al. (2003) studies.

Table 8

*Correlation table for UTAUT items*

	PE	EE	ATT	SI	FC	SE	ANX
PE							
EE	0.677**						
ATT	0.785**	0.745**					
SI	0.148	-0.127	0.144				
FC	0.378**	0.417**	0.405**	0.271*			
SE	0.35	0.098	0.071	0.197	0.183		
ANX	-3.99**	-0.651**	-0.447**	0.145	-0.359**	-1.00	

BI	0.252*	0.287*	0.302**	0.066	0.299**	0.301**	-.431**
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\*\*Correlation is significant at the 0.01 level (2-tailed)

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

### 3.1.4.5. System Usability Scale (SUS)

The SUS is a reliable and valid scale developed to understand system usability (Brooke, 1996). It is a 10-item Likert scale with anchors 1 being *Strongly disagree* to anchor 5 being *Strongly agree*. The 10 questions cover a number of crucial aspects like, complexity of system, and the need for support and training. The descriptive statistics of these measures are shown in Table 9. The scale displayed high reliability with Cronbach's  $\alpha = 0.91$ . This value is well above the acceptable reliable range (Nunnally, 1978).

Table 9

#### *Descriptive statistics of System Usability Scale measures*

	Measure	N	Score Range	Mean	Standard Deviation
1	Use system frequently	76	1-5	4.18	1.02
2	Found system complex	76	1-5	4.00	0.95
3	System easy to use	76	1-5	4.00	0.93
4	Need technical support	76	1-5	4.03	0.99
5	Functions were well integrated	76	1-5	3.57	1.03
6	Inconsistency	76	1-5	3.88	0.99
7	Learn system quickly	76	1-5	3.80	0.81

8	System cumbersome to use	76	1-5	3.92	1.10
9	Confident using system	76	1-5	4.13	0.82
10	Need to learn lot before using system	76	1-5	3.97	1.04

\*Items 2,4,6,8, 10 were reverse coded so that a higher value indicated higher usability

As per instructions of the original scale, participants in this study were asked to check all items, and to mark the center point if they felt that they couldn't answer a particular question.

$$\text{SUS Score} = \{(Q_1-1) + (Q_3-1) + (Q_5-1) + (Q_7-1) + (Q_9-1) + (5-Q_2) + (5-Q_4) + (5-Q_6) + (5-Q_8) + (5-Q_{10})\} * 2.5 \quad (2)$$

The SUS score was calculated according to pre-set instructions by the developer. As shown in Equation 2, each item had a different contribution to the overall score. The final SUS score is a rank on a scale of 0-100, where higher values indicate higher usability. Correlational analysis revealed that all items were positively correlated with the overall usability score and items easy to learn, not complex, easy to use, functions integrated, inconsistency, learn system, not cumbersome were correlated with each other, as shown in Table 10.

Table 10

*Correlation table of System Usability Scale Measures*

	Frequently	Not complex	Easy	Need Support	Functions Integrated	Inconsistency	Easy to learn	Not cumbersome	confident	Need to learn	SUS Score
Frequently	1										
Not Complex	0.387**	1									
Easy	0.428**	0.827**	1								
Need Support	0.093	0.473**	0.550**	1							
Functions integrated	0.268*	0.531**	0.633**	0.378**	1						
Inconsistency	0.365**	0.645**	0.685**	0.451**	0.549**	1					
Easy to learn	0.360**	0.579**	0.687**	0.198	0.435**	0.499**	1				
Not cumbersome	0.465**	0.750**	0.759**	0.446**	0.612**	0.802**	0.595**	1			
Confident	0.482**	0.666**	0.718**	0.486**	0.493**	0.615**	0.460**	0.749**	1		
Need to learn	0.221	0.641**	0.625**	0.582**	0.385**	0.572**	0.419**	0.655**	0.692**	1	
SUS Score	0.543**	0.840**	0.901**	0.614**	0.724**	0.806**	0.675**	0.699**	0.812**	0.744**	1

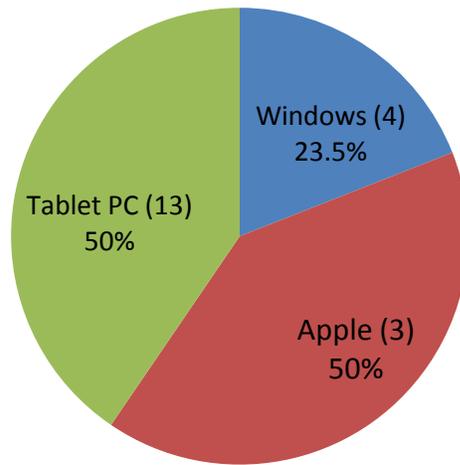
Based on recommendations from prior research, a score below 70 was used as a threshold to indicate usability issues, whereas a score above 70 was used to indicate higher usability of the product (Bangor, Kortum, & Miller, 2008), as shown in Table 11.

Table 11

*Adjective ratings (as adapted from Bangor, Kortum, & Miller, 2009) of SUS score range*

<b>Range</b>	<b>Adjective Rating</b>
90-100	Best Imaginable
80-90	Excellent
70-80	Good
<70	Indicates usability issues

In this study, participants were asked to discuss the usability of their current instructional technology. As shown in Figure 12, of the 76 respondents, 35.5 % indicated that they had usability issues with their current instructional technology, demonstrated by a total usability score of less than 70.



*Figure 11.* Percentage of respondents who indicated that they had usability problems with the current instructional technology

However, 85% of those respondents with lower usability scores said that they intended to use the technology in the next year (as indicated by a BI score of over 10 points), suggesting that this sample would continue to use technology that they are not necessarily satisfied with (as shown in Figure 13).

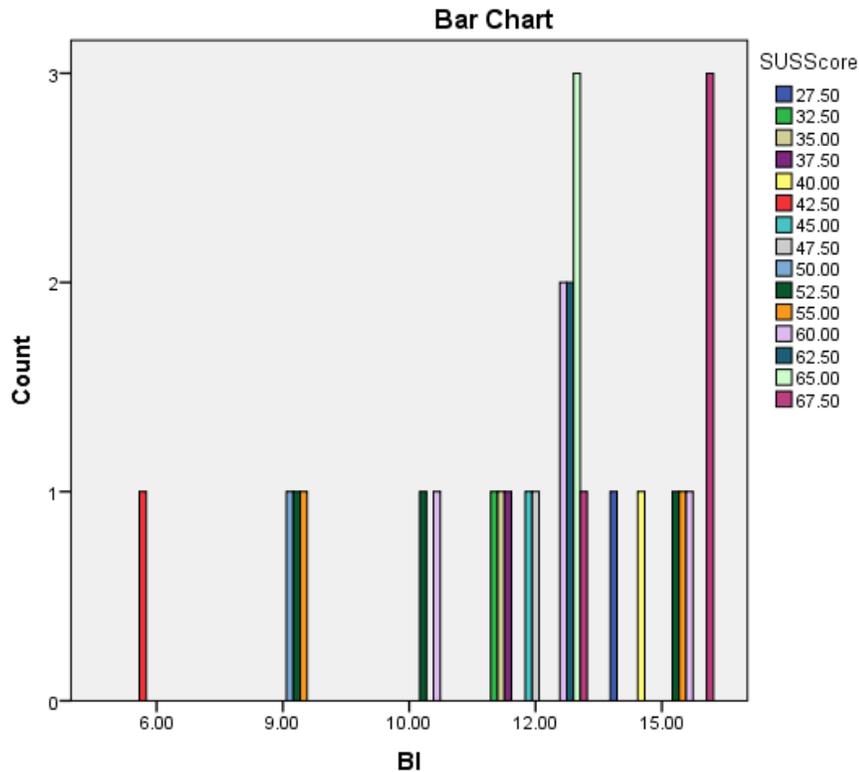


Figure 12. Behavioral Intention to use technology (BI) Totals & SUS Scores. This figure captures the BI totals of all SUS scores < 70.

A spearman Rho's correlation found a statistically significant relationship between the overall usability score and the behavioral intention to use technology (BI), indicating as usability increased, intention to use the technology increased ( $r_s[74] = 0.365, p < 0.01$ ).

### 3.1.4.6. Open Ended Items

In addition, respondents were asked how their job positions impacted their use of instructional technology. Open coding (Strauss & Corbin, 1990) was used to categorize the information into themes to provide insight into respondents' perceptions on how their job

impacted use of instructional technology. The themes that developed and the frequency count are listed in Table 12.

Table 12

*Frequency counts of Open-Ended Responses*

Theme	Count	Sample Statements
Related to their job title and or/duties	15	<i>“As my position is focused on teaching, incorporating innovations into my teaching can take a priority.”</i>
Related to the type of course and or/course material	14	<i>“I do 100% distance teaching so I am particularly interested in innovations that would help teach more effectively to students at a remote location from me.”</i>
Related to class size	8	<i>“my courses involve large &gt;100 person lecture halls where chalk boards can't be read by the students.”</i>
Related to goals for student learning	7	<i>“I'm always interested in technologies that will facilitate my students' work.”</i>
Related to time	6	<i>“I'd like to try more new technologies than I do, but time constraints (me doing too many things) keeps me from playing around too much.”</i>
Related to anxiety	6	<i>“It's got to be reliable and ready when the class starts. No waiting AT ALL. I'm there to teach NOT to entertain.”</i>
Related to support and/or training	6	<i>“Informal discussions with other faculty has been crucial.”</i>
Related to interest in technology	5	<i>“I am always trying to improve my teaching effectiveness and am open to trying effective, but not gimmicky, technologies that require minimal investment of my time.”</i>
Related to instructional style	4	<i>“A combination of Blackboard and a PC seems to be the best form of teaching.”</i>
Related to lack of flexibility	3	<i>“The GTA position is somewhat limited within the first year program because much of the course design is already orchestrated with little room for adjustment”</i>
Related to finding it difficult	2	<i>“A lot of variation in teaching each semester based on the course which makes it hard to</i>

		<i>adopt a technology.</i>
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Respondents indicated that their use of technology changed depending on their job title. Some of the respondents were in positions related to promoting technology use and thus spent a lot of time and effort using and finding new technology. While others felt that their job positions hindered them from using technology in the classroom. In the words of a Graduate Teaching assistant, *“The GTA position is somewhat limited within the first year program because much of the course design is already orchestrated with little room for adjustment.”* This sentiment was reflected by other graduate teaching assistants as well. Others felt that being solely involved with teaching helped them stay innovative, saying things like, *“As my position is focused on teaching, incorporating innovations into my teaching can take a priority.”* Others said that focusing on research didn’t allow them to focus on instructional technology. For instance, one Associate Professor commented, *“Not too much time for lots of teaching innovation due to heavy emphasis on research”*.

The type of course and course material also heavily influenced their use of instructional technology. Teaching online courses and ‘distant learning’ courses were found to necessitate the use of technology to a certain extent. Comments like, *“I am a distance learning faculty which requires me to exploit innovative technologies that can hold the attention and engage students who belong to an “instant gratification” generation.”* and *“I do 100% distance teaching so I am particularly interested in innovations that would help teach more effectively to students at a remote location from me.”* were echoed across those who were involved with those types of classes. Course material too impacted the use of instructional technology. Those who taught courses on technology found that using technology helped them in the classroom. Those who

taught courses that involved a lot of writing in the classroom said that they liked using the tablet PC and its related software to take notes, but one faculty member felt that “*Mathematical topics [are] generally best on board.*” In addition, a number of respondents who taught large classes felt that the size of the class made way for using technology. For instance, one faculty member said “*my courses involve large >100 person lecture halls where chalk boards can't be read by the students.*” However, the large class size also led to feelings of anxiety in using instructional technology. Sentiments like, “*I generally teach large classes, so I need to bear in mind that any problems with new technology will be multiplied by the number of students in the course (this makes me a little more careful when making changes.)*” were echoed by a few faculty members.

Some faculty members indicated that they wanted to create an interactive, effective learning environment for students and tried to adopt interactive technology for that purpose. However, others were worried that using technology would distract students and increase absenteeism. In the words of one faculty member, “*I don't want to use so much technology (or such new technology) that it actually detracts from the material.*”

Time was definitely a factor that influenced technology adoption, because a number of faculty members said that they simply had no time to try new technologies or to redesign their course material using technology. One faculty recognized that s/he had more time due to their job position and said, “*Since I am not a tenure-track position, I think that I have more flexibility in trying technology.*”

Graduate teaching assistants who had been trained to use technology were definitely keen on using technology in the classroom. For instance, this Graduate teaching assistant said, “*I taught with the freshmen engineering program, so we were instructed to use our tablet PCs to*

*run the course presentation and we were encouraged to facilitate student/teacher interaction via DyKnow.” One faculty member said, “Informal discussions with other faculty has been crucial.”*

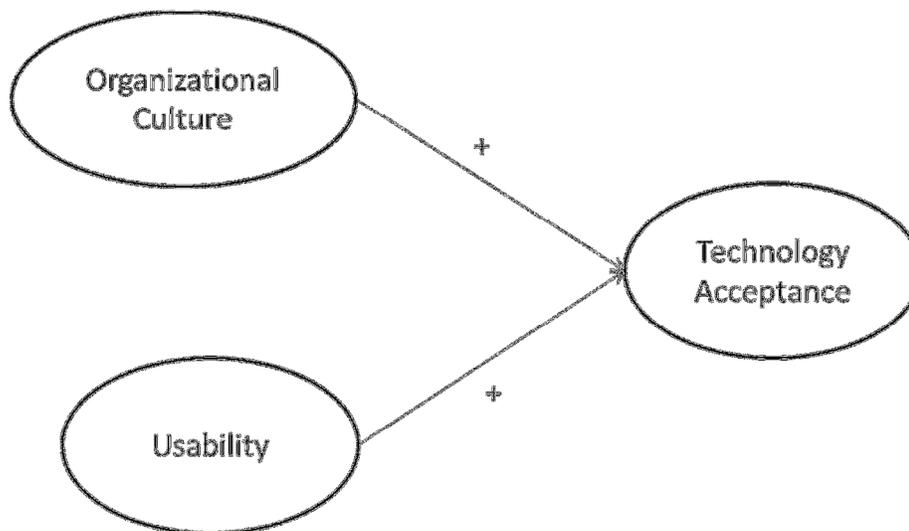
Finally, personal characteristics like interest in technology and instructional style also impacted the use of technology in the classroom. Those who were interested in staying current actively searched for new technologies while those who preferred traditional teaching styles preferred to stay away from it.

### **3.1.5. Data Analysis**

Questionnaire responses were scored and calculated according to the pre-set criteria for each instrument as specified in the original papers. Scores on the OCAI and SUS were used to quantify the organizational culture, and usability scores of the technologies by the faculty members from different departments of the College of Engineering at Virginia Tech. The UTAUT helped determine the acceptance of instructional technology by the faculty members.

An alpha level of 0.05 was used as a significance criterion for all statistical tests. Normality tests using the Shapiro-Wilk statistic suggested that all the measures, the Organizational culture measure, the Technology Acceptance measure and the Usability measure were non-normal ( $p < 0.05$ ), thus non-parametric equations were used in the statistical analyses. Discriminant validity was analyzed using confirmatory factor analysis and convergent validity was analyzed using correlation analysis between the items of the different instruments. Factor analysis is a statistical method used to identify expected variables that group together based on unexpected ones. It can measure theoretical variables by estimating it based on one or more tangible variables (Johnson, 1998). In particular, confirmatory factor analysis is used when the expected relationship is specified by the researcher. It is used to validate the theoretical model

based on how the data fits the model. Path Analysis is a method used to understand the relationship among a set of variables using a visual representation (Wright, 1921). For instance, as shown in figure 14, the path from 'Organizational Culture' to 'Technology Acceptance' suggests a direct relationship between the two. Structural Equation Modeling, which is a combination on factor analysis and path analysis, was used to analyze the data in this study.



*Figure 13.* An example of the hypothesized path model for Technology Acceptance

Cronbach's alpha was used to test the data for internal reliability. Cronbach's alpha is an assessment of internal uniformity. It is the amount by which dimensions on a scale are correlated (Cronbach, 1951). Values of 0.8 or higher are considered to have high reliability. Correlational analysis was also performed to determine which attributes formed the strongest relationship with technology acceptance.

Open ended responses were analyzed using content analysis, and specifically, thematic coding (Patton, 1980). Frequency counts of the codes were used to enumerate the responses.

### **3.1.6. Results**

#### **3.1.6.1. Hypothesis Testing**

##### **3.1.6.1.1. Research Question 1**

RQ1: What are the factors that facilitate technology acceptance in an organization?

*H1: Technology acceptance in an organization will be dependent on organizational culture, usability, job related factors and personal factors*

This research question was answered using results of study 1 and study 2. Study 1 focused on the organizational culture, usability, and technology acceptance constructs from a quantitative perspective whereas study 2 focus included job related factors and personal factors from a qualitative perspective. The paragraphs to follow will explain the results from study 1 and the reader is Chapter 3.2 to get results from study 2.

Structural equation modeling (SEM) was used to examine the relationship between organizational culture, usability, and technology acceptance. SEM is a type of method that allows estimation of both the strength and direction of relationships between variables in a hypothesized model. Here, the model to be estimated needs to be specified beforehand, and it itself acts as a confirmatory method. A conceptual SEM was developed relating organizational culture, usability, and technology acceptance. The magnitude and direction of relationships between the three variables in the model were then estimated using SEM methodologies. As explained in Chapter 1, the aim of this research was to understand the relationship between organizational culture, usability, and technology acceptance. AMOS 3.7 with maximum likelihood estimation was used to develop the structural equation model and the reader is referred to books by Byrne (2010) to get a detailed insight into developing SEMs with AMOS. Maximum

likelihood estimation has been found to be a fairly robust technique for non-normal variables (Muthen & Kaplan, 1985; Curran, West & Finch, 1996; Schumaker & Lomax, 2004, Kwon, 2010), provided that the skewness and kurtosis of the variables are smaller than 2.0 and 7.0 respectively (Curran et al., 1996). Table 13 shows the skewness and kurtosis values of all the variables that was included in this model.

Table 13

*Skewness and Kurtosis of all measures of SEM*

Measure	Skew	Kurt
Clan	1.559	5.07
Adhocracy	0.102	0.412
Market	0.827	1.757
Hierarchy	1.625	3.154
Performance Expectancy	-0.275	-0.90
Effort Expectancy	-0.839	0.315
Attitude	-0.124	-0.826
Social Influence	-0.299	0.172
Self-Efficacy	-0.005	-0.332
Anxiety	1.084	0.302
Behavioral Intention	-1.512	2.873
Use system frequently	-1.26	1.01
Found system complex	-0.84	0.29
System easy to use	-0.78	-0.74
Need technical support	-0.89	0.10
Functions were well integrated	-0.39	-0.48
Inconsistency	-0.44	-0.47
Learn system quickly	-0.36	-0.28

System cumbersome to use	-0.98	0.24
Confident using system	-0.97	0.78
Need to learn lot before using system	-0.94	0.27

Structural equation models consist of two models, a measurement model and then a structural one. Measurement models describe the relationships between observed (indicator) and unobserved (latent) variables. In simple words, it provides the connection between scores on an instrument and the underlying constructs that they are designed to measure and explain (Byrne, 2010). Latent variables are typically depicted using ellipses and indicator variables are depicted using squares or rectangles. Single headed arrows are used to depict the impact of one variable on another and double headed arrows are used to depict covariances or correlations between two variables. In the current model, the observed (manifest) variables are those measured using the OCAI, SUS, and UTAUT instruments. Since latent variables are not directly measured, they do not come with a measurement scale. However, the measurement model can also be used to establish a scale for latent variables within the model. The factor loading between one observed variable and each latent variable was fixed to one to assign the measurement scale of that particular observed variable to the latent variable. The observed variables used to assign the scales were based on reliability measures of Cronbach's Alpha. The observed variable with the highest reliability index was used to establish the scale for each latent variable.

On the other hand, the *structural* model, defines relations among the unobserved (or latent) variables in the model. In the current model, organizational culture, and usability were depicted as exogenous latent variables, meaning that they were not dependent on any other latent

variables in the model and technology acceptance was depicted as an endogenous latent variable and was hypothesized to be dependent or directly affected by at least of the other latent variables, usability, and organizational culture. Data that was utilized in the modeling efforts were obtained using the online survey which comprised of three pre-validated questionnaires used to measure organizational culture, usability, and technology acceptance respectively. All the items were adapted from existing literature to preserve content validity (Straub, Bourdreau, & Gefen, 2004). These three instruments are described in brief here, but the reader is referred to Chapter 3.1 for a detailed review.

The Organizational Culture Assessment Index (OCAI) was used to measure perceived organizational culture. The measures for this study displayed good reliability (Cronbach's alphas = 0.84 to 0.92). The System Usability Scale (SUS) was used to measure perceived usability of the instructional technology. The measures for this study displayed good reliability (Cronbach's alpha = 0.91). The Unified Theory of Acceptance and Use of Technology (UTAUT) was used to measure overall instructional technology acceptance. The measures for this study displayed good reliability (Cronbach's alphas = 0.75 to 0.97) with the exception of facilitating conditions (FC) which (Cronbach's alpha = 0.31) was dropped from this analysis.

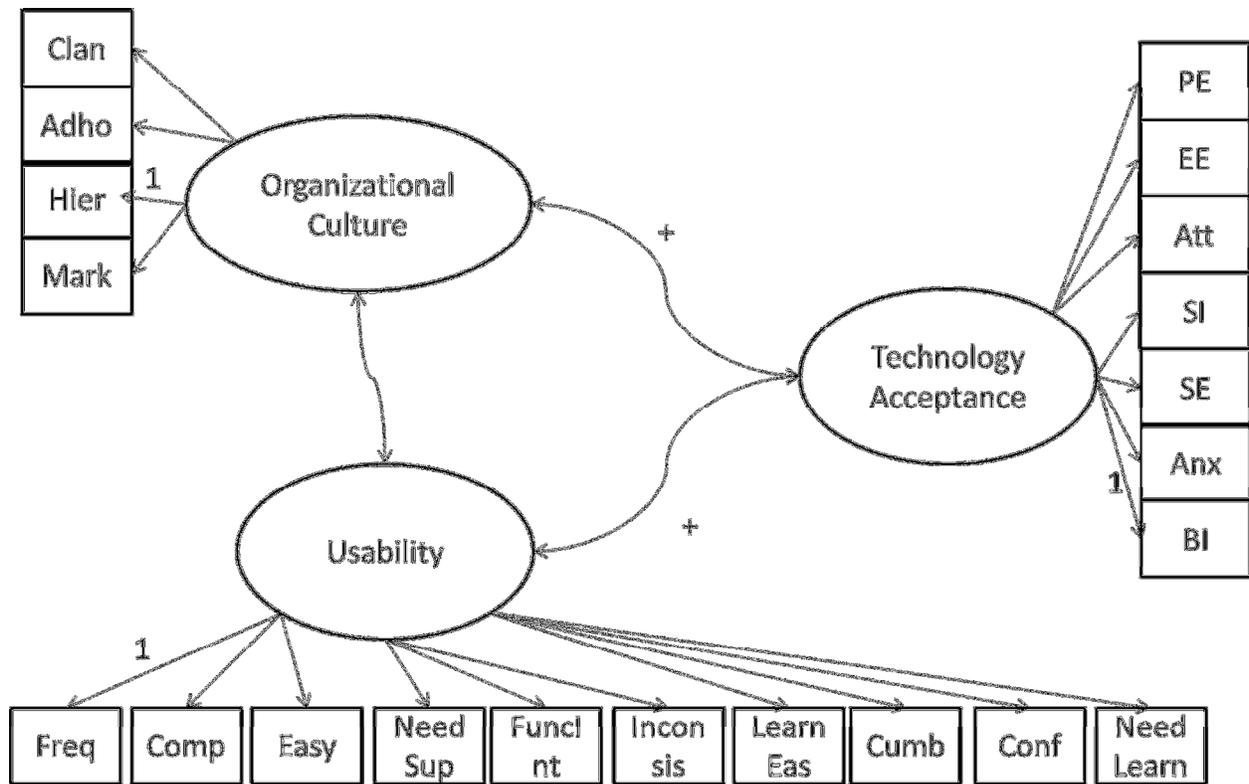


Figure 14. Conceptual model with hypothesized direction of path coefficients between organizational culture, usability and technology acceptance.

#### Measurement Model 1

The conceptual model, shown in Figure 15, that was initially developed relating organizational culture, usability and technology acceptance was used as the first measurement model. Since the organizational culture construct was measured using an ipsative scale, one of the scales was dropped to overcome multicollinearity. Dropping one of the scales has been found to have no effect on results (Anderson, Ball, Murphy & Associates, 1975). The measure with the lowest reliability was dropped from the organizational culture variable. Thus, the observed variables for the Organizational Culture variable were Clan, Adhocracy and Hierarchy.

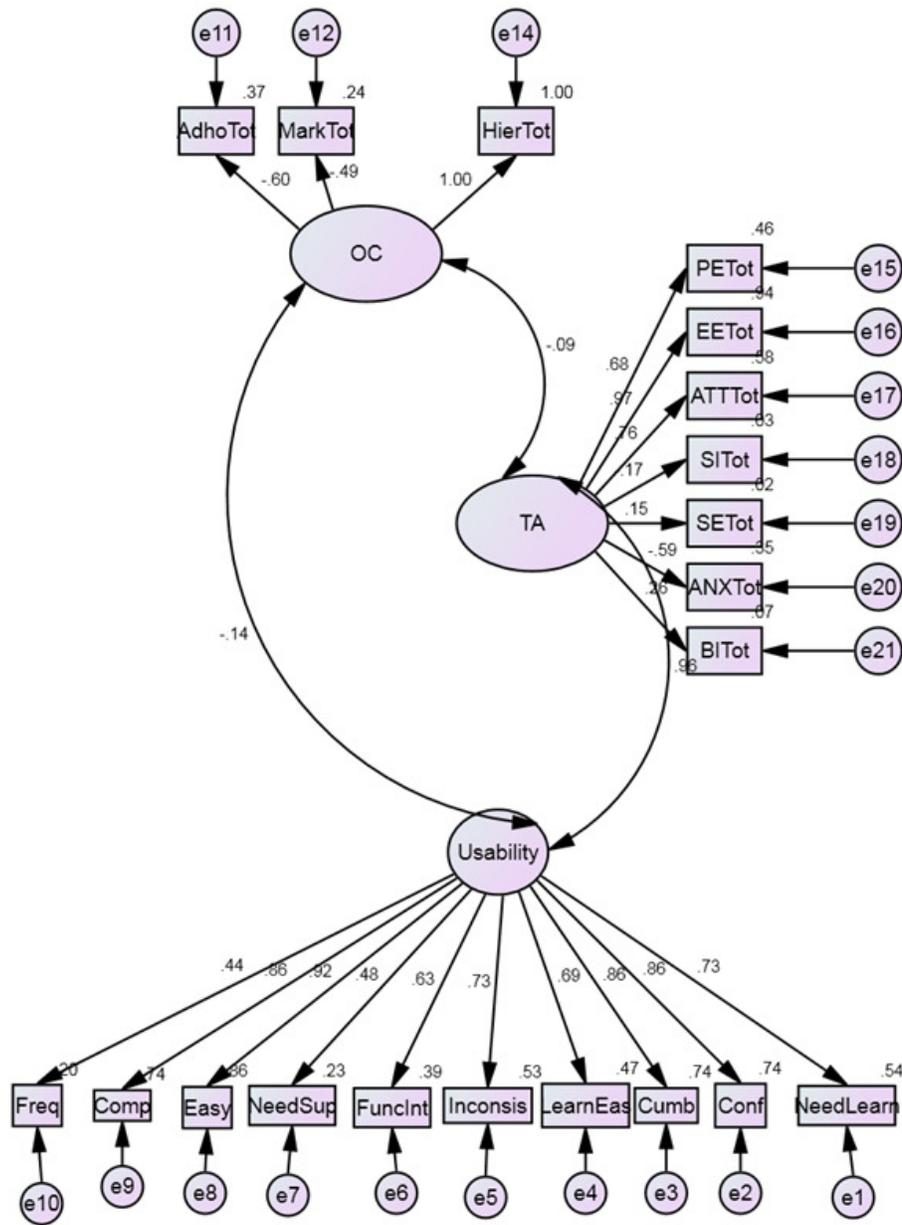


Figure 15: Initial Measurement model

The initial measurement model is shown in Figure 16. Correlations and covariances between direct measures within the measurement model are shown in table 15. In the measurement model, all loadings between observed and latent variables were significant expect for SE and SI on the latent variable measuring Technology Acceptance (TA).  $R^2$  values for the

observed values ranged from 0.02 for SE to 0.94 for EE. Overall, the measurement model showed adequate fit to the data [ $\chi^2$  (168, N =76) = 347.52,  $p < 0.001$ ]. The sample size was considered adequate for the Chi-Square test, based on Hoelter's critical number of 44 ( $p < 0.05$ ). However, the goodness of fit indices showed less than acceptable fit, as shown in Table 14, with only PGFI meeting the criteria.

Table 14

*Goodness of Fit indices of initial measurement model.*

	Criteria	Measurement Model
Chi-square statistic/df	$\leq 3.00$	2.06
GFI	$\geq 0.90$	0.677
AGFI	$\geq 0.90$	0.596
PGFI	$\geq 0.50$	0.542
RMSEA	$\leq 0.08$	0.11
CFI	$\geq 0.90$	0.81
NFI	$\geq 0.90$	0.69
IFI	$\geq 0.90$	0.815

Table 15

*Squared multiple correlations ( $R^2$ ) for observed variables and path coefficients\*\* between observed and latent variables in measurement model*

Variable	$R^2$	OC	Usability	TA
Clan	0.105	-0.24/-0.32* (0.12) -2.025		
Adho	0.412	-0.37/-0.64* (0.146) -2.538		
Hier	0.886	1.00/0.94***		
SUS-Freq	0.197		0.60/0.44* (0.156) 3.820	
SUS-Comp	0.736		1.07/0.86* (0.139) 7.669	
SUS-Easy	0.855		1.13/0.92* (0.136) 8.332	
SUS-Need Sup	0.235		0.63/0.48* (0.151) 4.185	
SUS-FuncInt	0.394		0.85/0.63* (0.155) 5.476	
SUS-Inconsis	0.53		0.93/0.73* (0.145) 6.409	
SUS-LearnEas	0.47		0.73/0.69* (0.136) 8.332	

SUS-Cumb	0.74	1.24/0.86* (0.161) 7.703
SUS-Conf	0.73	0.92/0.86* (0.12) 7.765
SUS-Need Learn	0.54	1.00/0.73***
PE	0.46	3.27/0.68* (1.45) 2.235
EE	0.94	4.90/0.97* (2.107) 2.326
ATT	0.58	4.15/0.76* (1.826) 2.273
SI	0.027	0.71/0.17 (0.588) -1.216
SE	0.022	0.70/0.15 (0.627) 1.114
ANX	0.345	-2.96/-0.59* (1.357) -2.183
BI	0.070	1.00/0.26***

\*\*Path Coefficients presented as: Unstandardized estimate/ Standardized estimate

(Standardized Error)

Critical Ratio <sup>\*</sup>(indicating significance at  $p < 0.05$ )

\*\*\* Unstandardized path coefficients for these observed variables were set to 1 to establish a scale for latent variable. There are no critical ratios for these paths as they were pre-set within the model

## Revised Model

Non-significant items were excluded from the revised measurement model ( $p < 0.05$ ) because only significant parameters in the confirmatory analysis model must be included in the final SEM. Non-significant parameters can be considered inconsequential to the model in the interest of parsimony (Byrne, 2010). Another important thing for consideration while revising measurement models is that of model misspecification which can lead to poor model fit. Reviewing the standardized residuals and modification indices can alert researchers of such situations (Byrne, 2010). High modification indices suggest that factor cross-loadings and error covariances exist, but before any changes are to be made, they must make theoretical sense. Re-specifying the measurement model requires addition of freely estimated parameters to the model and must be done one at a time with careful consideration, as it relates to theory and potential application of the results. Suggested error covariances were added for high modification indices, one step at a time.

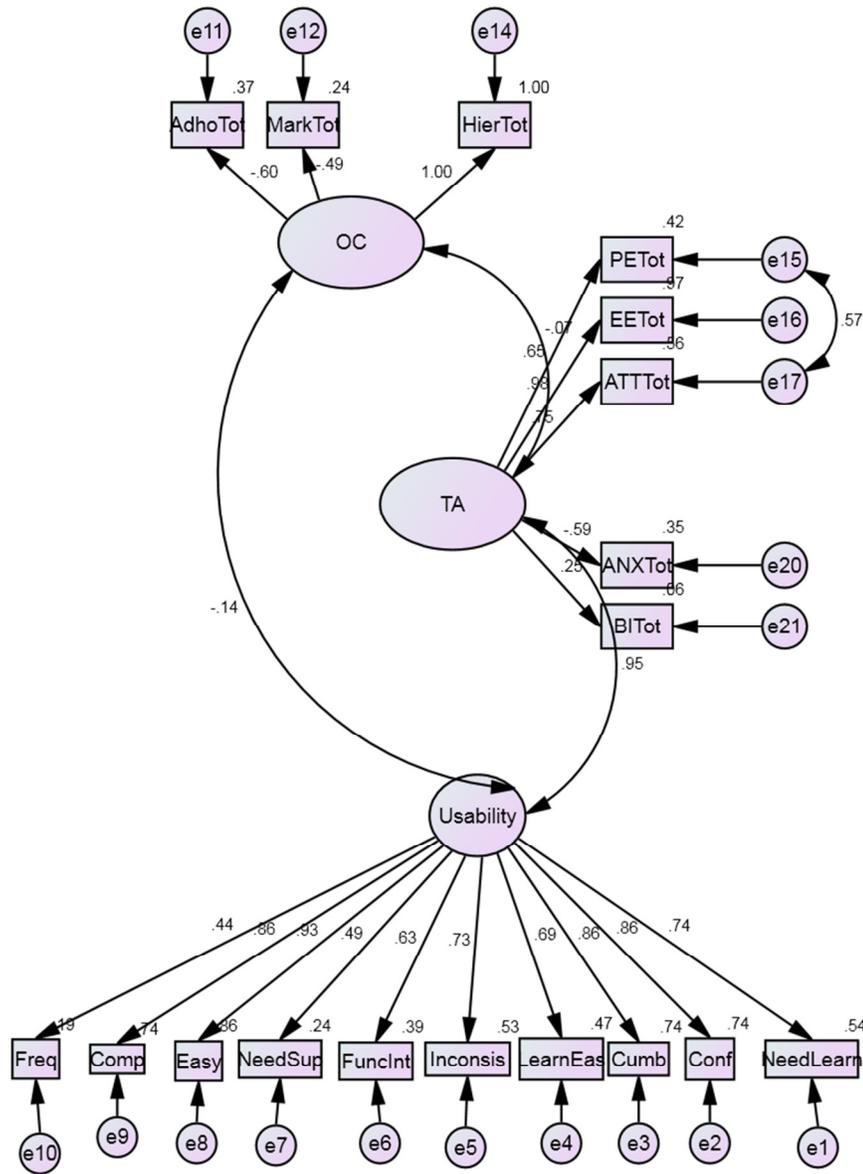


Figure 16. Revised measurement model

Overall, the revised measurement model (shown in Figure 17) showed adequate fit to the data [ $\chi^2$  (132, N =76) = 259.35,  $p < 0.001$ ]. The sample size was considered adequate for the Chi-Square test, based on Hoelter's critical number of 47 ( $p < 0.05$ ). Goodness-of-fit statistics revealed an improvement in model fit between the original measurement model and the revised model with PGFI meeting the criteria, and CFI and IFI almost meeting the specified criteria (table 15).

Table 16

*Goodness of Fit indices for the revised measurement model*

	Criteria	Measurement Model	Revised Model
Chi-square statistic/df	$\leq 3.00$	2.06	1.96
GFI	$\geq 0.90$	0.677	0.75
AGFI	$\geq 0.90$	0.596	0.68
PGFI	$\geq 0.50$	0.542	0.572
RMSEA	$\leq 0.08$	0.11	0.11
CFI	$\geq 0.90$	0.81	0.86
NFI	$\geq 0.90$	0.69	0.76
IFI	$\geq 0.90$	0.815	0.86

## Revised Model 3: Final Measurement Model

The observed ATT variable had both high error variances and high cross loadings with the Usability latent variable indicating that it was problematic for this data. Thus, it was removed from this model. Once the model was respecified with suggested error covariances (shown in Figure 18), the measurement model showed better fit to the data [ $\chi^2$  (116, N =76) = 198.45,  $p < 0.001$ ]. The sample size was considered adequate for the Chi-Square test, based on Hoelter's critical number of 54 ( $p < 0.05$ ). Goodness-of-fit statistics revealed a major improvement in model fit between the original measurement model and the revised model with PGFI, IFI, and CFI meeting the criteria (table 17). Since the modification indices do not show any room for

improvement, this model was deemed adequate to proceed to the evaluation of the structural model.

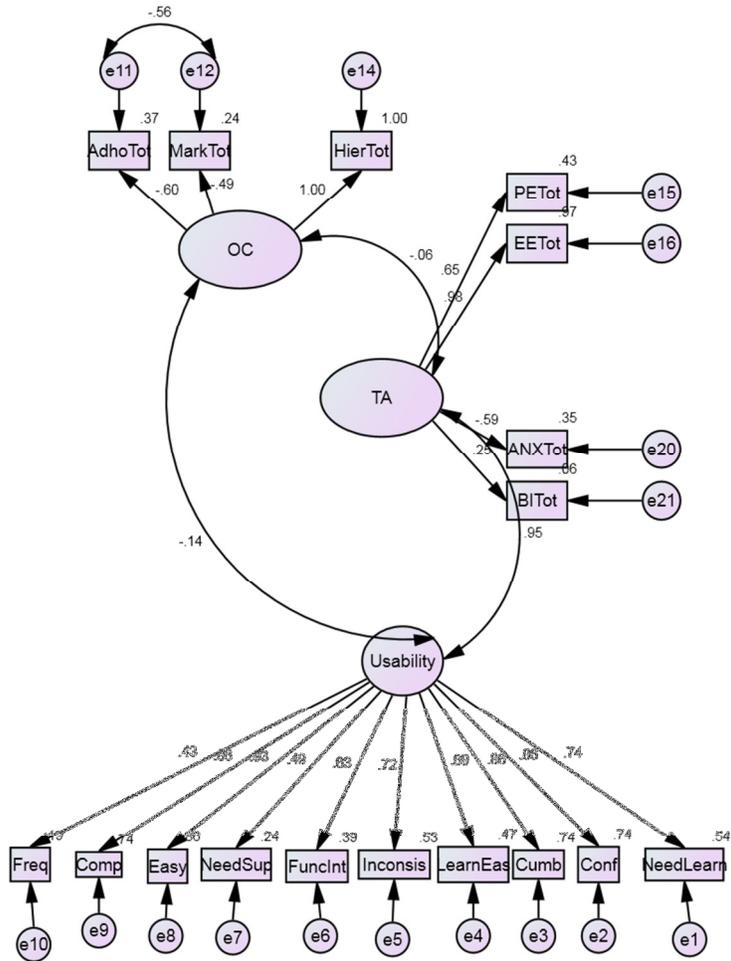


Figure 17. Revised measurement model that was deemed adequate for the structural model

Table 17

*Goodness of Fit indices for revised measurement model*

	Criteria	Measurement Model	Revised Model	Revised Model 3
Chi-square statistic/df	$\leq 3.00$	2.06	1.96	1.71
GFI	$\geq 0.90$	0.677	0.75	0.77
AGFI	$\geq 0.90$	0.596	0.68	0.70
PGFI	$\geq 0.50$	0.542	0.572	0.586
RMSEA	$\leq 0.08$	0.11	0.11	0.097
CFI	$\geq 0.90$	0.81	0.86	0.90
NFI	$\geq 0.90$	0.69	0.76	0.79
IFI	$\geq 0.90$	0.815	0.86	0.90

Structural Model

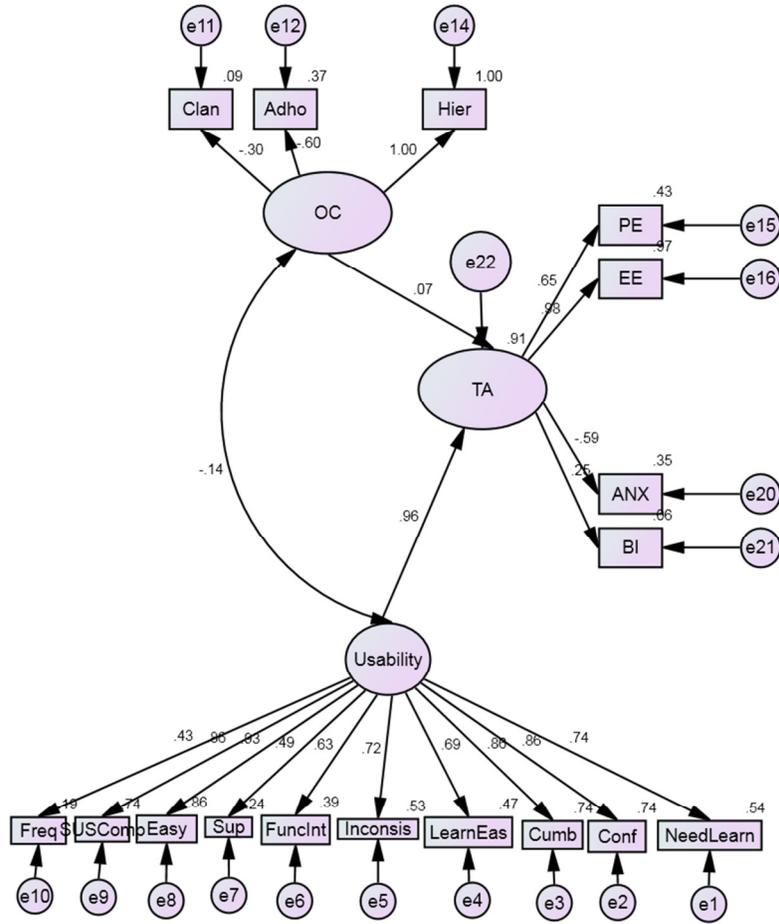


Figure 18. Final Structural Model

Overall, the structural model (shown in Figure 19) showed acceptable fit to the data ( $\chi^2 = 198.45$ ,  $df = 116$ ,  $p < 0.05$ ) (table 18). The structural path coefficient between Usability and Technology Acceptance was significant, but the path coefficient between Organizational culture and Technology acceptance was not ( $p < 0.05$ ). All the paths had the same sign as in the hypothesized model, indicating that organizational culture and usability had a positive influence on technology acceptance, although the coefficient between organizational culture and technology acceptance was not significant.

Table 18

*Goodness of Fit Indices for Structural Model*

	Criteria	Measurement Model	Revised Model	Revised Model 3	Structural Model
Chi-square statistic/df	$\leq 3.00$	2.06	1.96	1.71	1.71
GFI	$\geq 0.90$	0.677	0.75	0.77	0.773
AGFI	$\geq 0.90$	0.596	0.68	0.70	0.70
PGFI	$\geq 0.50$	0.542	0.572	0.586	0.586
RMSEA	$\leq 0.08$	0.11	0.11	0.097	0.097
CFI	$\geq 0.90$	0.81	0.86	0.90	0.90
NFI	$\geq 0.90$	0.69	0.76	0.79	0.783
IFI	$\geq 0.90$	0.815	0.86	0.90	0.90

91% of the variance ( $R^2$ ) in Technology Acceptance was explained by the independent latent variables, Organizational Culture and Usability. Usability had a direct positive effect on Technology Acceptance (0.96) and Organizational Culture had a direct positive effect on Technology Acceptance (0.07) although it was not significant. Standardized path coefficients for the final model shows that Usability had a larger direct effect (0.96) on Technology Acceptance than Organizational Culture (0.073) although the latter was not significant. Thus, this hypothesis was partially confirmed (table 19).

Table 19

*Standardized path coefficients for Structural Model*

	Technology Acceptance		
	Direct Effect	Indirect Effect	Total Effect
Organizational Culture	0.073	-	0.073
Usability	0.964	-	0.964

**3.1.6.1.1.1. Discussion**

The purpose of this method was to estimate a structural equation model to understand the relationships between organizational culture, usability, and instructional technology acceptance. Survey data from 76 faculty members and graduate teaching assistants was used to develop and refine this model. The initial hypothesized model was estimated and found to have adequate fit. The hypothesis that technology acceptance in an organization would be dependent on usability and organizational culture was partially confirmed because usability was found to have a direct effect on technology acceptance. The relationship between usability and instructional technology acceptance was found to be positive and statistically significant indicating that as usability increased, instructional technology acceptance increased as well. This finding is especially important for this study because 46 % of respondents indicated that they considered themselves as *early adopters* and 30% considered themselves to be *early majority*. Both these populations tend to approach new innovations with caution indicating that they are unlikely to use it if the

technology doesn't meet their expectations or if it is challenging to use. This finding also indicates that prior usability testing can be used to predict if a technology will be accepted or not. This is very important for any organization because unanticipated lack of adoption of technology can lead to unnecessary costs (Christensen, 1997). Currently, the College of Engineering at Virginia Tech appoints faculty members and undergraduate students to serve on different committees that evaluate technology, prior to purchase and decisions. However, research has shown that there are many problems with group-based decision making and problem solving (Van de Ven & Delbeco, 1971). Some of these include the effects of dominant personalities within the group, preference of quick decisions, and pressure to conform to the group (Dalkey & Hilmer, 1963; Hoffman, 1965). These evaluations are mainly subjective and informal, depending on their perception and preference for the technology in question. The results of this study suggest that formal usability testing using validated metrics must be employed. Formal testing will remove subjective biases and reduce the effect that domineering personalities and outspoken personalities can have on the overall decision of the committee.

This study did not find the relationship between organizational culture and technology acceptance to be significant, although it did find a positive relationship between the two. The organizational culture variable was measured using an ipsative scale. Ipsative scales have been designed to remove biases like the central tendency bias, and the acquiescence bias, which is extremely important to get reliable data (Brown, 2010). Forced-choice scales have also been popular because they are less vulnerable to distortion (Christiansen, Burns, & Montgomery, 2005; Vasilopoulos, Cucina, Dyomina, Morewitz & Reilly, 2006). However, ipsative scales can be problematic because their design forces multicollinearity, meaning that as one choice increases in value, the other one is forced to decrease. Due to this, researchers caution using multivariate

analysis methods with ipsative data, but the increasing popularity of ipsative scales have also brought on a surge of research to overcome problems with ipsative scales (McLean & Chissom, 1986; Brown, 2010). Suggestions have included using item response theory (IRT) (Brown, 2010), adding a normative scale, and deleting one of the scales to remove the interrelatedness (McLean & Chissom, 1986). It was decided to drop an ipsative scale for each of the models of this study since it was a relatively straightforward method and because dropping an ipsative scale does not affect the results (Anderson, Ball, Murphy & Associates, 1975). The results of numerous other studies (Tuan & Venkatesh, 2010; Tushman & O'Reilly, 1997; Twati, 2006) suggest that organizational culture can affect technology acceptance. In addition, the results of this study indicate that organizational culture can influence technology acceptance (Hypotheses 2, see tables 19 and 20) as well. Hence, it is likely that the design of the scale contributed to the lack of significance. This situation is also indicative of a problem with interdisciplinary research which often makes use of different types of measurement scales. There is a definite need for more research to bridge the gap between disciplines from a quantitative perspective.

#### **3.1.6.1.2. Research Question 2**

RQ2: How does organizational culture relate to technology acceptance?

*H2: Organizational culture will influence technology acceptance*

To examine Hypothesis 2, a Spearman's Rho correlation was conducted to assess the relationship between organizational culture and technology acceptance. The Behavioral Intention construct (BI) was used to measure technology acceptance. Since there were four measures of organizational culture, clan, adhocracy, market and hierarchy culture, each measure was used separately with the technology acceptance construct.

Clan Culture: Correlational analysis revealed a positive relationship between the clan culture measure and technology acceptance but this relationship was not significant ( $r_s[74] = 0.005, p > 0.05$ ).

Adhocracy Culture: The results of the correlational analysis between the adhocracy culture measure and technology acceptance was significant, ( $r_s [74] = 0.261, p < 0.05$ ), suggesting that as adhocracy culture scores increased, technology acceptance increased as well (Table 20).

Table 20

*Spearman's Rho Correlations between BI and Adhocracy*

		BI
Adhocracy	Spearman's Rho	0.261*
	Sig (2-tailed)	0.023

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

Market Culture: Correlational analysis revealed a positive relationship between the market culture measure and technology acceptance, but this relationship was not significant ( $r_s[74] = 0.183, p < 0.05$ ).

Hierarchy Culture: The results of the correlational analysis between the hierarchy culture measure and technology acceptance was significant, ( $r_s [74] = -0.271, p < 0.05$ ), suggesting that as hierarchy culture scores increased, technology acceptance decreased (table 21).

Table 21

*Spearman Rho's Correlations between BI and Hierarchy*

		BI
Hierarchy	Spearman's Rho	-0.271*
	Sig (2-tailed)	0.018

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

Based on the results of the correlational analysis, simple linear regression was conducted to further assess the relationships between organizational culture, using our measures of adhocracy culture, and hierarchy culture as our independent variables and Behavioral intention to adopt, as our dependent variable. Simple linear regression was chosen to overcome multicollinearity that is often associated with ipsative scales like the OCAI tool used to measure organizational culture. It was also of interest to this study to understand the individual relationship between the culture variables and technology acceptance. Results of the linear regression showed that adhocracy culture significantly predicted technology acceptance indicating that as adhocracy culture *increased*, technology acceptance *increased*. Results also show that hierarchy culture significantly predicted technology acceptance indicating that as hierarchy culture *increased*, technology acceptance *decreased*. Both accounted for approximately 7% of the variance. Thus, the hypothesis that organizational culture will influence technology acceptance was confirmed. Details of the regression model are shown in table 22.

Table 22

*Results of regression model analyzing relationship between Technology Acceptance and Organizational Culture*

Variable	Technology Acceptance (BI)				
	B	S.E.	$\beta$	R <sup>2</sup>	F
Adhocracy	0.10	0.004	0.261*	0.068	5.387
Hierarchy	-0.006	0.002	-2.71*	0.073	5.849

\* $p < 0.05$

### 3.1.6.1.2.1. Discussion

The purpose of this method was to understand the relationships between organizational culture, and instructional technology acceptance. Survey data from 76 faculty members and graduate teaching assistants was used to develop and refine this model. The results show that adhocracy culture and hierarchy culture can significantly predict technology acceptance and thus the hypothesis that organizational culture influences technology acceptance was verified. However both adhocracy culture and hierarchy culture only accounted for approximately 7% of the variance which indicates that technology acceptance depends on other variables as well.

The Organizational Culture Assessment Index (OCAI) is based on the Competing Values Framework which consists of two dimensions, a vertical axis and a horizontal one, resulting in a figure with four quadrants (as shown in figure 5). One dimension ranges from flexibility, discretion, and dynamism, to stability, order, and control. The other dimension ranges from a focus on internal preference with importance given to integration, collaboration, and unity, to an external preference, with importance given to differentiation, competition, and rivalry. Each

quadrant represents a type of culture; Clan, Hierarchy, Adhocracy, and Market (Cameron & Quinn, 2006). Clan and Market are on opposite ends of their respective dimensions whereas Adhocracy and Market are on opposite ends of their respective dimensions, indicating that as one culture increases, the other culture decreases. The results of this study allude to this fact indicating that as adhocracy culture *increased*, technology acceptance *increased* and as hierarchy culture *increased*, technology acceptance *decreased*.

As explained in Chapter 2, adhocracy culture is exhibited by an organization that is considered dynamic and entrepreneurial. They pride themselves to be on the leading edge. Leaders take on the role of innovators and emphasize risk-taking and experimentation. Success is measured by the use of new products or services. On the other hand, hierarchy culture is often exhibited by an organization with very formalized and stringent style of work and an emphasis on procedure. Leaders act as coordinators and organizers with efficiency as their main goal. Results of this study indicate that an organization with a strong hierarchical culture can hinder technology acceptance and that if an organization wants to foster an environment that facilitates technology acceptance and use, it should try and develop an adhocracy culture.

#### **3.1.6.1.3. Research Question 3**

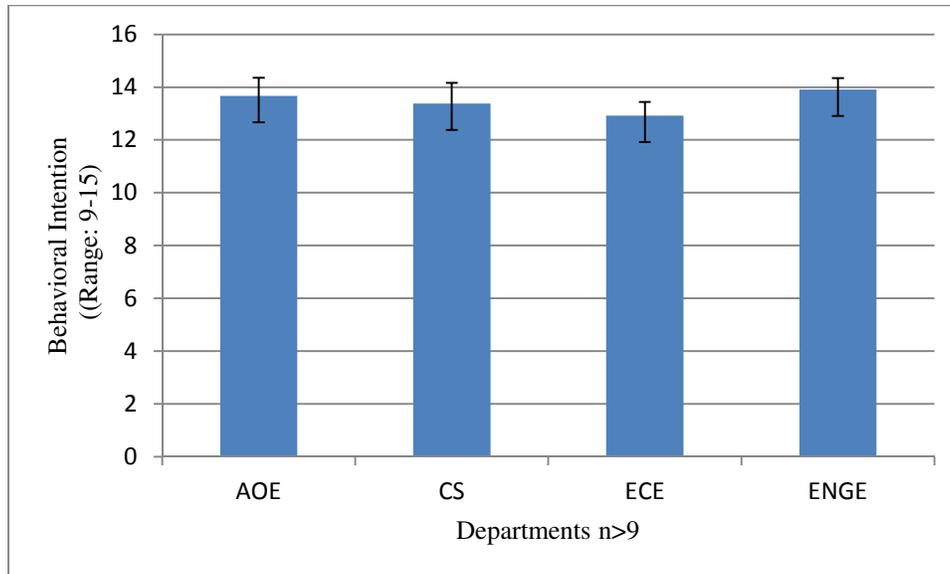
RQ 3: What are the differences and similarities across departments within an organization, regarding technology acceptance?

*H 3: Departments with adhocracy and clan cultures will be more likely to accept technology than those with hierarchical and market cultures*

The Mann-Whitney U test was used to evaluate differences across departments regarding technology acceptance. Departments with higher adhocracy and clan cultures were categorized as Group 1 and those with higher hierarchical and market cultures were categorized as Group 2. The Behavioral Intention to Use (BI) measure was used as the measure of instructional technology acceptance. All measurements were considered significant at  $p < 0.05$ .

Results of the Mann-Whitney U test indicate that behavioral intention to use technology in departments with clan and adhocracy culture did not differ significantly from those with market and hierarchy culture, [ $U = 400, p > 0.05$ ], with the sum of ranks being 814.50 for Group 1 (higher adhocracy and clan culture) and being 2111.50 for Group 2 (higher hierarchy and market culture). Thus the hypothesis that departments with adhocracy and clan cultures will be more likely to accept technology than those with hierarchical and market cultures was rejected.

Alternate analysis: An alternative analysis was conducted to understand the role that organizational culture played on individual departments adopting technology. Since not all departments had equal responses, with some as low as one respondent per department, it was decided to retain only the departments with  $n > 9$  to reduce the risk of a Type II error (McKillup, 2006). A Kruskal-Wallis test was used to measure the differences across these departments. Results of the test indicate that there were no significant differences across the departments regarding technology acceptance [ $\chi^2 (3, N = 45) = 2.59, p < 0.05$ ] (Figure 20).



*Figure 19.*Differences in Technology Acceptance across Departments (n>9)

### **3.1.6.1.3.1. Discussion**

The results of this study did not find any significant relationships between departments regarding technology acceptance, indicating that the departments had a unified view of the organizational culture of the college of engineering. The focus of this study was on the organizational culture of the overall college as a whole, and not individual departments. However, it would be interesting to conduct a follow-up study that focuses on individual departments of the college.

### **3.1.7. Discussion of Study 1**

This research effort was designed to explore the relationships between organizational culture, usability of technology, and overall acceptance of instructional technology. There has been plenty of research done in the domain of faculty adoption of technology leading to numerous suggestions to facilitate adoption. Most of this research is categorized into two broad categories; discovering barriers to adoption (Beggs, 2000; Hattangdi, Jha, Ghosh, 2010), and prediction of technology adoption (Carter, 1998; Sahin & Thompson, 2007; Surendra, 2001). However, higher educational universities are complex organizations and all elements within in must be provided consideration to facilitate of the technology adoption process. It has been suggested that the challenge in faculty adoption of instructional technology lies in redesigning the overall environment that needs to support adopters of technology (Jacobsen, 1998b). The findings of this research effort concur with this statement and add that the right organizational culture can not only facilitate instructional technology adoption, but can also overcome some of the barriers that are associated it. It also been suggested that technology adoption depends on the design and overall usability (Wilson, Sherry, Dobrovolny, Batty, & Ryder, 2000). The findings of this research effort concur with that statement, but add to it by asserting that faculty members will continue to use a technology perceived to have poor usability when faced with barriers, which in turn can affect the teaching and learning environment.

Research has shown that the majority of current students need to be taught with technology (Howe & Strauss, 2000), but it is also important to support faculty members who have to learn to teach new generations of students. Faculty members come into the organization with different mental models and values, often based off their own backgrounds and it is extremely important to align the goals of the institution with those of the faculty member. For

instance, Virginia Tech is a research I university, with an emphasis on research and grants, but the College of Engineering (COE) also places value on using new technology to teach students. In a complex domain such as this, faculty members may find it easier to focus on their research and use existing and/or outdated instructional tools unless it is easy for them to adapt to the different technologies. As discussed in Chapter 1, organizational culture is extremely important in an institution which is pressured to deal with various change agents. It is imperative to periodically check the alignment between perceived organizational culture of the members and the top administration of the institution.

Results of this study indicated that the current perceived organizational culture of the COE is the *Market* (focused on competition) and *Hierarchy* (focused on policies) cultures but the preferred organizational culture is the *Clan* (focused on collaboration) and *Adhocracy* (focused on innovation) cultures. However, it is also important to acknowledge that organizational culture varies from institution to institution. For traditional universities, high scores in the *Market* and *Hierarchy* quadrants could indicate a culture that is effective because they are stable and consistent. The College of Engineering at Virginia Tech differs from the rest by placing value on innovative technology. In relation to organizational culture, one might say that it would perceive itself to have an *adhocracy* culture, with a focus on innovation, which is very different from the perception of the faculty members who took part in this research effort. A possible silver lining is that the preferred culture (indicated by the dotted line in Figure 11) is the *adhocracy* culture which indicates that faculty members place value on innovation as well. In short, faculty members of the COE at Virginia Tech seemed to want a culture that focuses on teamwork, innovation, without the elements of policies and competition. The preferred culture profile is extremely important because the COE at Virginia Tech attempts to maintain an organizational

culture that facilitates technology adoption. It develops and maintains several strategic alliances, both internally and externally to the organization (Scales, Kothaneth, & Amelink, 2009) to support their technology initiatives. They also foster external alliances with the University Bookstore on campus allows for purchasing convenience and competitive pricing as well as internal alliances with the Communication Network Services (CNS) which allows them to maintain the wireless capability in the classrooms. They collaborate with the Faculty Development Institute (FDI) and conduct free training for faculty members and graduate students on using instructional technology. The COE also has an Instructional Technology team who provides in-class assistance and one-on-one training for faculty members who use interactive classroom software. However, for their efforts to be successful, it is important that the members make use of the various avenues.

Personality characteristics of faculty members are also important for consideration in this process, Faculty members have been found to be intellectual, profound and fiercely independent) and they enjoy being inspired in a free thinking environment (Baron & Wagele, 1994. It is thus quite understandable, that faculty members in the COE at Virginia Tech preferred their organizational culture to be more *clan-like* and *adhocracy-like* and less *hierarchical* and *market-like*. However, the COE, like many other colleges, has a very hierarchical structure with a ‘strong head’ culture. The strategic plan of the COE goes through fixed committees and departments in a strict hierarchical process. Faculty members are consulted during the developmental process, but they are often involved at a later stage. While the strongly-set hierarchical process can be considered one of the reasons behind the COE’s success, it is important to pay attention to the preferences of the members. At the same time, it is important to acknowledge that a hierarchical process can’t be simply done away upon the suggestion of its members. However, the *increase*

of member input, *early* on in the decision making process, can make the structure a little less hierarchical from the members' point of view. Another important point of consideration involves the types of faculty members who are typically involved in decision making. Those who are involved in the process are typically members of certain committees and groups who are often manned by senior faculty members because the junior level faculty members are in a race to achieve tenure, and simply do not have the time or resources. Interestingly enough, it is the junior level faculty members and some graduate teaching assistants who end up teaching students and using instructional technology on a regular basis. The tri-stage theory of faculty career (Baldwin, 1979) alludes to this situation as well. According to this theory, *novices* or those with twenty five years or more until retirement) gained satisfaction from interacting with students and administration; *midcareerists* or faculty who had between fifteen to twenty years to retirement gained satisfaction from compensation, and finally *disengagers* or those expecting retirement in five years or fewer gained satisfaction through good relationship with administration and proper compensation (Baldwin, 1979; Hagedorn, 1994). In order to provide efficient process that will promote innovative technology use in the classroom, it is important to involve the junior faculty early on in the decision process as well.

Developers of the OCAI tool (Cameron & Quinn, 2006) that was used in this study have their own recommendations to develop preferred organizational culture. According to them, an increase in the *clan culture* signifies that teamwork and trust should be promoted. Trust can be fostered by not only evaluating employee needs (Friel, 2006), but also taking necessary actions to address the needs (Fracaro, 2008). Currently, the Virginia Tech Center for Survey Research distributes a climate survey to all employees every two years. While it addresses important aspects like resources, diversity, POC, communications, co-workers, leadership, supervision, and

job satisfaction, there is no provision that focuses on technology assessment. This could be because Virginia Tech on the whole, is a research one university and is not necessarily interested in instructional technology. However, given the COE's push for innovative technology, it should make attempts to survey employee-needs that focus on instructional technology use. The next step should involve attempts to address needs, thereby increasing trust, and thereby fostering a clan culture.

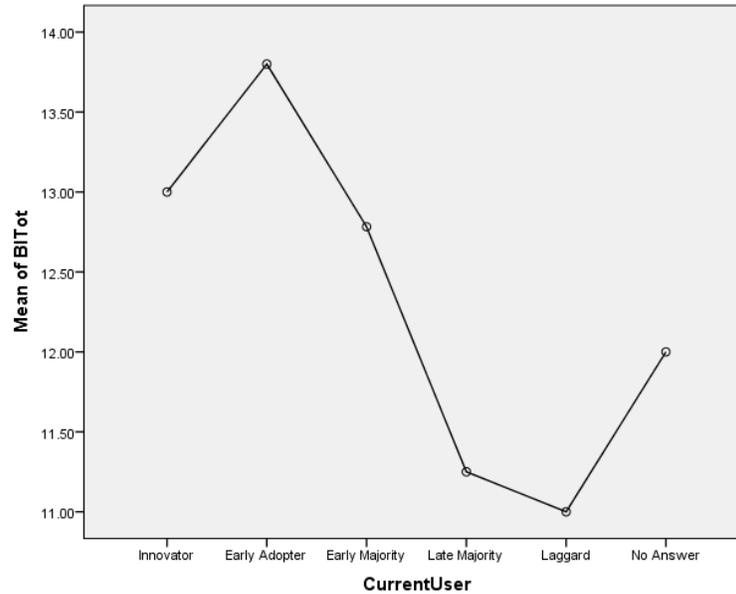
The preference for *the clan culture*, which focuses on collaboration, as well as the preference for the *adhocracy culture*, which is focused on innovation, indicates that there needs to be more encouragement and support in relation to instructional technology use. Lack of support and lack of recognition has been previously found to be a barrier to faculty adoption of technology as well (Chizmar & Williams, 2001). Developers of the OCAI also allude to this as well by indicating that adhocracy culture can be fostered by encouraging risk-taking, dynamism, recognizing creative solutions and clarifying the vision of the organization (Cameron & Quinn, 2006). Preference for these types of cultures also suggests a way to overcome some of the barriers that have been found to hinder faculty adoption of technology. Lack of interest, job relevance, and personal contribution (Beggs, 2000), lack of organizational support, lack of monetary support, lack of time (Chizmar & Williams, 2001), cost, legality, time, fear, usefulness, and complexity (Garrett et al, 2006) were found to be some of them. Factors influencing teachers' adoption of technology were found to include intrinsic motivators like flexible schedule, empowerment, access to technology, efficacy, content requirements and pedagogical values (Becker, 2000; Parker, 2003) and extrinsic motivators such as incentives (Parker 2003). The tenets of the clan culture include focus on collaboration and support and that of the adhocracy culture include focus on recognition for using innovative techniques. Thus, more

recognition and encouragement relating to instructional technology use could foster a clan and adhocracy culture as well overcome documented barriers to adoption. Another important point that the developers of the OCAI tool (Cameron & Quinn, 2006) recommend when there is a decrease in *hierarchy culture*, is to eliminate redundant paperwork and policies. As discussed, the lack of time has been found to be a common barrier that hinders faculty adoption of technology. Elimination of useless policies has a two-fold benefit in that it can save time as well.

Results of this study also suggested that usability was an extremely important factor in instructional technology adoption, adding to existing research (Wilson, Sherry, Dobrovolny, Batty, & Ryder, 2000). However, study 1 also found that 85% of those respondents who indicated that their current instructional technology had poor usability also said that they intended to use the technology in the next year. Perception of poor usability indicates inefficiency, poor effectiveness, and dissatisfaction (Abran et al. 2003), but the results suggest that this sample would continue to use technology that they are not necessarily satisfied with. This can have extremely negative implications in a classroom, because using instructional technology inefficiently can hinder the learning environment (Devlin, 1999). This finding implies that the process to use newer technology must be made simpler so that faculty members can use instructional technologies of their choice with satisfaction and ease.

An interesting finding of this study was that almost 50% of the participants in this study categorized themselves as *early adopters*, who define themselves to be “opinion leaders” who adopt technology with caution (Rogers, 1995). This is consistent with other research which has found that faculty members often used older and outdated equipment (Finley, 2003) when overcome with barriers to adoption (Garret et al., 2006). However, as shown in figure 22, this

group also displayed higher totals of behavioral intention to use technology than those who categorized themselves as *innovators*, *early majority*, *late majority*, and *laggards* (Rogers, 1995). This result could have two implications. First, this could suggest that majority of faculty value technology and envision themselves using it in the future. Alternatively, due to the numerous barriers that have been found to hinder technology adoption (Beggs, 2000; Chizmar & Williams, 2001), they will stick to using a technology they are familiar with, which implies that they would need more encouragement to use newer technology. The first implication could be a source of hope for the COE at Virginia Tech since it indicates that faculty members share their values on technology. The second implication, however, indicates that the COE must expand its efforts to motivate faculty members to use new technology. It will be challenging to verify one or the other without more research, but the safest route for the COE would be to assume that it would need to expand its efforts to attract more faculty members to the concept of trying and using new and innovative instructional technology.



*Figure 20.* Line graph depicting the relationship between adopter categories (Rogers, 1995) and Behavioral intention to use technology (BI)

Another additional finding from this study was the indication that promoting self-efficacy in faculty members could lead to technology acceptance (as shown in Table 6). Promoting self-efficacy has two-fold benefits for the COE because self-efficacy has also been found to influence performance (Bandura, 1982; Feltz, 1982) and faculty members who feel confident about their work tend to produce more outputs, which again increases their confidence (Taylor, Locke, Lee, & Gist, 1984).

### **3.1. 8. Outcomes of Study 1**

Results from this study were used to develop recommendations to facilitate instructional technology adoption in the educational environment. The 2012-2018 Strategic Plan for the College of Engineering (COE) at Virginia Tech has five themes to guide various strategies. Results from this study were drafted along the lines of the themes that were relevant to this study, to provide specific recommendations pertaining to this plan.

The COE Themes relevant to this study are as follows:

Theme 1: Provide a high quality environment for teaching, learning and research

Theme 5: Support a diverse community of faculty, staff, and students.

#### **3.1.8.1. Recommendations**

Developers of the Organizational Culture Assessment Instrument (OCAI) had generic recommendations to foster particular types of cultures based on respondents' preferences (Cameron & Quinn, 2006). These recommendations were used in conjunction with findings of Study 1 to develop 10 recommendations to foster a *clan* and *adhocracy* culture and this facilitate instructional technology. Providing regular surveys that focus on needs were suggested to develop a clan culture (Cameron & Quinn, 2006), but with regards to instructional technology, it was important to determine needs related to instructional technology use. It was important to increase trust, which in turn, would foster a clan culture. Trust can be fostered by not only evaluating employee needs (Friel, 2006), but also taking necessary actions to address the needs (Fracaro, 2008). Adhocracy fostered could be fostered by recognizing members who use technology (Cameron & Quinn, 2006). With regards to instructional technology, it was important to recognize those faculty members who use innovative instructional technologies thereby

showing that the institution placed value on innovation as well. A list of the recommendations are shown in table 23.

Table 23

*Recommendations to foster a clan and adhocracy culture and thus facilitate instructional technology acceptance*

Direct Action	COE Theme
Provide yearly faculty surveys that focus on their needs and requirements related to instructional technology use	1, 5
Based on above, make immediate attempts to discuss and rectify issues to increase trust	1,5
Recognize faculty members who provide informal assistance to peers through awards or monetary incentives to demonstrate value on innovation	1,5
Recognize faculty members who try new methods and techniques to demonstrate value on innovation	1,5
Encourage open communication and ‘open –door’ policies to foster a clan-like culture	5
Encourage trying new technologies and techniques to demonstrate value on innovation	1,5
Review policies regarding instructional technology use with faculty members and eliminate redundant ones based on suggestions	5
Allow faculty members of varying levels of experience to make more administrative decisions regarding instructional technology, to reduce hierarchy-	5

like culture	
Allow direct faculty input early in the strategic planning process.	5
Provide regular reminders of strategic plan and goals to keep members aligned with organization's goals	1,5

## **3.2. Study 2: Qualitative Focus Group interview of sample**

### **3.2.1. Research Design**

The purpose of this study was to gain a comprehensive understanding of instructional technology acceptance through a focus group interview of the sample. This study provided more insight into the relationship between organizational culture, usability, job- related factors and personal factors and instructional technology acceptance and was designed to answer the following research questions:

RQ 1: What are the factors that facilitate technology acceptance in an organization?

RQ 2: How does organizational culture relate to technology acceptance?

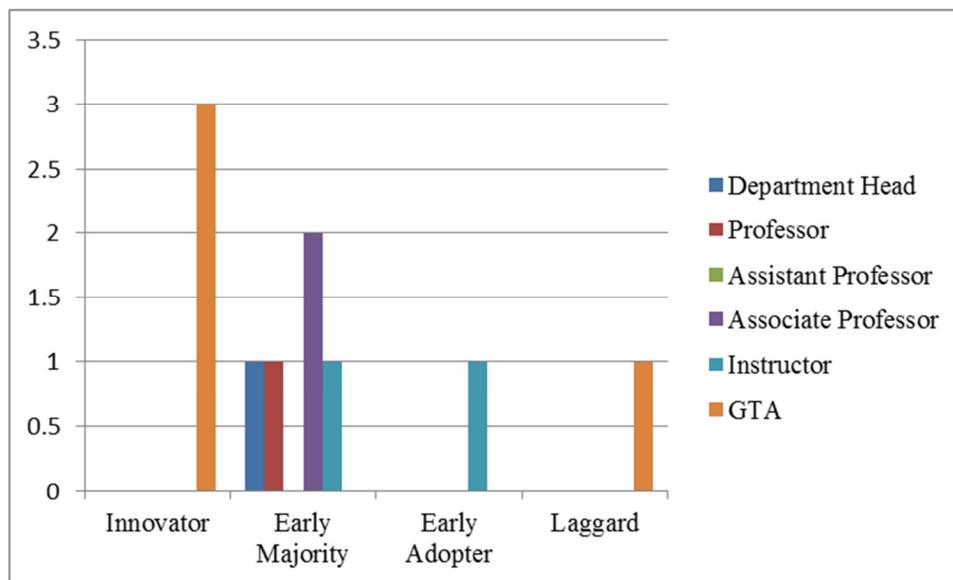
RQ 4: What is the relationship between organization culture, usability, and technology acceptance?

### **3.2.2. Participants**

As per recommendations for conducting focus groups (Stewart, Shamdasani, & Rook, 2007), a total of eleven participants were recruited using maximum variation sampling (Patton, 2002). This technique is a type of purposeful sampling that is used to discover common themes in heterogeneous groups. It is especially useful in qualitative inquiry because it provides a rich insight into each case as well as across cases, by discovering common themes. To effectively maximize variation in a small sample, participants must match certain criteria set by the researchers (Patton, 2002). In this particular study, the criteria were:

- Participant should have taken part in Study 1
- Participants should have agreed to take part in Study 2

- Participant should have been currently teaching or should have taught one or more courses in the College of Engineering
- Participants should have indicated they were an innovator, or early adopter, or early majority, or late majority, or laggard in Question 2 of study 1.
- Participants should have indicated their current job title at Virginia Tech in Question 3 of study 1



*Figure 21.* Bar graph showing sample variation in terms of job title and adopter category

Following suggestions from Patton (2002), sample variation was maximized to include participants that were as different as possible from each other using dimensions based on the criteria above. Figure 22 shows the sample variation in terms of job title and adopter category. Incentive to take part in this study included a raffle to a prize from the University bookstore.

### **3.2.3. Procedure**

While it was originally proposed to conduct one focus group interview, due to scheduling conflicts two focus group interviews were conducted with participants who fulfilled the above

criteria. Focus group interviews facilitate group discussions to generate themes or review results (Kitzinger, 1995). It is recommended to hold a focus group of six to twelve people who discuss issues under the guidance of a facilitator (Stewart, Shamdasani, & Rook, 2007). However, groups of four to six people, also known as *minigroups*, are often preferred over larger groups to get richer information from each participant (Greenbaum, 1988). Smaller focus group interviews are also popular due to feasibility and relative ease of moderation (Morgan, 1992). Each focus group took an hour to complete and was recorded using audio recorders. The research purpose of the study was explained to all the participants, after which each participant was asked to complete an informed consent procedure as approved by the Institutional Review Board at Virginia Tech. The interview protocol consisted of 10 questions [Appendix G] designed to obtain information about the role of organizational culture, usability and instructional technology acceptance. Aside from the pre-set questions, additional questions based on unanticipated information given by the participants were asked. Interviews were transcribed verbatim by using Inqscribe, which is a type of software dedicated to transcribing audio and video content.

#### **3.2.4. Analysis**

Content analysis and specifically, *thematic coding* was applied to the transcription to identify additional common themes and factors. Single classification codes (Insch, Moore, and Murphy, 1997) were used to categorize the information. Because of familiarity in the domain and experience in qualitative research, these methods were carried out by the researcher. These methods helped provide an overview of the relationship between organizational culture, usability and technology acceptance. First a coding scheme, using *a priori* coding (Miles & Huberman,

1984) was developed based on different constructs of the conceptual framework. Five overall themes were used to guide the content analysis.

The first theme was *organizational culture*, which described the internal processes within the COE, as perceived by the participants in Study 2. This theme was sub-classified into corporation (a tenet of the clan culture), value on innovation (a tenet of the adhocracy culture), policies and procedures (a tenet of the hierarchy culture) and value on getting the job done (a tenet of the market culture). Sub-themes also included departmental policies, and institutional policies.

The second theme was *usability*, which was based on the ISO definition (the amount by which a product can be used by certain users to attain their goals with *effectiveness, efficiency, and satisfaction* in a certain context). Since this study was not focused on the design of the technology, this theme was expanded to include anything related to technology, on the premise that all utterances related to technology impacted efficiency, effectiveness and satisfaction, thereby impacting the usability of the technology.

The third theme was *job-related factors*, which described anything related to their job, including, time, effort, course material etc.

The fourth theme was *personal factors*, which was sub-classified to include Rogers' (1995) categories on types of users. According to Rogers (1995), there are five types of users; *innovators* who are 'venturesome' and enjoy trying new technologies, *early adopters* who are 'respectable' who enjoy trying new technology as well but make careful technology adoption decisions; *early majority* who are 'deliberate' and are even more cautious when it comes to

adopting technology that the above category; *late majority*, who are ‘skeptical’ and tend to adopt technology once all uncertainties are removed, and *laggards*, who are ‘traditional’ and are suspicious of new technologies and make them extremely cautious about adopting technologies. Study 1 required participant to classify themselves into these categories from a current standpoint as well as based on what they would prefer to be, in the future. Study 2 looked at how these personal characteristics affected their technology acceptance.

An additional theme was *emergent factors* to group additional items that developed during the course of the interview and were not covered by the *a priori* themes. There were a total of six emergent factors that will be explained in detail in section 3.3.4 of this document.

Frequency analysis was used to enumerate the recurrent codes and themes. The unit of observation was utterances and is shown in table 23.

Trustworthiness was established by checking the credibility, transferability, dependability and confirmability of the qualitative data. Credibility of the study was enhanced using peer debriefing. Based on guidelines to conduct effective peer debriefing (Erlandson, Harris, Skipper, & Allen, 1993; Lincoln & Guba, 1985), the researcher consulted with a colleague who was a qualitative researcher at Virginia Tech but was unfamiliar with the study. This colleague conducted a critical review of the coding system. In addition, the researcher employed member checking, which is a method of verifying interpretations with colleagues who are familiar with the study (Erlandson et al., 1993). Member checking was conducted with a colleague who worked in the same domain and was thus familiar with this study. Based on their suggestions, codes were slightly modified to provide a richer insight into the data.

To ensure dependability of any study, the methodology employed in the study should be described in detail, thus allowing another researcher to conduct the same/similar study if necessary. These details also let the reader make their own judgments about the amount that good research techniques were followed. The details of the methodology should include the research design, the process of data collection, and a discussion of the effectiveness of the process (Shenton, 2004). All these details are included in this chapter to ensure a dependability of this study.

Confirmability is a measure of how accurately the findings are supported by the collected data (Lincoln & Guba, 1985). This was achieved by data triangulation and theory triangulation using results from Study 1 and results from external research studies. Specific details are included in the Discussion section of this chapter.

Transferability is achieved when the results of a study can be understood within the context of that particular domain. The detailed description that included specifics on the number of respondents, the type of organization involved, the time duration, and the data collection methods were provided in this chapter to ensure transferability (Shenton, 2004).

Based on guidelines by Miles & Huberman (1994), a matrix was developed by the researcher to visualize all codes and to help recognize patterns among the themes. Matrices are useful to gain an overview, to quickly identify themes, and to compare and communicate results (Miles & Huberman, 1994). The main aim of this study was to gain a better understanding of the concepts related to the proposed framework. The relationship between organizational culture, usability, and technology acceptance was further evaluated based on the content analysis. The analysis also led to an insight on the relationship between personal and job-related factors that

can impact technology acceptance. These were used to help develop overall recommendations to facilitate technology acceptance.

### 3.2.5. Results

The content analysis of the transcripts of the focus group interviews provided a richer understanding of the relationship between organizational culture, usability, job related factors and personal factors, and instructional technology acceptance. The frequency count of all the themes are shown in Table 24.

Table 24

*Frequency count to enumerate themes of Study 2*

	Themes	Frequency
1	<b>Organizational Culture</b>	
	Corporation-oriented	17
	Innovation-oriented	14
	Results-oriented	12
	Procedure-oriented	16
2	<b>Usability</b>	
	Efficiency	15
	Satisfaction	18
	Learnability	10
	Poor Design	12
3	<b>Job Related Factors</b>	

	Time	14
	Focus on Research & Administration	15
	Course Material & Structure	23
4	<b>Personal Factors</b>	
	Preference for being technology-savvy	25
	Attitude	7
	Risk-Averse	19
	Peer Influence	11
5	<b>Emergent</b>	
	Infrastructure	23
	Knowledge of tools	37
	Incentive	8
	Perception of students' use/attitude of technology	20
	Suggestions	15

### 3.2.5.1. Theme 1: Organizational Culture

Across both focus group interviews, it was apparent that faculty members and graduate teaching assistants were interested in trying innovative techniques and placed value on using technology, but they were forced to stick to familiar methods due to roadblocks in the environment.

One faculty member discussed the policies, saying,

*“I liked to do a help session for my class, an optional session. I found a time that most students could make it and I couldn't find a classroom anywhere on campus. It doesn't matter where, even if we have to walk all the way to the stadium, but there was no classroom anywhere on campus! So, what about one of the department conference rooms which holds 30 students? We can't assign conference rooms for regular classrooms. But, no-one's using the room during those hours.... it's like pulling teeth. They have policies which are good, but sometimes the bureaucracy is ridiculous.”*

This sentiment was echoed by a number of faculty members who said that departmental and institutional procedures sometimes stood in the way of *“do[ing] the right thing by the students.”* This alluded to results found in Study 1 and further suggested that the current organizational culture is focused on policies (*Hierarchy Culture*).

Respondents unanimously indicated that they were forced to spend a majority of their time on research. Time spent on research ranged from a few hours a day to about 25 hours a week with a smaller portion of their time being devoted to teaching. Faculty members felt that there was no perceived interest in how they taught their courses. According to this faculty member, *“Nobody cares what I do in class unless I complain with a problem. If you want to do something, it's up to you.”*

Another common sentiment was the perceived value on instruction. In the words of one respondent,

*“The way department values education, if you need to put in 10 more hours into education, or adopting a new technology, there has to be some kind of benefit from that.”*

*A lot of times there is really none. It's your extra time during your week and then a lot of the times, people already are devoting that to other things, so it's difficult to keep that balance."*

This was very indicative of a results-oriented culture similar to the findings from Study 1 (*Market Culture*). These type of comments suggested that participants preferred a culture where using instructional technology in the classroom was valued. This again was indicative of a preferred innovation-oriented culture, similar to the findings from Study 1 (*preferred Adhocracy Culture*).

Respondents also indicated that they wished they had more help and support when it came to using new technology. One respondent commented,

*"But you kind of need somebody that would go around and help people with those things because you don't necessarily have time to go and investigate it and learn it and let alone figure out the key points on when to implement it."*

Another respondent echoed similar sentiments by saying,

*"I've taught a couple of online classes, it's very obvious what classes are being taught by distance learning but nobody's ever knocked on my door and said 'would you like to know what software is available that could help you?' You have to go out and search for everything alone."*

Another participant said,

*“At a time where the support staff is being cut back and I think the burden is on the instructor and you can only ask a certain amount. If everything is expected from the instructor, then it gets to be too much of a burden. When you have the support staff helping you out with the new technology and new development, it's all fine. But, I have to wait 2-3 days to have the printer hooked up to my computer.”*

Comments like this suggested that they preferred an environment that was more supportive, similar to the findings of Study 1 (*preferred Clan culture*). Another instance of the preference of a ‘*clan culture*’ was indicated by their inclination to learn a new technology when they had the help of a colleague. In the words of one faculty member,

*“In my department, we all kind of started using DyKnow around the same time, so I guess what helped was having a whole group of us trying it out, so if somebody got stuck, they could just go down the hall, and people are pretty collegial, we almost always have our doors open so it's very easy to pop in and be like 'oh you know, I had this issue on DyKnow. Have you tried this?' The other thing is that we sometimes do is go to each other's classes and we'll observe what's going on in the classroom.”*

Another faculty said, *“Oh, we've had a couple of things blow up in our faces too, so you really need, if you will, the support of the department to back you up when things go bad in the classroom, because of a technology failure.”* indicating the preference for support when using new technology.

Even though no questions were formulated to assess the role of leadership, the ‘departmental head’ came up several times during the course of the interview. One common

theme with the departmental head was lack of empathy. For instance, one participant said, “*I have made comments about the number of hours it takes me just to record one 45-minute lecture and my department head just looks at me , or associate department head looks at like I'm crazy. It's not 45-minutes long.*” Another participant said, “*a number of the department heads, I don't think, have tried the new technology so they don't know what the cost is from a time investment ...so they think it's easy...it looks easy.*” This again relates to leaders of the ‘market culture’ who are found to be difficult and daunting.

It was also interesting to note that all the participants used the focus group interviews as an avenue to learn about the different techniques that other people used. They were constantly asking each other for inputs and feedback on various software. Dialogues like the one below were common in both focus group interviews:

*Participant 1: I don't know if I can ask a question, but do you have trouble with students with problems? Every week, out of 300, somebody's computers have died, somebody's hard-drive, somebody's got stolen, got dropped.*

*Participant 2: I have, in my syllabus, this is the college requirement and you have to have it. Obviously, there's some understanding, you work with them. I tell them, 'if you don't want to install DyKnow, that's okay. But, I'm not going to make any accommodations for the fact that you're not receiving the information that everyone else's getting.' You just can't. You have a 100-something students. 'You can make your own choices, but you have to live with the consequences.*

*Participant 3: SWAT, the software assistance group, they're pretty good about if the student legitimately purchased a computer and they have a problem, they get a loaner for 3-4 weeks. So, there are resources to help them.*

*Participant 1: And is DyKnow pretty reliable?*

*Participant 2: It is now.*

*Participant 1: Can they get the information later? Or do they have to be there?*

*Participant 4: Yeah, they can get it later. It's all recorded. It's all step by step, direction. They can play it back too. It's amazing! Every stroke is exactly..(mimics strokes with hands).*

*Participant 1: Yeah that's good. See, I didn't know. If I had a neighbor that used DyKnow who was like 'hey, you teach that big class, why don't you try this?' I would have thought more about it. But I just don't know about the new technology.*

This suggested that it might be useful to hold regular discussion forums where faculty members can learn from each other in an informal setting, aligning more with their preferred ‘clan’ method of working together and the ‘adhocracy’ method of being innovative.

### **3.2.5.2. Theme 2: Usability**

This study found several instances where usability, or rather the lack of usability, hindered the use of instructional technology. The lack of efficiency, due to technical trouble was found to be extremely common across both interviews. One participant said,

*“Yeah, I taught with DyKnow [interactive classroom software], a couple of years ago, with a class of 120-130 students, and we had problems with the Dyknow server and there were interruptions.....if there's an interruption, you lose the students' attention. So, the next time I taught the same class a year later, I didn't use DyKnow.”*

Another faculty member said,

*“Whenever you have some kind of new technology, there tends to be a technological issue of some sort that you end up running into. I know that happened to me with DyKnow and I ended up basically not using DyKnow at all because we're always having server problems during class. But, even not in those cases, I worked with other software, not everything is necessarily a big with the software but maybe a limitation that you didn't realize was actually there.”*

Participants also complained about the lack of satisfaction from being forced to switch from one technology to the other, saying things like:

*“well, that's the other problem, is that once you get established in one technology, transferring to another technology , I mean, that's why I don't even consider going to DyKnow, because I've been going to Classroom Presenter. It's not like my department will give me free time to learn this new technology to get involved.”*

Another participant said,

*“I have classes that are recording in macromedia breeze that have lived and died. All that investment time is completely wasted. And, if the college has to look at something and say, man, this is really cool, but it will only last a couple of years, it's not; you don't*

*want to make it available. At least, you don't want to recommend it to anybody, because it's not good. It takes a lot of investment time, a lot of preparation time to bring in a new technology that brings a new capability and you want to make sure that the investment is going to last for real.”*

In terms of the various instructional technologies, one common theme brought up in both the focus group interviews, was the lack of “learnability” of the new technology. In the words of one participant:

*“It takes more time than making slides to talk about and then you also have to learn about how to do it. The first time I asked the students to submit slides to me, I didn't realize that I had to save them before I close the session , so then I lost that and I was using it for participation in lecture, like for points, so that was kind of frustrating too. And, so my first year, I didn't really use it that much because I didn't have the time to figure out what I was supposed to teach and incorporate a lot of activities with like the tablet”.*

While this research study did not specifically ask questions related to the design of the technology, several instances of poor design came up in the course of the two focus group interviews. One participant said,

*“A real limitation to dyknow is that if you invest time in preparing things in dyknow, it's only good for that one semester, because it's specific to the course. So, sometimes I record lectures, so that we can do problem solving in class, rather than having lecture time but, then, the next semester, if I want to do the same thing, I have to*

*re-do the whole lecture. Then I have to look at using Camtasia or something, but now I've to use completely separate technology.”*

The poor design of the current course management software also acted as a barrier to using new instructional technology in the classroom. One respondent said, *“But between scholar [current course management software] being such a pain in the neck, from the standpoint of having to open up umpteen different folders to get to the submitted work and then have PDF annotator screw up so badly.”*

Other comments were made about the design of the tablet PC, *“you can't press the back button because you're in tablet mode. That combination doesn't work at all for me.”* One participant commented,

*“When I even did put it down as a tablet to project, I would tend to turn it one way, but if I pressed the button to turn the screen, it would also flip the projector, and students would be looking at it sideways or upside down. It's like either I have to adapt to them or they have to adapt to me and there's no middle ground.”*

### **3.2.5.3. Theme 3: Job-Related Factors**

Several job-related factors seemed to influence participants' decisions on using instructional technology. Respondents were asked to describe their average day and a common theme across all the answers was the lack of free time to try technology. For instance regarding their average day, one participant said,

*“1 hour a day goes into coordination and answering emails and getting things done, answering people and trying to accommodate day-to-day stuff and then probably*

*on average, 3 hours a day goes into teaching; that means actively being in class, I mean, I teach one or two classes per semester, but, on average, I spend like 15 hours on teaching. That's per week. That sometimes goes up, probably for example, if a student comes in or asks, or me interacting with a TA trying to grade or help with the grading. The others go into research, writing proposals.”*

Another participant echoed the sentiments of having a tight schedule and said,

*“Well, from an instructor view point, I do some of the course coordination for this class, so a lot of my time is spent trying to prepare other faculty, TAs for what's going to be happening in the upcoming week and then I also spend quite a lot of time on Scholar because I'm basically managing electronic homework submission. We also do Scholar quizzes so I can quiz questions and polls and stuff. And then, getting ready for the next test; then I do some teaching, office hours, meeting with some students”.*

Participants said that their tight schedule hindered their use of technology to a certain extent. In the words of one participant, *“We like teaching, that's why we do this thing, but it's the time that, you know, it's very difficult to find that extra 10 hours a week to do that.”* Another comment by a self-perceived *innovator* was, *“I can hear about this technology and think ‘hey! that would be a great idea’, but I don't have time to integrate it into my curriculum.”*

Coupled with the lack of time, another common theme that related to this domain of research was the course structure and material. Respondents acknowledged that it took a lot of time and effort to incorporate their course material into the various technologies. One commented, *“You're also trying to prepare slides for the presentation, and incorporate the*

*interaction with DyKnow, polls, for instance. It takes more time than making slides to talk about.”* One said that the reason why he refrained from using the newer technology was because he would have had to restructure some of his teaching material. In his words,

*“If I used a tablet and a powerpoint [set of slides], then I will have to readjust my slides because then I will have to leave room for taking notes or circling things.... It will take me a lot more effort to actually transition ...and put them into a tablet..if i want to use a tablet.”*

Another alluded to the same point and said that his choice of using a certain technology depended on the time he had, saying, *“I mean, I know about DyKnow but I use Camtasia, and that's actually the opposite. That's actually takes less time to prepare.”*

One graduate teaching assistant commented,

*“I'm also trying very hard to incorporate technology into it so that I can have discussions with my students and figuring out things like polls, and how to pull a slide and things like that, it takes time, so probably like 6 hours preparing for an hour lecture and maybe two hours to prepare for the two-hour lab. It's less time because it's more hands-on.”*

Some course materials involved the use of technology and that made using instructional technology a little more challenging because the ‘course-technology’ brought in its own technological trouble into the picture. In the words of one participant,

*“We keep running into a new bug that needs to be sorted out. I probably spend a week each year, trying to figure out why MATLAB or some other software doesn’t work on a particular subset of tablet. I’m not an IT person, nobody’s out there trying to identify these bugs before-hand, my IT people are actually terrific once we find a bug, helping solve it, but still, you know, it’s a week every year I have to go through and test out all the software be available to students to try to work with them to see what’s going on.”*

These findings imply that in the educational domain, job-related factors are very important when it comes to accepting technology.

#### **3.2.5.4. Theme 4: Personal Factors**

Study 1 elicited factors related to personality characteristics, based on Rogers’ (1995) adopter categories, *Innovator, Early Adopter, Early Majority, Late Majority, and Laggard*. As mentioned earlier, this study was designed to include representatives of different adopter categories to ensure that it truly represented the population.

There were differences across the five categories instructional technology acceptance. The self-perceived *innovators* and *early adopters*, in general, were rather knowledgeable about the newer instructional technologies that were used in the classroom and had extensive experience trying these technologies in the classroom.

Personal goals, in terms of teaching, also seemed to influence their use of instructional technology. As indicated by previous research (Rogers, 1995), the innovators, early adopter, and early majority were a lot more keen to incorporate technology into the classroom.

A self-perceived *innovator* said,

*“Well, there's the element of keeping up; it comes down to technology; this new equipment makes your grading more efficient or it's more efficient with your time, so there is an urge 'oh you have to keep up', and then you can trail it all the way back to , either there's an element of competition. We've got this latest and greatest technology. This is shown to improve students' learning or quiz time or performance on exams. You don't want to be stuck with this older technology.”*

Another self-perceived *early adopter* said,

*“We adopt technology to make things efficient, efficient in terms of student learning, efficient in terms of your time, students' time. If it doesn't make things easier, like DyKnow didn't for me one time, you don't use it anymore. So, whatever really helps in making things efficient.”*

In the words of a current *early majority* user,

*“I think part of it is that you hope that you're going to somehow improve student learning, student engagement, student motivation, and then also to maybe seem more relevant to the students who have grown up with computers and technology.”*

A self-perceived *laggard* acknowledged that his personality influenced his decision to use technology. In his words,

*“I think, I'm a little more hesitant, than on average, the other teachers in the department, ...I think part of it is that I get set in my ways, once I find something I really like that works well for me, I am sold on that and now I want to use that and it'll take pretty good convincing for me to change my idea.”*

Study 1 also asked participants to indicate what type of adopter they would like to be in the future. An interesting finding was related to their attitudes towards using instructional technology. Participants who had no preference for being faster adopters of technology had a lot more complaints, or in other words, had a *worse* attitude than those who did. Some of their comments included:

*“Having now used tablets to accept home works and return home works, it's disconnected me from the student population. I no longer have a means to learn their names like I used to. I actually have a very good memory and can memorize 125 names in a class, over a course of a semester. But, I don't do it now because I don't have a name on a piece of paper that I can see their face. So, I find that to be a big drawback to the technology.”*

and

*“My attendance was significantly lower when I had DyKnow, versus when I taught with the tablet. When I taught with the tablet, my attendance was 90%. When I taught with DyKnow, the same class the year before, the attendance was 50% .After that, I taught with power point and tablet and stuff, and I had perfect attendance. So, I stopped doing DyKnow after that.”*

However, those who reported that they would prefer being faster adopters of technology had better attitudes towards using technology. Comments like, *“SWAT, the software assistance group, they're pretty good about if the student legitimately purchased a computer and they have a problem, they get a loaner for 3-4 weeks. So, there are resources to help them.”* and, *“In some*

ways, that's [students being able to login to instructional software from anywhere to collect notes] helpful too because when I have students that have to travel for what not." Incidentally, most of these comments were made after complaints by other participants, suggesting that they were trying to avoid dissuading some of the participants who were new to using technology.

More importantly, having a preference for being technology-savvy also seemed to influence being risk-averse or not. For instance, comments like:

*"I taught with DyKnow, a couple of years ago, with a class of 120-130 students, and we had problems with the dyknow server and there were interruptions. Not every time, but there were certainly interruptions every week or so. There was a person to help, but it doesn't matter, if there's an interruption, you lose the students' attention. So, the next time I taught the same class a year later, I didn't use DyKnow. I just used my tablet."*

and,

*"I think on top of just learning how to use it, I think whenever you have some kind of new technology, there tends to be a technological issue of some sort that you end up running into. I know that happened to me with DyKnow and I ended up basically not using DyKnow at all because we're always having server problems during class."*

were both made by participants who indicated that they had no inclination to be more technology savvy-in the future.

All respondents seemed much influenced by peers, irrespective of their adopter category. In the words of one respondent who perceived herself to be an *innovator*, "For teaching, I want

*to find a reason, so I used clickers because the professor that was training me to teach the class, showed me that clickers can help with engagement in the lecture.”*

Another participant who perceived himself as an early adopter said, *“Ask the IT guys or usually I'll ask somebody else who's done it before , "how did this work?", "what's your feeling on using the tablet in the big class?"*

Similarly, a self-perceived laggard said, *“I think I was introduced to it in similar ways because of my teaching fellowship that was "here's a tablet, now use it!" and I did for the ENGE classes.”*

These findings suggest that personality characteristics are very important for technology acceptance. Being technology-savvy has been found to be important when it comes to technology acceptance and adoption, but this study added to existing research by also asking participants to indicate what type of adopter/user they would like to be. The results of this study indicate that the more technology-savvy a person wants to be, the better their attitude regarding technology is. This adds to results from Study 1 that found attitude (ATT) positively correlated with behavioral intention to use technology (BI). Another important finding was that peer influence is very important for this cohort. This corroborates with the findings in study 1 that suggest Social Influences (SI) influence technology acceptance.

#### **3.2.5.5. Theme 5: Emergent Factors**

There were six additional factors that emerged from these interviews. The details of each of these are listed in the paragraphs that follow.

##### *Infrastructure*

Infrastructure, including power supply, wireless, and classroom structure, seemed to have a big influence on technology acceptance. Faculty members complained that the infrastructure was outdated, and it made it worse that they had no control of classroom assignment since this often meant that they were in a technology-unfriendly classroom, with few power outlets, or structured in such a way that their preferred instructional style was impossible to use.

In the words of a of one participant regarding wireless connections,

*“I think in the classroom, the biggest challenge that I've had is reliability, because a lot of things that we're doing right now have to do with internet usage and it seems like as more people bring their own internet-ready devices that makes use of all the bandwidth and so being able to make sure that a classroom, particularly, large classes, where you might have 250-300 students trying to connect to the internet at one time has been an issue.”*

Another participant said the following about the room structure,

*“Last semester, I had 55 students, and there are 55 seats in the class. There were 50 the first day and they brought in more chairs. So, students at the back, I can't write on the board because from the back they can't see the board. So, I have to write on my tablet, which is fine, and it's what I'd like to do anyway, but even then, they have trouble seeing it from the back. It's not necessarily the technology, I think the technology's fine, I think we have outgrown our infrastructure in many ways.”*

Another commented on the differences in classroom facilities,

*“I don't use a tablet...I use a laptop...and one reason I have a laptop is that the classes have don't all have the same facilities. If all had the desktop pc or a certain thing that I could just put my stick in my memory stick in. Then I wouldn't use that laptop in class.”*

Another said the following about the power in the classrooms, *“One year, I used to carry around this power strip and I only had 6, it was the best I could do. It was kind of ridiculous. They have this tablet requirement. They have these computers, but they can't run them.”*

#### *Knowledge of tools*

Similarly, knowledge of existing tools also influenced technology acceptance. A number of participants did not know about a lot of the instructional technologies that were used by their colleagues in other departments. One participant even acknowledged the same saying,

*“I think part of it is even just I don't have an awareness of what the latest instructional tools are. If somebody said ‘well, here are the 5 top things that are being used or tried at other institutions and here's how it's working’ then I would be more open to trying those things out. But, I use DyKnow because somebody was like ‘oh we tried it at the college, we know it works. You can use it.’ but maybe there are things that are better than that that I'm just not aware of.”*

Participants also indicated that they were quite frustrated because they did not know who to turn to for help. In the words of one participant,

*“But, who do you go to? You go to see [name removed] in Engineering, you to see the Media Center, you go to see IDDL, I mean, how many people do I need to knock on the*

*door to find out what's going on? There's no central resource and nobody's coming to see me, and believe me, I get plenty frustrated because the summer I was teaching an online class and halfway through the semester, I found out that there was a resource on IDDL for my class that no-body had even told me about. My name was posted there, with a link and everything. I'm like, what the heck is this? So, I know there are resources out there, but I don't find them easy to find.”*

Another participant said, *“I think you're [moderator] hearing that another difficulty which is not everybody knows about the available software tools to use these things.”*

#### *Incentive*

Participants felt that there was no incentive to use technology. One participant said, *“I think if the college paid faculty members for their time to take on a new technology that they felt was going to be good, then [we would use technology].”* Another participant said, *“If you need to put in 10 more hours into education, or adopting a new technology, there has to be some kind of benefit from that. A lot of times there is really not.”*

#### *Perception of Students' Use/Attitude of Technology*

Perception of how students used technology impacted their use of instructional technology as well. There were a number of comments regarding how technological trouble disrupted students' attention and it was quite difficult to continue effectively teaching once their attention was lost. For instance, one participant said, *“I found too for the undergrads, if there's any disruption in technology, they're like ‘oh, that's it! We're done for the day!’”* Another faculty member echoed

the sentiments and said, *“if there's an interruption, you lose the students' attention. So, the next time I taught the same class a year later, I didn't use DyKnow. I just used my tablet.”*

A number of participants were also influenced by observations of other classes, and their reaction was mixed, depending on what they saw. One faculty member was unimpressed after an observation and said,

*“I noticed with the students is that you have the tablet requirement and then I co-teach this class, and so some days, I'll come in the back and just park myself and just sit at the back of the lecture and then you look out and it's youtube, facebook, espn. I don't want to tell the students, don't bring your [tablets] because there are a few that use it to take notes but a lot of them don't and of course the answer is ‘oh I'll just make my class more interesting’, but it's tough to compete with an internet connection.”*

Another participant had the opposite experience and said,

*“I had one interesting experience this semester, doing a peer evaluation for another professor, and I sat at the back, it was a big class, and he was teaching from a tablet. And, he was using camtasia or something else, but that kind of thing. And, they start off the class and I would say, 80% of the students with laptops open were on facebook or ... he was just using animated powerpoints, and then about two-thirds way through, he had an example, where he wrote something on the slides, and the participation instantly went up to about 90% and I thought ‘oh that's pretty cool’. So, make sure all my students are writing something on every slide. And then, about 10 minutes after that, he quit lecture and had them work in pairs on a particular problem, and it was absolutely a 100% at*

*that time. And, it really was a surprise to see what was on those computer screens. A big learning experience for me.”*

One participant acknowledged that prior observations of a colleague helped her a lot and it had both positive and negative effects. In her words,

*“I’ll go to [name removed]’ class and he’ll try something new on DyKnow and I’ll say ‘oh that seemed to really work well; I’ll have to try that in my class.’ That gives me the encouragement or if it’s a feature that I really haven’t seen or thought about, ‘then here’s someone else trying it’ that kind of encourages me. Or sometimes, it’s the reverse. Sometimes I see something, and I go ‘There’s no way I’m doing that’. But, then again, that observation sometimes helps too.”*

Some also acknowledged that they were encouraged if students seem to enjoy using the technology in the classroom. For instance, one faculty member said,

*“[Using DyKnow], you can tell them ‘Okay, everybody, work on this problem for 5 minutes and then I’m going to randomly choose some of you to talk about your solutions. I’ll do that in big classes. They seem to actually really like it.”*

Another graduate teaching assistant alluded to the same point and said,

*“One of my students, that I’ve been talking to a little bit about the tablet because I’ve been using DyKnow and different dyknow features, to kind of ask them but they’ve been very positive...I was really surprised. They said they take notes on it when I talk.”*

This further adds to their preference of a collaborative culture, but also implies that it's important to let faculty members observe those who have successfully incorporated the technology into the classroom.

### *Computer requirement*

There were mixed reactions regarding the computer requirement. Some participants felt that having the same requirement for all the departments wasn't the best way to go and made comments like,

*“I'm sure what you guys [pointing to someone from a different department] need in classroom is definitely different from what we need and I think that's probably one of my biggest frustrations is that they try to centralize this one solution for all of college of engineering and instead of making any one person very satisfied with what they have, everybody is 'meh', they don't quite fit.”*

Others were very happy with the requirement and said that they depended on the requirement to teach their classes effectively. In the words of a faculty member, “

*“I use DyKnow, so they take their notes there. DyKnow has groups, so they work in groups in class and they can have access to what everybody in the group is writing. So I just use the tablet requirement constantly. I really rely on that requirement for almost everything”.*

Related to the above point, some participants felt that the tablet requirement at the COE made them have to deal with disgruntled students who deviated from the requirement. In the words of one participant, “*there's this requirement and this expectation that this software should*

*work as is and how do we handle those students that don't adhere to those requirements.”*

Another commented,

*“Some of the students get around that [tablet requirement] by getting a Wacom tablet [external tablet that is not allowed by the College of Engineering], because then you can still write. Some of my students don't even have the Wacom, they just type. I did a circuit drawing in class and they couldn't draw circuits, and everyone was handing them papers and asking me to count that. And then I'm faced with, well, 'do I take points off your grade because you don't have a tablet, which is what the syllabus for the course says', but then, I'm like 'well, you were here' and you drew it. So, it kind of, I get upset sometimes, getting put in that position.”*

### *Suggestions*

Participants were quick to provide suggestions on how instructional technology acceptance could be better facilitated. The suggestions were grouped together based on similarity and are described in detail in the paragraphs to follow.

#### 1. Customized Technology Support

Participants also had their own suggestions as to what could facilitate technology acceptance. For instance, one participant suggested,

*“if you had a technology specialist, that worked on helping the faculty integrate the stuff into their courses, that's actually something that we had at UC-Davis when I was there, that there were specific people that would go around and help integrate these things with faculty. So, as long as faculty were interested, they knew the pedagogical aspects and*

*said okay, well, let's look at what you're trying to accomplish and then try and figure out what technologies that would do that. But, it took a person that had that position to kind of explore those things, so if you wanted to do surveys, if you wanted to do discussions, in different ways that you could do that.”*

Another participant added to that and said,

*“it would be nice if there was some sort of outreach in the essence of ..I've taught a couple of online classes, it's very obvious what classes are being taught by distance learning but nobody's ever knocked on my door and said 'would you like to know what software is available that could help you?' You have to go out and search for everything alone”.*

Another participant echoed the sentiments and said, *“Pay for a support person who comes around and not only advocates with the stuff but also sets it up for you and helps you with it when it doesn't work. That would make a huge impact.”*

## 2. Advertising of Available Tools

Related to support, suggestions were made about marketing and advertising the technologies available. One participant said,

*“the COE should advertise its available software more because I know about DyKnow because I taught in the freshman program and they advertised it to all of the TAs last semester. I thought that was maybe a college initiative, so maybe that's more of a department thing. And the other software that you [pointing to another participant] mentioned ...so maybe if there was a wiki or something, where new software, like Piazza,*

*if you realize that there's a reason why you would want to use it , like look this is a new software and this is why you would want to use it in class or a page like that.”*

Another commented, *“I think it's the inertia that you get used to doing it in certain ways and has to really offer something, quite different to be able to go and learn it and do it the other way around.”*

A self-perceived *laggard*, said,

*“I think that's an issue in that selling new technology to other people as well and kind of communicating the need for it. ..you really need to have a strong selling point of why you should change your way because this offers something and communicating that is sometimes a struggle.”*

### 3. Better Training

Participants also felt that better training options needed to be available to support them using technology. Some felt that the current training methodologies did not help them with using technologies in the classroom. In the words of one participant, *“it's [training] such a shotgun approach, that you don't remember it afterwards anyway.”* Another participant said,

*“FDI [Faculty Development Institute] has workshops on all these technologies, but they tend to be at such a low level that you don't get any useful information. You learn how to login to it and then that's almost it. It was really not that useful to go to, if you already have some knowledge. If you don't have any idea, they can be helpful.”*

Another participant alluded to training graduate assistants and said,

*“The other thing too is that, every semester, I'm faced with training all the graders and GTAs that are working with me on how to use scholar. My department doesn't help that, the college doesn't help that. I mean, does every faculty member really need to show the graduate students how to upload, download the slides? This seems like there're certain set of training that would help just offload some of the work of the faculty and allow us to get going quicker.”*

This sentiment was echoed by other participants who felt that while having teaching assistants was a big help, training them took up a lot of time and added a new layer of complexity.

### **3.2.6. Limitations**

As with any study, there are some limitations to this study. The coding for the content analysis was completed by the researcher only. However, the researcher had previous experience with content analysis and her familiarity with the area of research made her an asset to this study.

Another possible limitation was that in spite of questions that were designed to elicit perceptions of the College of Engineering, the results of this study revealed some perspectives of the participants regarding their individual departments. However, results from study 1 indicated that there were no individual differences between departments regarding their perceptions of the College of Engineering. It is recommended to follow-up with a study that focuses on individual departmental organizational culture to gain an insight on the possible differences between departments.

It was also attempted to recruit equal representation of all Rogers' (1995) adopter categories (based on self-report measures in Study 1) for this study. Only 5% of the entire

sample indicated that they belonged to the *Late Majority* category and none of those respondents indicated that they wanted to participate in the follow-up focus group interviews. It is recommended to add to the findings of this study by recruiting participants who categorize themselves as *late majority* and find their viewpoints regarding technology.

### **3.2.7. Discussion**

The results of Study 2 indicated that in this complex domain, several factors need to be satisfied in order to increase technology acceptance. In terms of organizational culture, it was apparent that this cohort preferred a culture that placed value on cooperation, support, and encouraged using new technology. In the focus group interviews, participants revealed that they were dissatisfied with the amount of support that they received when it came to using new technology, so much so that they seemed to think there was no real benefit to using technology. Faculty members readily indicated that monetary incentives, including those in the form of graduate teaching assistants would help. Both these points have been found previously as barriers to faculty members adopting technology (Chizmar & Williams; Garrett et al., 2006). Participants in Study 2 also indicated that they could not spend too much on learning how to use a technology because a major portion of their time was focused on conducting research. Virginia Tech is a research I university, with an emphasis on research and grants, but the College of Engineering (COE) also places value on using new technology to teach students. In a complex domain such as this, faculty members may find it easier to focus on their research and use existing and/or outdated instructional tools unless they see some sort of benefit in using new technologies. This study was focused on what institutions like the COE within Virginia Tech can do to encourage faculty members to use new instructional technologies. Results of Study 1 and Study 2 indicate the preference of a culture that places value on using technology. Faculty members in Study 2

felt that aside from providing an effective learning environment for students, there was no benefit from adopting new instructional technologies in the classes, implying that they needed more incentives to use technology. This has also been corroborated by previous research that state faculty need intrinsic and extrinsic motivators to successfully adopt technology (Parker, 2003). The current process within the COE involves an annual submission of a Faculty Activity Report with details of achievements over the past year. However, it does not elicit specific details of the use of innovative instructional technology, but only asks for an overview of examples of technology that have been used. This can negatively affect those faculty members who spend a lot of time trying to incorporate instructional technology into the classroom, because they may perceive that as a lack of interest in their use of instructional technology. This implies that metrics within the COE should be modified to include the use of innovation in the classroom.

As discussed in Chapter 1, research within Virginia Tech found that students were quite dissatisfied with the amount of technology that was used in the classroom (Scales, Kothaneth, & Amelink, 2009). The findings of Study 2 added to it by indicating that some faculty members were very affected by students' perception of using technology and often integrated technology into the classroom because they perceived it be useful for the student. However, current course evaluations that are done by students do not elicit their opinions of the use of innovative technologies in the classroom. Research has also shown that faculty members need to see the benefits of using technology in the classroom to continue taking the effort to use it (Parker 2003). The lack of feedback from students can act as a de-motivator and thus put those faculty members, who put a lot of effort trying to use innovative technology in the classroom, at a disadvantage.

With regards to the usability of the instructional technology, the lack of learnability was a big issue with the participants of this study. While it is apparent that there will always be an issue of a learning curve with any new instructional technology, it is extremely important to acknowledge the personal characteristics of this cohort as well. Populations such as the one in Study 2 tend to adopt innovation with hesitation and efforts must be made to minimize the adverse effects of the learning curve. Results of this interview clearly indicate that faculty members and graduate teaching assistants are extremely busy and juggle teaching, research and administration duties. The lack of encouragement to use new instructional technology coupled with the unexpected learning curve drives them away from using new and innovative technology in the classroom. This can be overcome by regular evaluation of instructional technology by a team that is knowledgeable in usability evaluation and instructional technology. Succinct results of usability characteristics, like learnability (which can indicate how long it can take to learn the technology) of these evaluations can be published in a central location that is easily accessible to faculty members. Once faculty members approach a new instructional technology expecting to invest certain amount of time to learn it, they could feel less frustrated when it comes to trying it and finally adopting it. Another method that has been found to address the learning curve problem of other software is the 'reveal functionality by familiarity' approach (Wilson, 2011). Upon first interaction, users are shown the basic core functions and as they become more familiar with the software, they can choose options to provide more functionality. This approach will be very useful for designing instructional technology which is mainly used by users who not only have do not have the time to learn all features at one go, but can also be overwhelmed by them.

Another recommendation that can address both the learning curve problem and the preference for a supportive culture is the use of student supporters for assigned faculty members. Numerous support/ mentoring programs have been implemented across various educational institutions to facilitate technology integration into the curriculum. In particular, the reader is referred to the article by Chuang, Thompson, & Schmidt (2003) who conducted an exhaustive literature review on using mentoring programs to facilitate technology adoption. Some models that they describe involve a graduate or undergraduate course where the project or field work incorporates pairing students with faculty members who are interested in using technology in the classroom. George Mason University and Iowa State University are some universities who offer this type of mentoring program for graduate students and faculty members. The University of North Texas and Carson-Newman College Teacher Education Department are some universities that offer a similar type of support program for undergraduate students and faculty members. Since the COE at Virginia Tech has over 300 faculty members, it might be impractical to have student supporters for each interested faculty member. However, one feasible option is to collaborate with the Faculty Development Institute (FDI). The FDI offers certain faculty members a new computer every few years while others become eligible if they take tracks of courses offered by the FDI. Undergraduate and/or graduate supporters can be assigned to these faculty members to help them overcome the learning curve of new technology. Another suggestion is to provide supporters to those faculty members who take loaner computers from the College of Engineering. Based on direct suggestions from participants in this study, these supporters can also help them incorporate technology in the classroom. However, this means that the supporters either need to go through some sort of training themselves or need to be studying a discipline related to instructional technology. The COE currently has an Instructional

Technology team, comprised of graduate students, who train and support faculty members, either as part of a training module or on a one-on-one basis. This team can be extended to include supporters who work with assigned faculty members.

Prior training and peer influence seemed important to all the participants of this study. However, it is important to acknowledge that training an intellectual group such as faculty members requires different techniques. Based on Adult Learning Theory principles (Knowles, 1990), this cohort needs to understand the importance of why they need to learn the subject. This indicates that it is important to explain the use of instructional software from a *pedagogical* point of view, prior to training. Currently, the Faculty Development Institute (FDI) at Virginia Tech collaborates with the Instructional Technology Team at Virginia Tech and offers training of various instructional technologies. However, all the classes are structured to focus on elements of the technology only. Results of this study indicate that each class should be redesigned to incorporate the importance of using these instructional technologies as well, to effectively motivate the participants.

Faculty members also complained about the structure of the classroom and felt that it often hindered their use of instructional technology. The COE is currently making an effort to renovate existing classrooms, but a possible workaround until all classrooms are redesigned could involve allowing those faculty members who use innovative instructional technologies in the classroom to teach in a classroom of their choice. This would help those who take the efforts to incorporate instructional technology in the classroom, but could also provide an incentive to those who were hesitant to use technology in the classroom.

An interesting finding of this study was that some of the participants' suggestions to facilitate instructional technology acceptance are already established with the COE, implying that the *lack of knowledge* of these processes was the main problem. For instance, one suggestion was that information regarding all instructional technology be stored in a central location. Currently, the Instructional Technology team maintains several websites on the main College of Engineering (COE) website solely related to instructional technology. These websites are detailed and provide access to handouts, tips, and support contact information. Another example was that faculty members suggested that more support would be helpful when it comes to using technology. They acknowledge that they took the help of departmental System Administrators, but said that they preferred more support. The Instructional Technology (IT) team within the COE offers free training based on faculty members' convenience. They also provide in-class assistance for certain technologies until a faculty member is comfortable using it on their own. This suggests that the problem is that faculty members don't know about the resources that they can use and that the COE should step up its outreach efforts. While, the IT team currently sends numerous emails, prints brochures, and develops handouts, it might be useful to also target departmental get-togethers and activities and collaborate with departmental system administrators.

The findings of this study also provided an insight into the research questions that this research effort was designed to address. The overall findings suggest that technology acceptance in an organization depended on many factors. Participants in this study seemed to prefer a collaborative and innovative organizational culture and found that unnecessary procedures and the focus on results (research, in this case) hindered their use of technology. In terms of usability, participants indicated that efficiency, effectiveness, satisfaction, and learnability impacted their

use of technology. For instance, technological trouble was found to negatively impact efficiency and similarly, they expressed dissatisfaction when they were forced to switch between technologies. In addition, in individuals such as faculty members with extremely busy lifestyles found the ability to quickly learn how to use a technology to be very important and the 'learning curve' of the technology was found to hinder their use of technology. Findings also indicated that job-related factors influenced their use of technology. For instance, in the educational domain, using instructional technology meant that teaching material had to be incorporated into the technology. This took a lot of time and effort which a lot of faculty members weren't in a position to provide. It is also interesting to note that one of the barriers to technology use that the job-related factors brought on was *lack of time*, which is a common barrier across previous research as well. However, *lack of time* can also be related to the type of organizational culture that is currently in existence. As mentioned earlier, the current organizational culture as perceived by the participants is one that is results-oriented (focused on research) and procedure-oriented. Both these cultures can also affect the amount of time that they have. The preferred cultures of being collaboration-oriented and innovation-oriented could also provide them a little leeway in terms of time and effort required to integrate technology in the classroom.

In terms of personal factors, it was very apparent that personality characteristics, personal goals, and individual perception of technology affected their use of technology. Those who were technology-savvy seemed to enjoy using technology in the classroom. Similarly, those who recognized that students needed to be taught using technology took more efforts to integrate their curriculum into the instructional technology. In terms of research question 1, the results of this study found that instructional technology acceptance depended on the right combination of organizational culture, usability, job-related factors, and personal factors.

Results of this study indicate that while faculty members and graduate teaching assistants were interested in trying innovative techniques and placed value on using technology, they were forced to stick to familiar methods due to roadblocks in the organizational culture. The current organizational culture was found to be results oriented (with a focus on research due to Virginia Tech being a research one university) and policy-oriented. Participants indicated that this hindered their use of technology in many ways. Participants also indicated a preference for a more collaborative and innovative culture, with institutional support when they attempted to use new technology in the classroom. This finding corroborates the results found in Study 1 that also suggested that certain types of organizational cultures can facilitate technology acceptance whereas others can hinder them. In terms of research question 2, the findings of this study indicated that organizational culture influenced technology acceptance.

In particular, results of this study indicated that collaborative and innovative organizational cultures, low learnability, high efficiency, high effectiveness, and high satisfaction associated with the instructional technology can facilitate technology acceptance whereas competitive and hierarchical organizational cultures, high learnability, low efficiency, low effectiveness, and low satisfaction associated with the instructional technology can hinder technology acceptance. In terms of research question 4, the findings of this study found that certain organizational cultures and high technology usability facilitated technology acceptance while certain organizational cultures and poor technology usability hindered technology acceptance. There was no indication that gender or age had any effects on instructional technology acceptance.

### 3.2.8. Outcomes of Study 2

Results from this study were used to develop recommendations to facilitate instructional technology adoption in the educational environment. The 2012-2018 Strategic Plan for the College of Engineering (COE) at Virginia Tech has five themes to guide various strategies. Results from this study were drafted along the lines of the themes that were relevant to this study to provide specific recommendations pertaining to this plan.

The COE Themes relevant to this study are as follows:

Theme 1: Provide a high quality environment for teaching, learning and research

Theme 5: Support a diverse community of faculty, staff, and students.

#### 3.2.8.1. Recommendations

Results of this study suggest that the following recommendations will facilitate a technology-oriented environment and thus instructional technology acceptance (table 25).

Table 25

#### *Recommendations to facilitate instructional technology acceptance*

Direct Action	COE Theme
Learnability of the technology should be evaluated prior to any decision making by a team who is familiar with usability methods and instructional technology	1
Reports with usability evaluation results should be centrally located, preferably on the college of engineering website	1,5
All departmental system administrators should collaborate with the Instructional Technology team to act as the departmental liaison between the College of Engineering and the individual departments	1
The Faculty Activity Reports (FARS) should elicit details of use of innovative	1,5

instructional technologies in the classroom and be used as a basis for faculty awards.	
Student course evaluations should elicit extensive information on the use of innovative instructional technology in the classroom.	1,5
Incentives to use technology should be provided in the form of awards based on student recommendation.	5
Graduate/Undergraduate supporters should be assigned with those faculty members with COE loaner computers. These supporters should have a background in instructional design and education.	5
Identify faculty members who use innovative instructional technologies within each department and allow them to use a classroom of choice for teaching.	1,5
Send regular newsletters specific to instructional technology tools	1,5
Redesign training modules using principles from Adult Learning Theory (Knowles, 1980) and findings from other research	1,4, 5

### 3.2.8.2. Design guidelines

While this study was not focused specifically on design specifications of instructional technology, participants indicated that the following design guidelines would facilitate of two popular instructional technologies, DyKnow and the Tablet PC.

#### *Guidelines for DyKnow*

DyKnow is collaborative instructional software that is used by many faculty members within the COE at Virginia Tech. However, several participants indicated that certain features hindered them in the classroom. The following design guidelines can facilitate the use of DyKnow in the classroom.

- Allow digital notes to be reusable by faculty members across different classes to save time and effort.

In the words of a faculty member, “*A real limitation to DyKnow is that if you invest time in preparing things in DyKnow, it's only good for that one semester, because it's specific to the course.*”

- Include easy tutorials within the software that faculty members can have constant access to.

Participants said that they often forgot the material that was taught to them during training modules, indicating that it would be useful to design instructional software that could have quick tutorials within the interface that could help users.

- Use the ‘reveal functionality by familiarity’ approach to reduce the learning curve and thus avoid overwhelming new users.

This approach is currently being followed by popular software developers (Wilson 2011), but can be especially useful when designing instructional software. The basic premise of this approach is that functionality revelation depends upon familiarity. Upon first interaction, users are shown the basic core functions and as they become more familiar with the software, they can choose options to provide more functionality. This approach will be very useful for designing instructional technology which is mainly used by users who not only have do not have the time to learn all features at one go, but can also be overwhelmed by them.

#### *Guidelines for the Tablet PC*

- Identify basic instructional activities and make attempts to make those as easy as possible

The tablet PC has been advertised as one that has become “standard” in a number of domains, including that of education (“Tablet PCs and Notebooks”, 2012). However, the current design has been found to hinder basic instructional activities. One common comment was regarding the challenge to project the screen and write on the tablet at the same time. One participant commented,

*“But, with my tablet, maybe it's a setting, but if I want to put it into tablet mode, I can't project with it, so if I'm trying to write with it, I have to hold the screen or lay the screen down, or half turn the screen, but if I turn it completely or make it a tablet where it's easier to write on, that just drives me crazy, and I can't figure out how to do it.”*

The findings of this research suggest that it is important to identify key instructional activities and make attempts to make those activities easy achievable.

- Use universal icons to prevent mistakes in the classroom to avoid disruption of the classroom environment.

As discussed in Chapter 3.3.4, participants were very sensitive to the impact that their technology use had on student learning. It was very important that the classroom environment stayed undisrupted because participants found that once there was a slight technology malfunction, it adversely affected students' concentration.

### **3.3. Study 3: Summative Evaluation by panel of experts**

The objective of this study was for experts to review the proposed framework and provide recommendations for change. Summative evaluation is used to determine if the goals of the object being evaluated are achieved. This can be done using a variety of measures (Scriven, 1967). This study was originally going to employ the Nominal Group Technique (NGT) to facilitate expert evaluation of recommendations. However, it was decided to incorporate an online Delphi technique due to its similarities to the NGT, but with added advantages that it could be done virtually and ensures anonymity. Delphi techniques have been found to be especially useful when dealing with heterogeneous participants to overcome domination by a few people either due to personality or rank (Linstone & Turoff, 2002). Research has also shown that face-to-face group decision making techniques might not be suitable in a heterogeneous environment, as it can be challenging to focus on solving the problem at hand and not be biased by personal interests (Uhl, 1983).

#### **3.3.1. Research Design**

This study was designed to answer the following research question:

RQ 5: What can an organization do to facilitate technology acceptance?

#### **3.3.2. Participants**

Based on recommendations for Delphi techniques (Clayton, 1997), seven experts were recruited using maximum variation sampling (Patton, 2002). This technique is a type of purposeful sampling that is used to discover common themes in heterogeneous groups. It is especially useful in qualitative inquiry because it provides a rich insight into each case as well as across cases, by discovering common themes. To effectively maximize variation in a small

sample, participants must match certain criteria set by the researchers (Patton, 2002). In this particular study, the criteria were:

- Participants were considered subject matter experts based on experience and/or domain knowledge of either of the following areas:
  - Characteristics of various instructional technologies
  - Implementation of instructional technology in the classroom
  - College of Engineering policies

Following suggestions from Patton (2002), sample variation was maximized to include participants that were as different as possible from each other using dimensions based on the criteria above. Request to participate in the study were sent through emails. Incentive to take part in this study included a raffle to win a \$25 Amazon gift certificate.

### **3.3.3. Procedure**

Before the study started, the researcher explained the purpose of this study to all the participants via email. Each participant was then asked to review and complete an informed consent procedure approved by the Institutional Review Board at Virginia Tech. Based on recommendations on conducting a Delphi technique (Clayton, 1997), it occurred in three phases:

- Phase 1: All the recommendations from the findings of Study 1 and 2 were aggregated using an online tool called Qualtrics (Appendix H). Every recommendation was given a 5-point Likert-type scale, with zero in the middle and anchors -2 indicating *Strongly Disagree* and +2 indicating *Strongly Agree*. Phase 1 ended when the link to the list of recommendations to be evaluated was sent to all participants.

- Phase two involved a series of smaller steps:
  - Step 1: Participants were asked to rank the recommendations in order of feasibility using the Likert-type scale discussed above, and was also asked provide a short description as to why they thought so.
  - Step 2: Once all the participants submitted their results, the responses were aggregated with a measure for the central tendency. The participants were then asked to review their scores based on the group's central tendency and edit it if desired. If they decided not to make any changes, they were asked to provide an explanation as to why their answers should stay the same.
  - Step 3: The process was repeated if the researcher decided it was necessary.
- Phase 3: Final recommendations were those statements that received a mean rating of '+1' indicating group consensus.

Participants were also asked an additional open-ended question to provide feedback on what they would do to facilitate instructional technology acceptance and the right type of organizational culture.

#### **3.3.4. Analysis**

This analysis of the data collected in this study was relatively straightforward. At each step of the Delphi technique, responses were averaged to get a central tendency value. As mentioned above, if there was a deviation from the central score, the participant could revise their rank based on the central tendency if they chose. However, no significant deviations were found in this study. Once all the ranked recommendations were in, the researcher chose those

statements whose mean rating was '+1' or higher, thus indicating strong agreement amongst the experts.

Content analysis, using open coding (Strauss & Corbin, 1990) was used to categorize the information into themes to provide insight into the experts' perceptions on how they would facilitate instructional technology acceptance and a technology-oriented organizational culture.

### **3.3.5. Results**

#### **3.3.5.1. Delphi Technique**

The results of this study indicated that the following recommendations were regarded as important to develop an organizational culture that could facilitate instructional technology acceptance.

1. Issues relating to faculty members' needs related to instructional technology use must be addressed and rectified
2. Encourage direct faculty input early in the strategic planning process.
3. Encourage open communication among and 'open-door' policies.
4. Encourage trying new technologies and techniques in the classroom.
5. Recognize faculty members who try new methods and techniques in the classroom
6. Review departmental policies with faculty members of varying levels of experience, and consider changes based on suggestions.
7. Prior to any decision making, ease of learning and ease of use of all instructional technology should be evaluated by a team who is familiar with usability methods and has knowledge of the instructional domain

8. Based on above, evaluation reports with results should be centrally located and easy accessible, preferably on the COE website
9. The Faculty Activity Reports (FARS) should elicit more details of use of innovative instructional technologies/techniques in the classroom and be used as a basis for faculty awards.
10. Graduate/Undergraduate supporters should be provided to faculty members with COE loaner computers. These supporters should have a background in instructional design and education
11. Identify faculty who use innovative technology/techniques within each department and provide them the added benefit of choice of classrooms for teaching.
12. Incorporate all levels of faculty (instructor, associate professor, etc.) input into the computer requirement decision-making process
13. Send regular newsletters to all faculty members, specific to instructional technology tools
14. Redesign training modules using principles from Adult Learning Theory (Knowles, 1980) and findings from other research.

#### **3.3.5.2. Open-ended Questions**

The results of the analysis of the open-ended questions provided a richer understanding of the experts' insights into how a technology-oriented organizational culture and instructional technology acceptance could be facilitated. Frequency counts of the themes are shown in Table 26.

Table 26

*Frequency counts to enumerate themes of Study 3*

	Theme	Frequency Count	Sample Statement
1	Recognition/Incentives	11	<i>“Faculty need to see direct benefits related to incorporating instructional technology into their teaching as it relates to student learning and to their efficiency as a teacher in terms of delivering course content.”</i>
2	Better Training	10	<i>The FDI sessions are helpful for getting basics but somehow it all looks and feels different when I am in a classroom facing 400 students.”</i>
3	Encouragement/Support	5	<i>“Encourage trying new technologies and techniques in the classroom - This active approach should make faculty aware of new things they can try in the classroom.”</i>
4	More time to be provided	3	<i>“Providing TIME to integrate.”</i>

As shown in table, there were several common themes across the experts. Experts believed that *recognition using incentives or awards* was very important to facilitate instructional technology use. In the words of one expert, *“Provide monetary incentives for faculty to revamp and incorporate new technology into their curriculum. Provide monetary awards for faculty who successfully integrate new technology into their classroom while enhancing learning”*. Another expert alluded to a similar point and specified that *rewards* are important and said, *“To get faculty to change their behavior and to value technology use, I think you need to influence*

*motivation. To me that means providing appropriate rewards for using technology and for helping others to do the same.”*

Another expert said that it was important to recognize those faculty members who assisted others as well, saying, *“Increasing competence beliefs through providing appropriate rewards for helping others to do the same [using technology].”* Another expert agreed with the same point and added, *“This will provide even more incentive for faculty and allow others to see what they can do in the classroom”*. In the words of another expert, *“A motivator must be devised that encourages faculty to become better teachers. Currently research is a priority, teaching is secondary.”* Related to the above point, experts also pointed out that faculty members needed to see some benefits in using instructional technology in the promotion and tenure process. One expert commented, *“Would find a better way to evaluate teaching based on learning outcomes in the classroom and then incorporate this into promotion and tenure.”* Another alluded to the same point and said,

*“Making it [use of technology] valued in the tenure process. Adopting better teaching practices currently carry little value in the tenure and promotion process. As faculty are crunched for time, learning new technology and ways of using it in teaching can be a very low priority.”*

Experts also believed that training was very important to facilitate instructional technology acceptance. One expert said,

*“Perhaps hire professional educators to teach and partner them with researchers (that don't teach frequently). Provide a serious in depth (minimum one month)*

*course to all new teaching faculty on effective instruction. This course would incorporate current research and use of technology in the classroom that encourages better teaching.”*

Another said, *“FDI needs to have sessions led by faculty who use the technology so that they can demonstrate how it is actually used in the classroom.”* referring to the current training courses offered by the Faculty Development Institute (FDI) at Virginia Tech. Another expert alluded to the same point and said, *“I think hands-on, in-the-moment training in actual classroom settings is very important. For example, the FDI sessions are helpful for getting basics but somehow it all looks and feels different when I am in a classroom facing 400 students.”*

The results of Study 3 also acknowledged that more time was needed to help faculty members use instructional technology. In the words of one expert, *“Ensure that faculty are provided with training and TIME to integrate technology.”* Another said that more incentives were needed to overcome the lack of time, saying, *“To accomplish some of these goals faculty will need incentives. Time is a limited resource.”*

Study 3 revealed that experts believed that faculty members should be more involved in the strategic planning process. One expert commented, *“[Faculty having direct input early on] will allow faculty to feel a sense of ownership which may increase commitment.”* Another expert pointed out that it was important to involve students in the process. In his words,

*“Try building a bottom-up strategy in which students expect faculty to use instructional technologies available to them. This will require developing/implementing*

*excellent technology-assisted learning modules at freshmen and sophomore level-courses for exciting students about use of technology-based teaching and learning.”*

Due to the nature of qualitative inquiry, it is also of interest to develop an insight into recommendations that were considered unimportant by the experts in Study 3. For one, experts did not think that annual surveys needed to be sent to faculty members. Similarly, experts also felt that regular reminders of strategic goals would not be useful to facilitate instructional technology use. This could be indicative of the fact that faculty members are already overburdened and would not be able to devote extra time to surveys and review reminders. Experts also did not think it was as important to recognize faculty members who provided informal assistance to peers through awards or monetary incentives. This might have been again related to time as well as their busy schedule. It would have been difficult to automatically capture all those who provided informal assistance without faculty members informing the COE in some way. Experts felt that using electronic documentation and storing documentation related to instructional technology on a central website was not going to be useful to facilitate instructional technology use. One reason could be that changing the type of documentation that they're used to would require time and effort, both of which were of the essence to faculty members. Faculty members also seemed more familiar with their departmental procedures, so a possible workaround could be providing the information on each departmental website. The overall response from the experts suggested that involving departmental system administrators would not help the process. In the words of one expert,

*“System administrators are often not qualified to provide instructional technology support. They are hired for the unique technical requirements of their department.*

*Information Technology and Instructional Technology are two unique fields. Using system administrators in this role isn't advised.”*

Experts also felt that eliciting information and basing awards on student evaluation would not increase instructional technology use. This could have been because faculty members have been found to be concerned with appropriateness of using student evaluations to judge their teaching abilities. Some of their concerns have included students' immaturity, their inability to make judgments due to lack of experience, and how students' course evaluations are often correlated with their grades (Aleamoni, 1974).

### **3.3.6. Discussion**

The results of Study 3 revealed that experts in this domain believed that instructional technology acceptance is a complex process in the educational domain and depends on a number of factors. For instance, experts felt that it was extremely important to support faculty needs by addressing their issues with instructional technology use immediately. This is something that is of great need at colleges like the College of Engineering at Virginia Tech. The current Virginia Tech Employee Climate survey is done once in two years and does not focus on instructional technology use. This can be interpreted as a lack of interest and thereby lack of value in the use of instructional technology in the classroom.

Related to above, experts also believed that 'open communication' would facilitate the instructional technology acceptance process. Open communication between faculty members as well as with departmental heads can not only foster trust in times of uncertainty (Allen, Jimmieson, Bordia, & Irmer, 2007), but also foster a collaborative organizational culture (Cameron & Quinn, 2006). Having "open-door policies" can also increase alignment between

faculty goals and institutional goals and allow departmental heads to foster culture that values teaching by seemingly trivial efforts (Wright, 2008).

Experts also believed that faculty input should be incorporated very early in the strategic planning process and that all levels of faculty input should be incorporated into the computer requirement decision process. Strategic planning at most universities involves the input of key representatives of stakeholders like students, faculty, and staff, under the guidance of the leader (Paris, 2003). Likewise, the strategic planning process at the COE at Virginia Tech involves the deans, the University Provost's council, the University Academic Advisory Committee as well as faculty members. While the strength of their strategic plan can be attributed to the markup of this diverse and knowledgeable team, it is important to not only ensure that faculty inputs are elicited early on in the process but also to make sure that all levels of faculty members participate in the development of this plan. Research has shown that faculty members who serve on various advisory committees tend to be mid or senior level faculty members (Baldwin, 1979). However, since it is often the non-tenured faculty members who end up teaching, it is important to involve the junior faculty early on in the decision process as well. Similarly, experts who participated in study 3 believed that departmental policies should be reviewed by faculty members of varying levels of experience.

The results of Study 3 indicated that the Faculty Activity Reports (FARS) that faculty members turn in every year should elicit more details of use of innovative instructional technologies/techniques in the classroom and be used as a basis for faculty awards. Previous research has shown that the traditional faculty reward system does not include instructional technology use (Callas, 1982). Results of this research effort also indicate that faculty members

are dissatisfied with the incentive process and find that it hinders their instructional technology use. Research has shown that faculty rewards can vary from royalty payments to specific awards (Wolcott, 1997). However, the reward systems in colleges within research one universities are dominated by customs of awarding promotion and tenure and are often not aligned with faculty members' goals (Mingle, 1993). These reward systems have also been considered to be dependent on extrinsic factors and completely ignore intrinsic motivation (Lonsdale, 1993). In colleges within research-one universities, these reward systems focus on institutional goals of research and end up completely undermining teaching. Recognition of faculty members who try new methods and techniques in the classroom can help reform the reward system and thus align faculty goals with that of the college.

Relating to the above point, experts who participated in Study 3 also believed that non-monetary incentives could facilitate the instructional technology acceptance process. As the COE at Virginia Tech is working on modifying its existing infrastructure to support technology use in the classroom, a number of classrooms still have outdated structures, in terms of learning space design, power outlets, and desks structures. Participants felt that those classrooms hindered their use of instructional technology acceptance. This has been echoed by other researchers who suggest that outdated infrastructures are big barriers to facilitating instructional technology acceptance (Owusu-Ansah, Neill, & Haralson, 2011). However, a possible workaround with this problem until universities can revamp all their classrooms could be allowing the faculty members who use instructional technology in the classroom to teach in a classroom of choice. The current process at the COE at Virginia Tech involves the University Registrar allocating classrooms to faculty members. If faculty members can teach in a classroom of their choice, they might be more inclined to be willing to use instructional technology in the classroom.

Results of Study 3 also indicated that experts believed that all instructional technology had to be evaluated prior to use with a focus on ease of use and ease of learning. According to them, it was also important to make these evaluation reports accessible to all faculty members. When faculty members are tasked with learning how to use technology, they switch roles to become learners. However, adult learners learn best if they are provided all the information and can make their own decisions (Knowles, 1990). Once faculty members can approach a new technology with an idea of how difficult or how long it might take, they are more likely to be less frustrated with the learning curve aspect of a new technology.

The findings of Study 3 also revealed that faculty members need supporters who will help them integrate technology in the classroom. This methodology has been successfully adopted by other universities who assign 'mentors' based on students enrolled in Instructional Design/Education courses to faculty members who want to incorporate technology (Chuang, Thompson, & Schmidt, 2003). This can have twofold benefits because it will benefit the faculty member who gets additional help but also the supporter who gets credit for their class. Experts also believed that encouraging faculty members to use technology in the classroom will be important to facilitate technology acceptance.

Experts in Study 3 believed that regular newsletters with information on all instructional technology tools were important to facilitate instructional technology acceptance suggesting that they recognized that faculty members are extremely busy and do not have time to go look around for new technology. Regular newsletters specific to instructional technology can provide faculty members all the information they need to make a decision on using instructional technology in the classroom.

Finally, the experts who participated in Study 3 indicated that it was important to redesign current training modules based on findings from research. Training programs must be designed such that it emphasizes learning and provides assistance to faculty members in integrating the technology into their curriculum (Rogers, 2000). This is very important because instructional technology must be used *effectively* to have an impact on the teaching and learning environment.

## **CHAPTER 4: CONCLUSION**

### **4.1. Outcomes and Contributions**

This research effort consisted of three studies to provide an understanding of the relationship between organizational culture, usability and instructional technology acceptance. This research effort bridged a gap in existing research because in the extant literature, there was no study that combined the three domains. The overall findings indicated that a collaboration-oriented (Clan) and innovation-oriented (Adhocracy) organizational culture can facilitate instructional technology acceptance. Personal factors and job-related factors also play a role in instructional technology acceptance, but the findings of this research effort suggest that certain types of organizational cultures can offset obstacles that are brought on by personal and job-related factors. Additionally, the findings also indicate that certain organizational cultures could force users to continue to use a technology that has poor usability, which in turn could raise important questions on the efficiency of using the technology. Overall, this research suggests that the clan and adhocracy organizational cultures will facilitate instructional technology acceptance, in spite of challenges brought on by job-related factors and personal factors. These cultures will help users choose instructional technologies that they find usable and thus will use with efficiency, effectiveness and satisfaction. This finding is extremely important for the educational environment because it can foster a more efficient teaching and learning environment and help colleges achieve their goal of providing students with a high-quality education. A summary of specific contributions of this research effort is shown in Table 27.

Table 27

*Contributions of this research effort*

<b>Results from this research effort</b>	<b>Findings from previous research</b>
Clan and adhocracy culture can facilitate instructional technology acceptance	New finding
Hierarchy culture and market culture can hinder instructional technology acceptance	New finding
High usability (Low learnability, high efficiency, high effectiveness, high satisfaction) can foster instructional technology acceptance	ISO 92411; Nielsen, 1991; but new with regards to instructional technology research
Lack of time can hinder instructional technology acceptance	Supported by findings in Garrett et al., 2006; Carter, 1998;
Focus on research can hinder instructional technology acceptance	Supported by findings in Sahin & Thompson, 2007; Surendra, 2001
Lack of incentives can hinder instructional technology acceptance	Supported by findings in Chizmar & Williams, 2001; Garrett et al., 2006
Course material can influence instructional technology acceptance	Supported by findings in Becker, 2000
Lack of support can hinder instructional technology acceptance	Supported by findings in Beaudin, 2002; Bariso, 2003
Attitude can influence instructional technology acceptance	Supported by findings in Rogers, 2000;
Peer influence can influence instructional technology acceptance	Supported by findings in Walsh, 1993; Garrett et al., 2006;
Infrastructure can influence instructional technology acceptance	Supported by findings in Brzycki & Dudt, 2005
Knowledge of tools can influence instructional technology acceptance	Supported by findings in Butler & Selbom, 2002
Perception of students' use/attitude of technology can influence instructional technology acceptance	Supported by findings in Parker 2003

The purpose of study 1 was to gain an understanding of the perceptions of the participants regarding organizational culture, usability and acceptance of instructional technology. It was designed to answer research questions 1, 2, and 3 (RQ1, RQ 2, and RQ 3). A questionnaire comprising of questions from Organization Culture Assessment Instrument (OCAI), Unified Theory of Acceptance and Use of Technology (UTAUT) and System Usability Scale (SUS), was administered to all the participants (as shown in Figure 2). The OCAI was used to understand the organizational culture of the College of Engineering (COE) from the perspectives of faculty members within the COE at Virginia Tech. The UTAUT questions helped us understand particular perceptions of their instructional technology and the SUS scale determined how usable participants found their instructional technology. In addition, the questionnaire included questions that elicited job-related factors and personal factors that influenced instructional technology acceptance as well as a demographic section to gain a deeper insight into the background of the participants. Structural equation modeling was used to examine the relationships between organizational culture, usability, and instructional technology acceptance. The findings of Study 1 indicated a significant, positive relationship between usability and instructional technology acceptance, and a positive relationship between organizational culture and instructional technology acceptance, albeit a non-significant one. The organizational culture variable was measured using an ipsative scale. While ipsative scales have been found to have numerous advantages, they can be problematic for multivariate analysis because their design forces multicollinearity, meaning that as one choice increases in value, the other one is forced to decrease. The results of numerous other studies (Tuan & Venkatesh, 2010; Tushman & O'Reilly, 1997; Twati, 2006) suggest that organizational culture can affect technology acceptance. In addition, the results of linear regression analysis from Study 1 indicate

that organizational culture can influence instructional technology acceptance (Hypotheses 2, see tables 19 and 20) as well. Hence, it is likely that the design of the scale contributed to the lack of significance. This situation is also indicative of a problem with interdisciplinary research which often makes use of different types of measurement scales. There is a definite need for more research to bridge the gap between disciplines from a quantitative perspective. The findings from Study 1 also suggest that only the Performance Expectancy (PE), Effort Expectancy (EE), Anxiety (Anx), and Behavioral Intention (BI) measures were significant with regards to acceptance of instructional technology. Study 1 provides a basic mixed-method understanding of the overall perceptions of the participants and highlighted key factors of instructional technology acceptance. Results from this study were used to develop the following recommendations to facilitate the clan and adhocracy culture and thus facilitate instructional technology acceptance:

1. Provide yearly faculty surveys that focus on their needs and requirements related to instructional technology use
2. Based on above, make immediate attempts to discuss and rectify issues to increase trust
3. Recognize faculty members who provide informal assistance to peers through awards or monetary incentives to demonstrate value on innovation
4. Recognize faculty members who try new methods and techniques to demonstrate value on innovation
5. Encourage open communication and ‘open –door’ policies to foster a clan-like culture
6. Encourage trying new technologies and techniques to demonstrate value on innovation
7. Review policies regarding instructional technology use with faculty members and eliminate redundant ones based on suggestions

8. Allow faculty members of varying levels of experience to make more administrative decisions regarding instructional technology, to reduce hierarchy-like culture
9. Allow direct faculty input early in the strategic planning process.
10. Provide regular reminders of strategic plan and goals to keep members aligned with organization's goals

In turn, the results from Study 1 were used to guide the design of the subsequent study that focused on adding qualitative in-depth interview information to the findings.

Study 2 was designed to answer research questions 1 and 2, and 4 (RQ 1, RQ 2 and RQ 4). In this study, a purposeful sample of eleven participants was chosen using maximum variation sampling, for an in-depth focus group interview. This allowed for the collection of valuable qualitative open-ended responses which were analyzed in conjunction with the standardized quantitative instruments mentioned in study 1. In particular, results of this study indicated that collaborative (Clan) and innovative (Adhocracy) organizational cultures, coupled with instructional technologies that have low learnability, high efficiency, high effectiveness, and high satisfaction can facilitate instructional technology acceptance whereas competitive (Market) and hierarchical (Hierarchical) organizational cultures, high learnability, low efficiency, low effectiveness, and low satisfaction associated with the instructional technology can hinder instructional technology acceptance. The outcome of study 2 was the development of recommendations that could facilitate instructional technology acceptance as well as the description of a comprehensive framework describing the relationship between organizational culture, usability and instructional technology acceptance. The following recommendations were outcomes of Study 2:

1. Learnability of the technology should be evaluated prior to any decision making by a team who is familiar with usability methods and instructional technology
2. Reports with usability evaluation results should be centrally located, preferably on the college of engineering website
3. All departmental system administrators should collaborate with the Instructional Technology team to act as the departmental liaison between the College of Engineering and the individual departments
4. The Faculty Activity Reports (FARS) should elicit details of use of innovative instructional technologies in the classroom and be used as a basis for faculty awards.
5. Student course evaluations should elicit extensive information on the use of innovative instructional technology in the classroom.
6. Incentives to use technology should be provided in the form of awards based on student recommendation.
7. Graduate/Undergraduate supporters should be assigned with those faculty members with COE loaner computers. These supporters should have a background in instructional design and education
8. Identify faculty members who use innovative instructional technologies within each department and allow them to use a classroom of choice for teaching.
9. Send regular newsletters specific to instructional technology tools
10. Redesign training modules using principles from Adult Learning Theory (Knowles, 1980) and findings from other research

The purpose of study 3 was to conduct a summative evaluation of the recommendations based on findings from study 1 and 2 by a panel of experts. It was designed to answer research

question 5 (RQ 5). In this study, a panel of experts reviewed all the recommendations using the Delphi Technique. Study 3 revealed that experts in the educational domain believed that instructional technology acceptance is a complex process and depends on a number of factors. The results of Study 3 study indicated that the following recommendations were important to develop an organizational culture that could facilitate instructional technology acceptance:

1. Issues relating to faculty members' needs related to instructional technology use must be addressed and rectified
2. Encourage direct faculty input early in the strategic planning process.
3. Encourage open communication among and 'open-door' policies.
4. Encourage trying new technologies and techniques in the classroom.
5. Recognize faculty members who try new methods and techniques in the classroom
6. Review departmental policies with faculty members of varying levels of experience, and consider changes based on suggestions.
7. Prior to any decision making, ease of learning and ease of use of all instructional technology should be evaluated by a team who is familiar with usability methods and has knowledge of the instructional domain
8. Based on above, evaluation reports with results should be centrally located and easy accessible, preferably on the COE website
9. The Faculty Activity Reports (FARS) should elicit more details of use of innovative instructional technologies/techniques in the classroom and be used as a basis for faculty awards.
10. Graduate/Undergraduate supporters should be provided to faculty members with COE loaner computers. These supporters should have a background in instructional design and education

11. Identify faculty who use innovative technology/techniques within each department and provide them the added benefit of choice of classrooms for teaching.
12. Incorporate all levels of faculty (instructor, associate professor, etc.) input into the computer requirement decision-making process
13. Send regular newsletters to all faculty members, specific to instructional technology tools
14. Redesign training modules using principles from Adult Learning Theory (Knowles, 1980) and findings from other research.

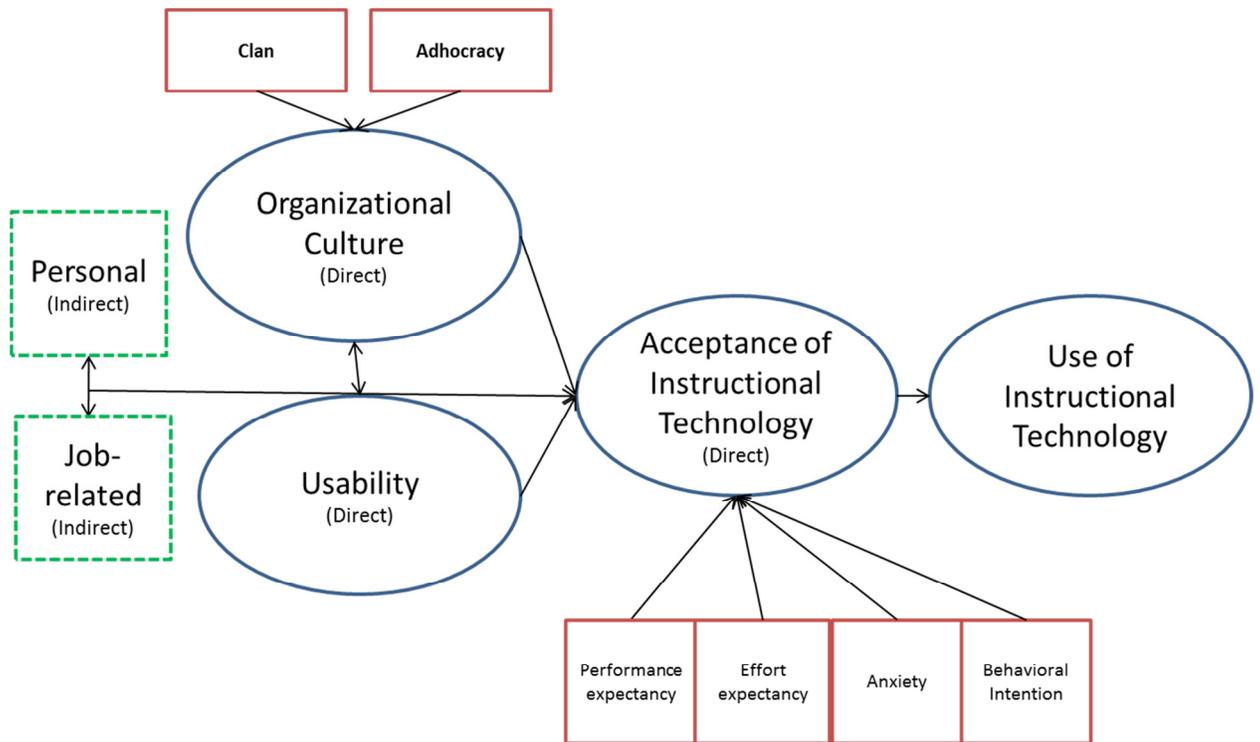
While this study was not focused specifically on design specifications of instructional technology, participants indicated that the following design guidelines would facilitate of two popular instructional technologies, DyKnow and the Tablet PC.

#### *Guidelines for DyKnow*

- Allow digital notes to be reusable by faculty members across different classes to save time and effort.
- Include easy tutorials within the software that faculty members can have constant access to.
- Use the ‘reveal functionality by familiarity’ approach to reduce the learning curve and thus avoid overwhelming new users.

#### *Guidelines for the Tablet PC*

- Identify basic instructional activities and make attempts to make those as easy as possible
- Use universal icons to prevent mistakes in the classroom to avoid disruption of the classroom environment.



*Figure 22.* The relationship between organizational culture, usability, personal factors, job-related factors and instructional technology acceptance.

The initial hypothesized conceptual model (shown in Figure 3) was modified to reflect the findings from this research effort. The modified conceptual model (shown in Figure 25) suggests that the Clan (collaboration-oriented) and Adhocracy (innovation-oriented) organizational cultures and instructional technologies with high usability, high performance expectancy (PE), low effort expectancy (EE), low anxiety (Anx), and high behavioral intention (BI) can facilitate instructional technology acceptance. Personal factors and job-related factors also play a role in instructional technology acceptance.

## 4.2. Discussion

It was predicted over three decades ago that higher education would undergo a transformation and instructional technologies would eventually be integrated into the curriculum (Gilbert, 1995). However, research has shown that there are still pockets within universities where instructional technology has not been integrated into the curriculum. There is tremendous pressure on faculty members to teach with instructional technology. Aside from the demographic make-up of the majority of current students (Howe & Strauss, 2000), research has also shown that moving away from the lecture-format can enhance the teaching/learning environment (Bolger & Sprow, 2002). Faculty members are now expected to teach and develop innovative methods to deliver courses with ever-changing curriculum, contribute heavily in scholarly activity, and take part in various committees (Bolger & Sprow, 2002). The responsibilities of faculty members in research-one universities include teaching and scholarship. These responsibilities are extended to include outreach activities in land-grant universities as well. Findings from this study indicate that faculty members allocated their time to each of these tasks and juggled their many duties. The findings of this research effort also suggest that developing an organizational culture that focuses on collaboration and innovation and technology can facilitate the use of instructional technology in the classroom.

Results of Study 1 indicated that over 48% of participants indicated that they would prefer using more than one type of instructional technology in the classroom. This isn't surprising considering the numerous advantages that using instructional technologies can offer, including multi-modal teaching, and developing a rich learning environment ("The Future of Higher Education, 2008). The COE at Virginia Tech, like many other colleges, is challenged with the need to provide students a skillset that can be used in a professional setting. What

remains in a state of flux is the process by which it can be efficiently integrated. The expert-evaluated recommendations outlined in this document can facilitate acceptance of instructional technology by providing the motivation that faculty members need and the support structure that they depend on.

One can find an indication of an institution's purpose and values by reviewing the mission statement (Wolcott, 1997). For instance, the mission statement of the COE at Virginia Tech indicates that its goals include drawing good students to provide them with high-quality engineering education, and supporting faculty development to sustain its reputation as a research university ("Mission of the College", 2012). In this day and age, it seems synonymous that providing a good education also requires the use of suitable technology, however it is very important to acknowledge that faculty members need support to 'keep up' with technology and transform their educational styles. In terms of the COE mission statement, it means that in order to provide high-quality education, there also needs to be support that is provided to faculty members with regards to instructional technology use. The COE mission statement does not explicitly state its commitment to support faculty members using instructional technology. This 'lack of perceived value' has been felt by faculty members as shown in results of Study 1 and Study 2. Participants in Study 3, who were a mix of administrators, technology specialists and faculty, also alluded to the same point, indicating that it was important to provide support to faculty members who use instructional technology. The overall findings indicated that a collaboration-oriented and innovation-oriented organizational culture can facilitate instructional technology acceptance.

It has been acknowledged that personal characteristics of users also influence their use of technology. Rogers' (1995) categorized adopters into five main classifications, innovator, early adopters, early majority, late majority and laggard, with early majority and late majority occupying the biggest space under a normal distribution curve. However results of this study show that the biggest categories were early adopters and early majority. While this could be indicative of only this particular sample, it could also be due to the changes in technology since the seminal work of Rogers (1995). Results of this study indicate that more research needs to be conducted to establish if the categories of innovativeness (Rogers, 1995) need to be updated.

A mixed methodology was chosen to understand the relationships between organizational culture, usability, and instructional technology acceptance. This type of methodology was specifically chosen due to advantages in both types of research. The positivist paradigm is based on the premise that behavior can be explained using objective measures (Firestone, 1987). This type of research design also allows for external validity or generalizability which suggests that the researcher can extend the findings of a study to a target population (Henry, 1990). Thus, the findings from Study 1 that suggest adhocracy culture and usability can influence instructional technology acceptance, can be generalizable to similar colleges. On the other hand, within the constructivist paradigm, the aim of research is to provide an insight into a particular situation from the perspective of the participants through rich descriptions (Wildemuth, 1993). These descriptions are developed in such a way that it allows readers to effectively gain tacit knowledge of the situation (Myers, 2000). This type of generalizability where the onus of making subjective judgments based off rich descriptions, falls on readers, is also termed transferability (Lincoln & Guba, 2000). Thus, the rich descriptions provided in study 2 will help

readers make judgments about what facilitates instructional technology acceptance and the rich description of the context can help them reiterate this study if necessary.

It is interesting to note that barriers to instructional technology acceptance such as lack of time, lack of resources, high complexity, lack of perceived value, cost have been in existence for the past few decades (Ertmer, 1999; Fauley, 1983; Nee, 1993). This indicates that in spite of technological advancements and different strategies of implementation, the basic obstacles remain the same. Recently, researchers have started to assert that the main barriers are not technical or financial ones; instead they are organizational, cultural, and psychological barriers (Cohen, 1994; Dede, 2007). The results of this research effort allude to that as well by suggesting the certain types of organizational cultures can facilitate instructional technology acceptance.

Finally, it is important to note that while all the recommendations from this research effort were drafted along the lines of the strategic plan of the Virginia Tech College of Engineering, several of these recommendations are applicable to any college within a higher education university.

### **4.3. Future Research**

As discussed, the instrument that measured organizational culture in Study 1 used an ipsative format which might have contributed to the lack of significance in the structural equation model developed in Study 1. It is recommended to re-iterate this study with a normative version of this instrument and compare the results. The comparison would also be useful to bridge a gap in current interdisciplinary research which often makes use of different types of measurement scales.

In general, this research found that participants perceived the current organizational culture to be one that is hierarchical and competitive which could be indicative of a research one university. It would be interesting to conduct this study in a teaching university and compare differences and similarities between perceptions of faculty members. It is also recommended to conduct a longitudinal study to research these relationships and gain an insight into how the relationship between organizational culture, usability, and instructional technology would change as technology advances. Another point of interest would be to re-iterate this study with 100% distance learning faculty and see if any perspectives change.

## REFERENCES

- Abran, A., Khelifi, A., Suryan, W., & Seffah, A. (2003). Usability meanings and interpretations in ISO standards. *Software Quality Journal*, *11*(4), 325-338.
- Adkins, B., & Caldwell, D. (2004). Firm or subgroup culture: where does fitting in matter most? *Journal of Organizational Behavior*, *25*(8), 969-978. doi: 10.1002/job.291.
- Aleamoni, L. (1974). Typical Faculty Concerns about Student Evaluation of Instruction. *In the proceedings of Symposium on Methods of Improving University Teaching*. Technion, Israel Institute of Technology, Haifa, Israel.
- Allen, J., Jimmieson, N., Bordia, P., & Irmer, B. (2007). Uncertainty during Organizational Change: Managing Perceptions through Communication. *Journal of Change Management*, *7*(2), 187-210.
- Amabile, T. M., Conti, R., Coon, H., Lazenby, J., & Herron M. (1996). Assessing the Work Environment for Creativity. *Academy of Management Journal*, *39* (5), 1154-1184.
- Anderson, B., Ball, S., Murphy, T., & Associates. (1975). *Encyclopedia of educational evaluation*. San Fransisco; Josey-Bass Publishers.
- Anderson, J. E., & Schwager, P. H. (2004). SME Adoption of Wireless Technology: Applying the UTAUT Model. *Proceedings of the 7th Conference of the Southern Association for Information Systems (SAIS)*. Savannah, Georgia, 39-43.
- Anderson, T., Varnhagen, S., & Campbell, K. (1998). Faculty adoption of teaching and learning technologies: Contrasting earlier adopters and mainstream faculty. *The Canadian Journal of Higher Education*, *2*(3), 71-98.
- Axtell, C., Holman, D., & Wall, T. (1997). Promoting innovation: A change study. *Journal of Occupational and Organizational Psychology*, *79*(3), 509-516.
- Baldwin, G. (1979). Adult and Career Development: What Are the Implications for Faculty? *In Current Issues in Higher Education*, Vol. 2. Washington, D.C.

Baldwin, R. (1979). Adult and Career Development: What are the implications for Faculty? *Current Issues in Higher Education*, American Association for Higher Education, vol .2, 13-20.

Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist*, 37, 122-147.

Bangor, A., Kortum, P. T., Miller, J. T (2008). An Empirical Evaluation of the System Usability Scale. *International Journal of Human-Computer Interaction*. 24, 574--594

Barber, D.A. (2012). 5 Higher Ed Tech Trends for 2012. *Campus Technology Digital Magazine*. Retrieved from <http://campustechnology.com/Articles/2012/01/09/5-Higher-Ed-Tech-Trends-for-2012.aspx?Page=1>

Bariso, E. U. (2003). The computer revolution: Friend or foe to FE college staff. *British Journal of Educational Technology*, 34(1), 85-88.

Barley, S. R., Meyer, G. W., & Gash, D. C. (1988). Cultures of Culture: Academics , Practitioners and the Pragmatics of Normative Control. *Administrative Science Quarterly*, 33(1), 24-60.

Barney, J. B. (1986). Organizational Culture: Can It Be a Source of Sustained Competitive Advantage? *The Academy of Management Review*, 11(3), 656-665.

Baron, R. & Wagele, E. (1994). *The Enneagram Made Easy: Discover the 9 Types of People*. Harper Collins.

Barriball, K., & While, A. (1994). Collecting data using a semi-structured interview: a discussion paper. *Journal of Advanced Nursing*, 19(2), 328.

Bartell, M. (2003). Internationalization of universities: a university culture-based framework. *Higher Education*, 45, 43-70.

Beaudin, L. C. (2002). *Bernard Lonergan's notions of authenticity and technology integration*. Unpublished doctoral dissertation, University of Calgary, Calgary, Alberta, Canada.

Becker, H. J. (2000, January, 2000). Findings from the teaching, learning, and computing survey: Is Larry Cuban right? *Paper presented at the School Technology Leadership Conference*, Washington, DC

Beggs, T. A. (2000). Influences and barriers to the adoption of instructional technology. *In Proceedings of the Mid-South Instructional Technology Conference*. (ERIC Document Reproduction Service No. ED446764)

Berrio, A. (2003). An Organizational Culture Assessment Using the Competing Values Framework: A Profile of Ohio State University Extension. *Journal of Extension*, 41(2). Retrieved from <http://www.joe.org/joe/2003april/a3.php>

Bloomer, S. & Croft, R. (1997). Pitching Usability to Your Organization. *Interactions*, November + December, p 18-26.

Bolger, D. & Sprow, R. (2002). Teaching, Technology, and Tenure: How are they valued? *In the proceedings of the 2002 EDUCAUSE conference*. Atlanta, Georgia.

Brooke, J. (1996). SUS: A Quick and Dirty Usability Scale. *Usability Evaluation in Industry*. Taylor & Francis. London.

Brown, A. (2010). *How Item Response Theory can solve problems of ipsative data* (Doctoral Dissertation). University of Barcelona. Retrieved from <http://www.psychometrics.cam.ac.uk/uploads/documents/Anna%20Brown%20Bibliography/Tesis%20Doctoral%20Anna%20Brown%202010%20distribution.pdf>

Brzycki, D. & Dudt, K. (2005). Overcoming Barriers to Technology Use in Teacher Preparation Programs. *Journal of Technology and Teacher Education*, 13(4), 619-641. Norfolk, VA: AACE.

Buller, J. (2012, February 14th). Promoting Research while Advancing Instruction, Part 1. *Faculty Focus. Focused on Today's Higher Education Professional*. Retrieved July 9<sup>th</sup>, 2012 from <http://www.facultyfocus.com/articles/academic-leadership/promoting-research-while-advancing-instruction-part-1/>

- Bulter, D., & Selbom, M., (2002). Barriers to Adopting Technology for Teaching and Learning. *EDUCAUSE Quarterly*, 2, 22-28.
- Byrne, B. (2010). *Structural equation modeling with AMOS: Basic Concepts, Applications, and Programming* (2nd edition). Routledge Academy, New York.
- Callas, D. (1982). Rewards and classroom innovations. *Community College Review* 10(2): 13-18.
- Cameron K. & Freeman S. (1991). Cultural congruence, strength, and type: Relationships to effectiveness. *Research in Organizational Development*, 5: 23-58.
- Cameron, K. (2004). A process for Changing Organizational Culture. University of Michigan Business School, White paper. Retrieved March 10th, 2010 from [www.scholar.google.com](http://www.scholar.google.com).
- Cameron, K. S., & Quinn, R. E. (1999). *Diagnosing and changing organizational culture*. Reading: Addison-Wesley.
- Cameron, K.S. & Ettington, D.R. (1988). The conceptual foundations of organizational culture. *Higher Education: Handbook of Theory and Research*, 356-396. New York.
- Cameron, S. K., & Quinn, E. R. (2006). *Diagnosing and Changing Organizational Culture: Based on the Competing Values Framework*. John Wiley and Sons.
- Carlsson, C., Carlsson, J., Hyvonen, K., Puhakainen, J., & Walden, P. (2006). Adoption of Mobile Devices/Services — Searching for Answers with the UTAUT. *Proceedings of the 39th Annual Hawaii International Conference on System Sciences* , 132a-132a.
- Carter, C.W. (1998). *An assessment of the status of the diffusion and adoption of computer-based technology in Appalachian College Association colleges and universities* (Doctoral Dissertation, Virginia Polytechnic Institute and State University, 1998). ProQuest Digital Dissertations. (UMI No. AAT 9905169)
- Cavaye, A.L.M. (1995). User participation in system development revisited. *Information and Management*, 28, 311- 323.

Chizmar, J., & Williams, D. (2001). What do Faculty Want? *EDUCAUSE Quarterly*, 24 (1), 18-24.

Christensen, C. (1997). *The Innovator's Dilemma. When New Technologies Cause Great Firms To Fail*. Harvard Business School Press. Boston, MA.

Christiansen, N, Burns, G., & Montgomery, G. (2005). Reconsidering the use of forced-choice formats for applicant personality assessment. *Human Performance*, 18, 267-307.

Chuang, H., Thompson, A., & Schmidt D. (2003). Faculty Technology Mentoring Programs: Major Trends in the Literature. Retrieved from [http://www.public.iastate.edu/~mstar/mentor/Technology\\_mentoring0128.htm](http://www.public.iastate.edu/~mstar/mentor/Technology_mentoring0128.htm)

Chubin, D., K. Donaldson, B. Olds, and Fleming, L. (2008). Educating Generation Net-Can U.S. engineering woo and win the competition for talent? *Journal of Engineering Education*, 97(3), 245-57.

Claver, E. (1998). Organizational culture for innovation and new technological behavior. *The Journal of High Technology Management Research*, 9(1), 55-68. doi: 10.1016/1047-8310(88)90005-3.

Claver, E., Llopis, J., Garcia, D., & Molina, H. (1998). Organizational culture for innovation and new technological behavior. *The Journal of High Technology Management Research*, 9(1), 55-68. doi: 10.1016/1047-8310(88)90005-3.

Clayton, M. (1997). Delphi: a technique to harness expert opinion for critical decision-making tasks in education. *Educational Psychology*, 17(4), 373-386.

Cohen, P. (1994). The Online Classroom. *Association for Supervision and Curriculum Development*, Vol 36, No. 10. Retrieved from [http://m.ascd.org/publications/newsletters/education\\_update/dec94/vol36/num10/The\\_Online\\_Classroom.aspx](http://m.ascd.org/publications/newsletters/education_update/dec94/vol36/num10/The_Online_Classroom.aspx)

Cox G. & Hopkins W. (1996). Developing a Whole Organizational Culture. *In Cultural Diversity Sourcebook*. ODT Inc.

Cronbach, L. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16(3), 297-334.

Curran, P., West, S., & Finch, J. (1996). The robustness of test statistics to nonnormality and specification error in confirmatory factor analysis. *Psychological Methods*, 1(1), 16-29.

Curtis, L., Edwards, C., Fraser, K., Gudelsky, S., Holmquist, J., Thornton, K., & Sweetser, K. D. (2010). Adoption of social media for public relations by nonprofit organizations. *Public Relations Review*, 36, 90-92.

Dalkey, L., & Hilmer, O. (1963). An Experimental Application of the Delphi Method to the Use of Experts. *Management Science*.

Deal, T. & Kennedy, A. (1982). *Corporate Culture: The Rites and Rituals of Corporate Life*. Reading, PA: Addison-Wesley

Debusse, J., Lawley, M., & Shibl, R. (2008). Educators' perceptions of automated feedback systems. *Australasian Journal of Educational Technology*, 24(4), 374–386. Retrieved from <http://www.ascilite.org.au/ajet/ajet24/debusse.html>.

Dede, C. (2007). Transforming Education for the 21<sup>st</sup> Century: New Pedagogies that help all students Attain Sophisticated Learning Outcomes. Commissioned by the NSCU Friday Institute. Retrieved from [http://thenetwork.typepad.com/files/dede\\_21stc-skills\\_semi-final.pdf](http://thenetwork.typepad.com/files/dede_21stc-skills_semi-final.pdf)

Denison, D. R. (1996). What is the Difference between Organizational Culture and Organizational Climate? A Native's Point of View on a Decade of Paradigm Wars. *Academy of Management Review*, 21(3), 619-654.

Deshpande, R., & Webster, F. (1989). Organizational Culture and Marketing: Defining the Research Agenda. *Journal of Marketing*, 53(1), 3-15.

Devlin, M. (1999). Students' perceptions of their learning environments: an improved procedure? *In the proceedings of HERDSA Annual International Conference*, Melbourne, 12-15<sup>th</sup> July.

- Diehl, V. A., & Norman, K. (1988). Development of an instrument measuring user satisfaction of the human-computer interface, *Proceedings of ACM CHI '88* (Washington, DC), pp. 213-218.
- Erlandson, D., Harris, E., Skipper, B. & Allen, S. (1993). *Doing naturalistic inquiry: a guide to methods*. Newbury Park, Ca: Sage.
- Ertmer, P.A. (1999). Addressing first- and second-order barriers to change: strategies for technology integration. *Educational Technology Research and Development*, 47(4), 47-61.
- Fauley, F. (1983). The new training technologies: their rocky road to acceptance. *Training and Development Journal*, December, 22-25.
- Feltz, L. (1982). Path analysis of the causal elements in Bandura's theory of self-efficacy and an anxiety-based model of avoidance behavior. *Journal of Personality and Social Psychology*, 42, 764-781.
- Fink, D. (1998). Guidelines for the Successful Adoption of Information Technology in Small and Medium Enterprises. *International Journal of Information Management*, 18(4), 243-253. doi: 10.1016/S0268-4012(98)00013-9.
- Finley, T.R. (2003). *A descriptive study of utilization of technology from a perspective of full-time faculty in Virginia's higher education teacher-education programs (Doctoral dissertation)*, The George Washington University, 2003). ProQuest DigitalDissertations. (UMI No. AAT 3083800)
- Firestone, W. (1987). Meaning in Method: The Rhetoric of Quantitative and Qualitative Research. *Educational Researcher*. Vol. 16, no.7, 16-21.
- Fracaro, K. (2008, August). Keys to Attaining Employee Trust. *Contract Management*, 12-16.
- Fralinger, B., & Olson, V. (2007). Organizational Culture at the University Level: A Study Using the OCAI Instrument. *Journal of College Teaching and Learning*, 4(11), 85-98.
- Friel, B. (2006, March). The Trust Factor. *Government Executive*, v38.

- Garrett, P., Brown, A., Hart-Hester, S., Hamadain, E., Dixon, C., Pierce, W., & Rudman, W. (2006). Identifying Barriers to the Adoption of New Technology in Rural Hospitals: A Case Report. *Perspectives in Health Information Management* 3(9). Retrieved from [http://perspectives.ahima.org/index.php?option=com\\_content&view=article&id=99:identifying-barriers-to-the-adoption-of-new-technology-in-rural-hospitals-a-case-report&catid=48:information-technology&Itemid=92](http://perspectives.ahima.org/index.php?option=com_content&view=article&id=99:identifying-barriers-to-the-adoption-of-new-technology-in-rural-hospitals-a-case-report&catid=48:information-technology&Itemid=92)
- Gilbert, S. (1995). Teaching, Learning, & Technology — the Need for Campus wide Planning and Faculty Support Services. *Change: The Magazine of Higher Learning*, 27(2), 47-48.
- Green K. & Gilbert S. (1995). Great Expectations: Content, Communications, Productivity, and the Role of Information Technology in Higher Education. *Change*. Vol. 27, No. 2 (Mar. - Apr., 1995), pp. 8-18. Retrieved 5th February 2011 from <http://www.jstor.org/stable/40165177>
- Greenbaum ,T. L. (1988). *The Practical Handbook and Guide to Focus Group Research*. Lexington, MA: Lexington.
- Hagedorn, S (1994). Retirement Proximity's Role in the Prediction of Satisfaction in Academe." *Research in Higher Education*, 1994, 35(6), 711–728.
- Handy, C.B. (1985). *Understanding Organizations*. Harmondsworth, Penguin Books
- Harrington, S. J. & Ruppel, C. P. (1999). Practical and value compatibility: their roles in the adoption, diffusion, and success of telecommuting. *Proceedings of 20th International Conference of Information Systems*. Charlotte, USA, 103-112.
- Harrison, R. (1972). Understanding your organization's character. *Havard Business Review*, May/June, 119-128.
- Hattangdi, A., Jha, S., & Ghosh, A. (2010). A Literature Review of the Perceptions of Faculty about Technology Enabled Distance Education. *International Journal of Arts and Sciences*, 3(18), 379-390.
- Henry, G. T. (1990). *Practical Sampling*. Newbury Park, CA: Sage

- Hoffman, L. (1965). Group Problem-Solving. *Advances in Experimental Social Psychology*, II. New York, Academic Press.
- Horton, L., Kim, K., Kothaneth, S., and Amelink, C. Macroergonomic Analysis of Instructional Technology Adoption: A Case Study on Tablet PC Adoption. *Proceedings of the 2011 ASEE Annual Conference*. Vancouver, B.C
- How Students Rate Instructors' Use of Information Technology in Courses (2011, August 21<sup>st</sup>). *Almanac of Higher Education 2011*. Retrieved from <http://chronicle.com/article/How-Students-Rate-Instructors/128461/>
- Howe, N. & Strauss, W. (2000). *Millennials Rising: The Next Great Generation*. Random House Digital, Inc.
- Iacovou, C. L., Benbasat, I., & Dexter, A. S. (1995). Electronic Data Interchange and Small Organizations :Adoption and Impact of Technology. *MIS Quarterly*, 19(4), 465-485.
- Iivari N. (2006). *Discourses on 'Culture' and 'Usability Work' in Software Product Development*. (Doctoral Dissertation) University of Oulu.
- Information Technology. (2012). In Merriam-Webster's online dictionary. Retrieved from <http://www.merriam-webster.com/dictionary/information%20technology>
- Insch, G., Moore, J., Murphy, L. (1997), "Content analysis in leadership research: examples, procedures, and suggestions for future use", *Leadership Quarterly*, 8, 1-25.
- ISO/IEC 9241-14. (1998). Ergonomic requirements for office work with visual display terminals (VDT)s - Part 14 Menu dialogues,
- Jacobsen, D.M. (1998b). Adoption patterns of faculty who integrate computer technology for teaching and learning in higher education. *Paper presented at the meeting of the ED-MEDIA/ED-TELECOM 98 World Conference on Educational Telecommunications*, Freiburg, Germany.
- Januszewski, A. & Molenda, M. (2008). *Educational Technology: A definition with commentary*. New York: Lawrence Erlbaum Associates.

- Johnson, D. E. (1998). *Applied Multivariate Methods for Data Analysts* (First Edition). Pacific Grove, CA: Brook/Cole Publishing.
- Kitzinger, J. (1995). Introducing focus groups. *British Medical Journal*, 311, 299-302.
- Knowles, M.S. (1990). *The adult learner: A neglected species*. Houston: Gulf Publishing
- Kothaneth, S., Amelink, C., & Scales, G. (2011). Adoption of the Tablet PC by the Engineering Education Department at Virginia Tech. *Proceedings of the 2011 ASEE Annual Conference*. Vancouver, B.C
- Krumbholtz, M. & Maiden, N. (2001). The implementation of enterprise resource planning packages in different organizational and national cultures. *Information Systems* 26(3): 185-204
- Kwon, G. (2010). *A Model Based Design Framework for Interoperable Communication Systems*. (Doctoral Dissertation). Retrieved from Dissertations and Thesis Database.
- Leavitt, H. (1964), *Applied Organization Change in Industry: Structural, Technical, and Human Approaches*. *New Perspectives in Organization Research*. New York, NY: John Wiley.
- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Beverly Hills, CA: Sage Publications, Inc.
- Lincoln, Y. S., & Guba, E. G. (2000). Paradigmatic controversies, contradictions, and emerging influences. *Handbook of Qualitative Research* . Thousand Oaks, CA: Sage.
- Linstone, H., & Turoff, M. (2002). *The Delphi Method. Techniques and Applications*. Retrieved from <http://is.njit.edu/pubs/delphibook/delphibook.pdf>
- Lonsdale, A. (1993). Changes in incentives, rewards and sanctions. *Higher Education Management* 5:223-35.
- Lowenthal, P. R., & Wilson, B. G. (2010). Labels do matter! A critique of AECT's redefinition of the field. *TechTrends*, 54(1), 38-46. doi:10.1007/s11528-009-0362-y
- Lucey, N. M (1991). *More than Meets the I: User-Satisfaction of Computer Systems*. Unpublished thesis for Diploma in Applied Psychology, University College Cork, Cork, Ireland

- Mann, D., Shakeshaft, C., Becker, J., & Kottkamp, R. (1999). West Virginia Story: Achievement Gains from a Statewide Comprehensive Instructional Technology Program. *Milken Exchange on Educational Technology*.
- McKillup, S. (2006). *Statistics Explained: An Introductory Guide for Life Scientists*. Cambridge University Press.
- McLean, J. & Chissom, B. (1986). Multivariate Analysis of Ipsative Data: Problems and Solutions. *In proceedings of the Annual Meeting of the Mid-South Educational Research Association*. Memphis, TN. 19-21
- Miles, M.B., & Huberman, A.M. (1984). *Qualitative Data Analysis*, 16. Newbury Park, CA: Sage.
- Mingle, J. R. (1993). Faculty work and the cost/quality/access collision. *Trusteeship* 1(5):11-16.
- Mission of the College. (2012). Retrieved August 7<sup>th</sup>, 2012 from <http://www.eng.vt.edu/overview/mission>
- Morgan, D. L. (1992). Designing focuses group research. *In Tools for Primary Care Research*. Thousand Oaks, CA: Sage. 177-93.
- Morris, M., & Dillon, A. (1996). The importance of usability in the establishment of organizational software standards for end user computing. *International Journal of Human Computer Studies*, 45(2), 243-258.
- Muthen, B., & Kaplan, D. (1985). A comparison of some methodologies for the factor analysis of non-normal Likert variables. *British Journal of Mathematical and Statistical Psychology*, 38(2), 171-189.
- Myers, M. (2000). Qualitative Research and the Generalizability Question: Standing Firm. *The Qualitative Report*, Volume 4, Numbers 3/4. Retrieved from <http://www.nova.edu/ssss/QR/QR4-3/myers.html>
- National Education Technology Plan (2010). Retrieved January 2011, from <http://www.ed.gov/technology/netp-2010>

- Nee, J. G. (1993). Unity through diversity. *Tech Directions*, 52(8), 47-49.
- Nielsen, J. (1993). *Usability Engineering*. Academic Press, Inc., San Diego.
- Norman, D. (2002). *The Design of Everyday Things*. New York: Doubleday Business
- Nunnally, J. (1978). *Psychometric theory*. New York: McGraw-Hill.
- Oblinger, D. (2003). Boomers & Gen-Xers, Millennials: Understanding the “New Students”. *EDUCAUSE Review*, July/August 2003.
- Orlikowski W.J. (1996). Improvising organizational transformations over time: a situated change perspective. *Inform. Systems Res.*, 7(1), 63-92.
- Oshlyansky, L., Cairns, P., & Thimbleby, H. (2007). Validating the Unified Theory of Acceptance and Use of Technology (UTAUT) tool cross-culturally. *Proceedings of the 21st British HCI Group*, 83-86. Retrieved from <http://portal.acm.org/citation.cfm?id=1531429>.
- Owusu-Ansah, A., Neill, P., & Haralson, M. (2011). Distance Education Technology: Higher Education Barriers during the First Decade of the Twenty-First Century. *Online Journal of Distance Learning Administration*, Volume XIV, Number II, Summer 2011. Retrieved from [http://www.westga.edu/~distance/ojdla/summer142/ansah\\_142.html](http://www.westga.edu/~distance/ojdla/summer142/ansah_142.html)
- Paris, K. (2003). Strategic Planning in the University. Office of Quality Improvement. University of Wisconsin-Madison. Retrieved from <http://oqi.wisc.edu/resourcelibrary/uploads/resources/Strategic%20Planning%20in%20the%20University.pdf>
- Parker, A. (2003). Motivation and Incentives for Distance Faculty. *Online Journal of Distance Learning Administration*, 6(3).
- Patton, M.O. (1980). *Qualitative Research Methods*. Beverly Hills, CA: Sage.
- Patton, M.Q. (2002). *Qualitative Research and Evaluation Methods*. Thousand Oaks, CA: Sage.

- Pettigrew, M. A. (1979). On Studying Organizational Cultures. *Administrative Science Quarterly*, 24 (4), 570-581
- Pliskin N., Romm T., Lee S., & Weber Y. (1993). Presumed Versus Actual Organizational Culture: Managerial Implications for Implementation of Information Systems. *The Computer Journal* 36(2). p. 143-152.
- Quality Education Data (QED) (2004). *Technology Purchasing Forecast, 2003-2004*. Denver,CO: Scholastic, Inc.
- Quinn, R. E. & Rohrbaugh. J (1983). A Spatial Model of Effectiveness Criteria: Towards a Competing Values Approach to Organizational Analysis. *Management Science*, Vol. 29, No. 3 (Mar., 1983), pp. 363-377.
- Quinn, R.E., & Spreitzer, G.M. (1991). The psychometrics of the competing values culture instrument and an analysis of the impact of organizational culture on quality of life. *Research in Organizational Change and Development*, 5: 115-142.
- Reilly, C. A. O., Chatman, J., & Caldwell, D. F. (1991). People and Organizational Culture: A Profile Comparison Approach to Assessing Person-Organization Fit. *Academy of Management*, 34(3), 487-516.
- Rogers, E. M. (1995). *Diffusion of Innovations*, Free Press, New York: NY.
- Rogers, D. L. (2000). A Paradigm Shift: Technology Integration for Higher Education in the New Millennium. *AACE Journal*, 1(13), 19-33. Charlottesville, VA: AACE.
- Rogers, P. L. (2000). Barriers to adopting emerging technologies in education. *Journal of Educational Computing Research*, 22(4), 455-472.
- Ruppel, C. P. & Harrington, S. J. (2001). Sharing Knowledge through Intranets: A Study of Organizational Culture and Intranet Implementation. *IEEE Transactions on Professional Communication* 44(1). Pp. 37-52.
- Sackmann, S. (1991). Uncovering culture in organizations. *Journal of Applied Behavioural*

Sahin, I. & Thompson, A. (2007). Analysis of Predictive Factors That Influence Faculty Members' Technology Adoption Level. *Journal of Technology and Teacher Education* .15(2), 167-190.

Salaway, G., Caruso, J. B., & Nelson, M. R. (2007) .The ECAR Study of Undergraduate Students and Information Technology. *EDUCAUSE, 2007*. Retrieved Oct.12, 2009, from <http://connect.educause.edu/library/abstract/TheECARStudyofUnderg/45075>

Scales G., Kothaneth S., Pokorski D., Bailey D. & Amelink C (2010). Strategic Alliances for Successful Deployment of Instructional Technologies. *In the proceedings of 177th American Society in Engineering Education Conference & Exposition*, June 20th –June 23rd, 2010, Louisville, Kentucky.

Schein, E. (1996). Culture: The missing concept in organizational studies. *Administrative Science Quarterly*, 41, 229-240.

Schumacker, R., & Lomax, R. (2004). *A beginner's guide to structural equation modeling*. Mahwah, NJ: Lawrence Erlbaum.

Scott, J. E. (2008). Technology acceptance and ERP documentation usability. *Communications of the ACM*, 51(11), 121. doi: 10.1145/1400214.1400239.

Scriven, M. (1967). The methodology of evaluation. *Perspectives of curriculum evaluation*, 39-83. Chicago, IL: Rand McNally.

Seels, B., & Richey, R. (1994). *Instructional technology: The definition and domains of the field*. Washington DC: Association for Educational Communications and Technology.

Sculley J. (1989). The relationship between business and higher education: A perspective on the 21<sup>st</sup> century. *Communications of the ACM*, 32,1056–1061.

Shenton, A. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for Information*, 22, 63-75.

- Smart, J. & John, E. (1996). Organizational Culture and Effectiveness in Higher Education: A Test of the "Culture Type" and "Strong Culture" Hypotheses. *Educational Evaluation and Policy Analysis*, 18 (3), pp. 219-241
- Stansberry, S. & Harris E. (2005). Understanding the Interrelationship of Instructional Technology Use and Organizational Culture: A Case Study of a Veterinary Medical College. *Journal of Veterinary Medical Education*, 32(1), 31-35.
- Stewart, D. W., Shamdasani, P. N., & Rook, D. W. (2007). *Focus Groups: Theory and Practice* (2nd ed.). Thousand Oaks, CA: Sage.
- Straub, D., Boudreau, M-C. & Gefen, D. (2004). Validation guidelines for IS positivist research. *Communications of the Association for Information Systems*, 13(24).
- Strauss, A., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. Newbury Park, CA: Sage Publications, Inc.
- Surendra, S.S. (2001). *Acceptance of web technology-based education by professors and administrators of a college of applied arts and technology in Ontario* (Doctoral Dissertation, University of Toronto, 2001). ProQuest DigitalDissertations. (UMI No. AAT NQ58603)
- Tablet PCS and Notebooks (2012). Retrieved August 8<sup>th</sup>, 2012, from <http://www.shopfujitsu.com/store/>
- Taylor, A. & Schmidlein, F. (2000). Creating a Cost Framework for Instructional Technology. *The Technology Source*. Retrieved March 20th 2011 from <http://ts.mivu.org/default.asp?show=article&id=1034>.
- Taylor, S., Locke E., & Lee C., & Gist M. (1984). Type A Behavior and Faculty Research Productivity: What are the Mechanisms? *Organizational Behavior and Human Performance*, 34, 402- 418.
- Technology. (2012). In Merriam-Webster's online dictionary. Retrieved from <http://www.merriam-webster.com/dictionary/technology>

- The Future of Higher Education (2008). *The Economist Intelligence Unit*. Retrieved from [http://www.nmc.org/pdf/Future-of-Higher-Ed-\(NMC\).pdf](http://www.nmc.org/pdf/Future-of-Higher-Ed-(NMC).pdf)
- Thong, J. Y. L., & Yap, C. S. (1995). CEO characteristics, organizational characteristics and information technology adoption in small businesses. *Omega*, 23(4), 429–442. Elsevier. doi: 10.1016/0305-0483(95)00017-I.
- Treister, N.W. (1998). Physician Acceptance of New Medical Information Systems: The Field of Dreams. *Physician Executive* 24(3), 20-24.
- Tront, J. G. (2007). Practices through a Large- Scale Tablet PC Deployment. *IEEE Computer Society*, 36-42.
- Tuan, L. & Venkatesh, V. (2010). Organizational Culture and Technological Innovation Adoption in Private Hospitals. *International Business Research*, 3(3), 144-153.
- Tullis, T.S., & Stetson, J.N. (2004). A Comparison of Questionnaires for Assessing Website Usability. *Proceedings of UPA 2004* (7-11 June 2004).
- Tushman, M. L. & O'Reilly, C. A. III (1997). *Winning through Innovation: A Practical Guide to Leading Organizational Change and Renewal*. Boston, MA: Harvard Business School Press.
- Twati, J. (2006). *Societal and Organizational Culture and the Adoption of Management Information Systems in Arab Countries* (Doctoral Dissertation). Griffith Business School. Retrieved from <http://www4.gu.edu.au:8080/adt-root/uploads/approved/adt-QU20070719.142959/public/02Whole.pdf>
- Uhl, N. (1983). Using the delphi technique in institutional planning. *New Directions for Institutional Research*, 1983(37), 81-94.
- U.S. Census Bureau (2009). Computer and Internet Use in the United States. Retrieved January 2010 from <http://www.census.gov/hhes/computer/publications/2009.html>
- Van de Ven, A., & Delbeco, A. (1971). Nominal versus Interacting Group Processes for Committee Decision-Making Effectiveness. *The Academy of Management Journal*. Vol. 14, No. 2, 203-212.

- Vasilopoulos, N. L., Cucina, J. M., Dyomina, N. V., Morewitz, C. L., & Reilly, R. R. (2006). Forced-choice personality tests: A measure of personality and cognitive ability? *Human Performance*, 19, 175-199.
- Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2009). User Acceptance of Technology: Toward a Unified View. *Management Information Systems*, 27(3), 425-478.
- Walker, T. (2010). *Toward the Development, Application, and Evaluation of the Student Success-Oriented System Design Methodology*. (Doctoral Dissertation). Virginia Polytechnic and State University (URN : etd-12242010-124345).
- Wallace, J., Hunt J., & Richards C. (1999). The relationship between organisational culture, organisational climate and managerial values. *International Journal of Public Sector Management*, Vol. 12 (7), 548 – 564
- Walsh, S. M. (1993). Attitudes and perceptions of university faculty toward technology based distance education. *Doctoral dissertation*, University of Oklahoma, Dissertation Abstracts International, 54, 781A.
- Wildemuth, B. (1993). Post-positivist research: two examples of methodological pluralism. *Library Quarterly*, 63, 450-468.
- Wilson, B, Sherry, L. Dobrovolny, J., Batty, M, & Ryder, M. (2000). Adoption of learning technologies in schools and universities. *Handbook on information technologies for education & training*. New York: Springer-Verlag.
- Wilson, M. (2011, April 5<sup>th</sup>). *When is Learnability More Important than Usability?* Retrieved from <http://www.uxbooth.com/blog/when-is-learnability-more-important-than-usability/>
- Wixon, D., & Wilson, C. (1997). The usability engineering framework for product design and evaluation. *Handbook of human-computer interaction*, 2, 653-688.
- Wolcott, L. (1997). Tenure, promotion, and distance education. Examining the culture of faculty rewards. *American Journal of Distance Education*, 11:2, 3-18.

Wright, M. (2008). *Always at Odds? Creating Alignment between Faculty and Administration Values*. SUNY Press.

Wright, S. (1921). Correlation and causation. *Journal of Agricultural Research*, 20(7), 557-585.

Yeung, K.O, Brockbank J. W., & Ulrich D. O. (1991). Organizational cultures and Human Resources Practices: An Empirical Assessment. *Research in Organizational Change and Development*, 5, 59-81.

Yu, T. (2009). A Review of Study on the Competing Values Framework, *International Journal of Business and Management*, 4(7).

**APPENDIX A**  
**The Organizational Culture Assessment Instrument used in Study 1**

1. Dominant Characteristics		Now	Preferred
	The organization is a very personal place. It is like an extended family. People seem to share a lot of themselves.		
	The organization is a very dynamic entrepreneurial place. People are willing to stick their necks out and take risks.		
	The organization is very results oriented. A major concern is with getting the job done. People are very competitive and achievement oriented.		
	The organization is a very controlled and structured place. Formal procedures generally govern what people do.		
	Total		
2. Organizational Leadership		Now	Preferred
	The leadership in the organization is generally considered to exemplify mentoring, facilitating, or nurturing.		
	The leadership in the organization is generally considered to exemplify entrepreneurship, innovating, or risk taking.		

	The leadership in the organization is generally considered to exemplify a no-nonsense, aggressive, results-oriented focus.		
	The leadership in the organization is generally considered to exemplify coordinating, organizing, or smooth-running efficiency.		
	Total		
3. Management of Employees		Now	Preferred
	The management style in the organization is characterized by teamwork, consensus, and participation.		
	The management style in the organization is characterized by individual risk-taking, innovation, freedom, and uniqueness.		
	The management style in the organization is characterized by hard-driving competitiveness, high demands, and achievement.		
	The management style in the organization is characterized by security of employment, conformity, predictability, and stability in relationships.		

	Total		
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4. Organization Glue		Now	Preferred
	The glue that holds the organization together is loyalty and mutual trust. Commitment to this organization runs high.		
	The glue that holds the organization together is commitment to innovation and development. There is an emphasis on being on the cutting edge.		
	The glue that holds the organization together is the emphasis on achievement and goal accomplishment. Aggressiveness and winning are common themes.		
	The glue that holds the organization together is formal rules and policies. Maintaining a smooth-running organization is important.		
	Total		
5. Strategic Emphases		Now	Preferred
	The organization emphasizes human development. High trust,		

	openness, and participation persist.		
	The organization emphasizes acquiring new resources and creating new challenges. Trying new things and prospecting for opportunities are valued.		
	The organization emphasizes competitive actions and achievement. Hitting stretch targets and winning in the marketplace are dominant.		
	The organization emphasizes permanence and stability. Efficiency, control and smooth operations are important.		
	Total		
6. Criteria of Success		Now	Preferred
	The organization defines success on the basis of the development of human resources, teamwork, employee commitment, and concern for people.		
	The organization defines success on the basis of having the most unique or newest products. It is a product leader and innovator.		

	<p>The organization defines success on the basis of winning in the marketplace and outpacing the competition. Competitive market leadership is key.</p>		
	<p>The organization defines success on the basis of efficiency. Dependable delivery, smooth scheduling and low-cost production are critical.</p>		
	<p>Total</p>		

**APPENDIX B**  
**System Usability Scale used in Study 1**

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I think that I would like to use this system frequently					
I found the system unnecessarily complex					
I thought the system was easy to use					
I think that I would need the support of a technical person to be able to use this system					
I found the various functions in this system were well integrated					
I thought there was too much inconsistency in this system					
I would imagine that most people would learn to use this system very quickly					
I found the system very cumbersome to use					
I felt very confident using the system					
I needed to learn a lot of things before I could get going with this system					

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**APPENDIX C**  
**Unified Theory of Acceptance and Use of Technology (UTAUT) used in Study 1**

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I find the system to be useful in my job					
Using the system enables me to accomplish tasks more quickly					
Using the system increases my productivity					
If I use the system, I will increase my chances of getting a raise					
My interaction with the system is clear and understandable					
It is easy for me to become skillful at using the system					
I find the system easy to use					
Learning to operate the system is easy for me					
Using the system is a good/bad idea					
The system makes work more interesting					
Working with the system is fun					
I like working with the system					
People who influence my behavior think that I should use the system					
People who are important to me think I should use the system					
The senior management of this business has been helpful in the use of the system					
In general, the organization has supported the use of the system					
I have the resources necessary to use the system					
I have the knowledge necessary to use the system.					
The system is not compatible with other systems I use.					

A specific person (or group) is available for assistance with system difficulties					
I could complete a job or task using the system...					
If there was no one around to tell me what to do as I go.					
If I could call someone for help if I got stuck.					
If I had a lot of time to complete the job for which the software was provided.					
If I had just the built-in help facility or assistance.					
I feel apprehensive about using the system.					
It scares me to think that I could lose a lot of information using the system by hitting the wrong key.					
I hesitate to use the system for fear of making mistakes I cannot correct.					
The system is somewhat intimidating to me.					
I intend to use the system in the next 12 months					
I predict I would use the system in the next 12 months.					
I plan to use the system in the next 12 months					

## **APPENDIX D (Demographic Questions)**

Please answer the following demographic questions to the best of your knowledge

Department:

Number of courses taught (either currently or altogether):

- 0
- 1-2
- 2-5
- 5+

Ethnicity:

- American Indian or Alaska Native
- Asian
- Black or African American
- Hispanic or Latino
- Native Hawaiian or Pacific Islander
- Other (Please Explain)

Country of Origin:

We would like to be able to contact you for a short follow-up interview at your convenience. Please provide your contact information if you will be interested.

Name:

Email Address:

## **APPENDIX E (Additional Open-Ended Questions)**

Which of these technologies do you currently employ for instructional purposes?

- Laptop
- Tablet PC
- Smart Phone
- Other (please explain)

Which of these technologies would you like to employ for instructional purposes?

- Laptop
- Tablet PC
- Smart Phone
- Other

Please choose which type of user best describes you currently.

- Innovator (defined to be 'venturesome'; like to try new innovations with enthusiasm )
- Early Adopter (defined to be 'opinion leaders'; like to try innovations with caution )
- Early Majority (defined to be 'deliberate'; hesitate before adopting innovation )
- Late Majority (defined to be 'skeptical'; usually adopt innovation under peer pressure)
- Laggard (defined to be 'traditional'; usually adopt innovation when it has become mainstream )

Please choose which type of user you would like to be in the future

- Innovator (defined to be 'venturesome'; like to try new innovations with enthusiasm
- Early Adopter (defined to be 'opinion leaders'; like to try new innovations with caution

- Early Majority (defined to be 'deliberate'; hesitate before adopting new innovation)
- Late Majority (defined to be 'skeptical'; usually adopt new innovation under peer pressure)
- Laggard (defined to be 'traditional'; usually adopt new innovation when it has become mainstream)

Please describe your current position at Virginia Tech

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Please share some key points on how your work position impacts you using new instructional technology

## **APPENDIX F (Complete Questionnaire)**

Thank you for taking the time to fill out this survey. The following questions will give you an opportunity to tell us more about your experience with instructional technology.

### Informed Consent for Participants in Research Projects Involving Human Subjects

Project Title: The Effects of Organizational Culture and Usability on Technology Acceptance

Principal Investigators:

Glenda Scales, Dean-Engineering

Tonya Smith-Jackson, Department of Industrial and Systems Engineering

Shreya Kothaneth, Department of Industrial and Systems Engineering

1. I hereby agree to participate in this research project. I understand that my participation is voluntary, and I will be asked about my experiences and perception of organizational culture and instructional technology.
2. I understand that I will be asked to participate in an online survey, which will take no longer than 20 minutes to complete.
3. I understand that I can withdraw from the project at any time without penalty of any kind. In the event that I withdraw from the project, any data collected will be destroyed.
4. I understand that I will receive no compensation for my participation in this project, but I can request a copy of the results for my own record.
5. I understand that there are no known risks to participating in this project. I also understand that the benefits of this project are great, as my responses may help implement professional development opportunities.
6. I understand that I will remain anonymous throughout the research study. Only the principal investigators will have access to my responses.
7. This project has been approved, as required, by the Institutional Review Board for Research Involving Human Subjects at Virginia Polytechnic Institute and State University.
8. If I feel I have not been treated according to the descriptions in this form, or that my rights as a participant in the research have been violated during the course of this project, I know I can contact Dr. David Moore, Chair, IRB, Research Division, Virginia Tech, Dr. Glenda Scales, the Associate Dean of International Programs and Information Technology, Dr. Tonya Smith-

Jackson, Associate Professor, Department of Industrial and Systems Engineering, or Shreya Kothaneth, Doctoral Candidate, Department of Industrial and Systems Engineering.

9. I voluntarily agree to participate in this study and agree to be a participant according to the terms outlined above. I have read and understand the Informed Consent and conditions of this project. By clicking ">>", I hereby give my voluntary consent for participation in this study.

Should I have any questions about the research project or procedure, I may contact:

Dr. Glenda Scales (540) 231-9754

Shreya Kothaneth (540) 449-3126

Dr. David Moore, Chair, IRB (540) 231-4991

←-----BEGIN-----→

Which of these technologies do you currently employ for instructional purposes?

- Laptop
- Tablet PC
- Smart Phone
- Other (please explain)

Which of these technologies would you like to employ for instructional purposes?

- Laptop
- Tablet PC
- Smart Phone
- Other

Please choose which type of user best describes you currently.

- Innovator (defined to be 'venturesome'; like to try new innovations with enthusiasm )
- Early Adopter (defined to be 'opinion leaders'; like to try innovations with caution )
- Early Majority (defined to be 'deliberate'; hesitate before adopting innovation )
- Late Majority (defined to be 'skeptical'; usually adopt innovation under peer pressure)

- Laggard (defined to be 'traditional'; usually adopt innovation when it has become mainstream )

Please choose which type of user you would like to be in the future

- Innovator (defined to be 'venturesome'; like to try new innovations with enthusiasm
- Early Adopter (defined to be 'opinion leaders'; like to try new innovations with caution
- Early Majority (defined to be 'deliberate'; hesitate before adopting new innovation
- Late Majority (defined to be 'skeptical'; usually adopt new innovation under peer pressure
- Laggard (defined to be 'traditional'; usually adopt new innovation when it has become mainstream

Please describe your current position at Virginia Tech .....

Please share some key points on how your work position impacts you using new instructional technology .....

←-----OCAI CURRENT-----→

Please answer the following questions keeping the CURRENT organizational culture of the overall College of Engineering in mind.

Please distribute 100 points among the four choices given, so that the highest points are given to the choice that is most closely related to your organization.

1. Dominant Characteristics		Now
	The organization is a very personal place. It is like an extended family. People seem to share a lot of themselves.	
	The organization is a very dynamic entrepreneurial place. People are willing to stick their necks out and take risks.	
	The organization is very results oriented. A major concern is with getting the job done. People are very competitive and achievement oriented.	

	The organization is a very controlled and structured place. Formal procedures generally govern what people do.	
	Total	
2. Organizational Leadership		Now
	The leadership in the organization is generally considered to exemplify a no-nonsense, aggressive, results-oriented focus.	
	The leadership in the organization is generally considered to exemplify coordinating, organizing, or smooth-running efficiency.	
	The leadership in the organization is generally considered to exemplify a no-nonsense, aggressive, results-oriented focus.	
	The leadership in the organization is generally considered to exemplify coordinating, organizing, or smooth-running efficiency.	
	Total	
3. Management of Employees		Now
	The management style in the organization is characterized by teamwork, consensus, and participation.	
	The management style in the organization is characterized by individual risk-taking, innovation, freedom, and uniqueness.	
	The management style in the organization is characterized by hard-driving competitiveness, high demands, and achievement.	
	The management style in the organization is characterized by security of employment, conformity, predictability, and stability in relationships.	
	Total	
4. Organization Glue		Now
	The glue that holds the organization together is loyalty and mutual trust. Commitment to this organization runs high.	

	The glue that holds the organization together is commitment to innovation and development. There is an emphasis on being on the cutting edge.	
	The glue that holds the organization together is the emphasis on achievement and goal accomplishment. Aggressiveness and winning are common themes.	
	The glue that holds the organization together is formal rules and policies. Maintaining a smooth-running organization is important.	
	Total	
5. Strategic Emphases		Now
	The organization emphasizes human development. High trust, openness, and participation persist.	
	The organization emphasizes acquiring new resources and creating new challenges. Trying new things and prospecting for opportunities are valued.	
	The organization emphasizes competitive actions and achievement. Hitting stretch targets and winning in the marketplace are dominant.	
	The organization emphasizes permanence and stability. Efficiency, control and smooth operations are important.	
	Total	
6. Criteria of Success		Now
	The organization defines success on the basis of the development of human resources, teamwork, employee commitment, and concern for people.	
	The organization defines success on the basis of having the most unique or newest products. It is a product leader and innovator.	

	The organization defines success on the basis of winning in the marketplace and outpacing the competition. Competitive market leadership is key.	
	The organization defines success on the basis of efficiency. Dependable delivery, smooth scheduling and low-cost production are critical.	
	Total	

←-----OCAI PREFERRED-----→

Please answer the following questions keeping the PREFERRED culture of the overall College of Engineering in mind (or where you would prefer the College of Engineering to be in 5 years).

Please distribute 100 points among the four choices given, so that the highest points are given to the choice that is most closely related to your organization.

1. Dominant Characteristics		Preferred
	The organization is a very personal place. It is like an extended family. People seem to share a lot of themselves.	
	The organization is a very dynamic entrepreneurial place. People are willing to stick their necks out and take risks.	
	The organization is very results oriented. A major concern is with getting the job done. People are very competitive and achievement oriented.	
	The organization is a very controlled and structured place. Formal procedures generally govern what people do.	
	Total	
2. Organizational Leadership		Preferred
	The leadership in the organization is generally considered to exemplify mentoring, facilitating, or nurturing.	

	The leadership in the organization is generally considered to exemplify entrepreneurship, innovating, or risk taking.	
	The leadership in the organization is generally considered to exemplify a no-nonsense, aggressive, results-oriented focus.	
	The leadership in the organization is generally considered to exemplify coordinating, organizing, or smooth-running efficiency.	
	Total	
3. Management of Employees		Preferred
	The management style in the organization is characterized by teamwork, consensus, and participation.	
	The management style in the organization is characterized by individual risk-taking, innovation, freedom, and uniqueness.	
	The management style in the organization is characterized by hard-driving competitiveness, high demands, and achievement.	
	The management style in the organization is characterized by security of employment, conformity, predictability, and stability in relationships.	
	Total	
4. Organization Glue		Preferred
	The glue that holds the organization together is loyalty and mutual trust. Commitment to this organization runs high.	
	The glue that holds the organization together is commitment to innovation and development. There is an emphasis on being on the cutting edge.	
	The glue that holds the organization together is the emphasis on achievement and goal accomplishment. Aggressiveness and winning are common themes.	
	The glue that holds the organization together is formal rules and policies. Maintaining a smooth-running organization is important.	
	Total	

5. Strategic Emphases		Preferred
	The organization emphasizes human development. High trust, openness, and participation persist.	
	The organization emphasizes acquiring new resources and creating new challenges. Trying new things and prospecting for opportunities are valued.	
	The organization emphasizes competitive actions and achievement. Hitting stretch targets and winning in the marketplace are dominant.	
	The organization emphasizes permanence and stability. Efficiency, control and smooth operations are important.	
	Total	
6. Criteria of Success		Preferred
	The organization defines success on the basis of the development of human resources, teamwork, employee commitment, and concern for people.	
	The organization defines success on the basis of having the most unique or newest products. It is a product leader and innovator.	
	The organization defines success on the basis of winning in the marketplace and outpacing the competition. Competitive market leadership is key.	
	The organization defines success on the basis of efficiency. Dependable delivery, smooth scheduling and low-cost production are critical.	
	Total	

←-----INSTRUCTIONAL TECHNOLOGY: SUS & UTAUT-----→

Did you use a laptop (Windows/Mac) or a tablet PC to teach during the past academic year?

Yes (please specify which type)

No [Those who answer 'No' are exited out of the survey]

Keeping the instructional technology you just named in mind, please answer the following questions.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I think that I would like to use this system frequently					
I found the system unnecessarily complex					
I thought the system was easy to use					
I think that I would need the support of a technical person to be able to use this system					
I found the various functions in this system were well integrated					
I thought there was too much inconsistency in this system					
I would imagine that most people would learn to use this system very quickly					
I found the system very cumbersome to use					
I felt very confident using the system					
I needed to learn a lot of things before I could get going with this system					

Keeping the instructional technology you just named in mind, please answer the following questions.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I find the system to be useful in my job					
Using the system enables me to accomplish tasks more quickly					
Using the system increases my productivity					

If I use the system, I will increase my chances of getting a raise					
My interaction with the system is clear and understandable					
It is easy for me to become skillful at using the system					
I find the system easy to use					
Learning to operate the system is easy for me					
Using the system is a good/bad idea					
The system makes work more interesting					
Working with the system is fun					
I like working with the system					
People who influence my behavior think that I should use the system					
People who are important to me think I should use the system					
The senior management of this business has been helpful in the use of the system					
In general, the organization has supported the use of the system					
I have the resources necessary to use the system					
I have the knowledge necessary to use the system.					
The system is not compatible with other systems I use.					
A specific person (or group) is available for assistance with system difficulties					
I could complete a job or task using the system...					
If there was no one around to tell me what to do as I go.					
If I could call someone for help if I got stuck.					
If I had a lot of time to complete the job for which the software was provided.					
If I had just the built-in help facility or assistance.					

I feel apprehensive about using the system.					
It scares me to think that I could lose a lot of information using the system by hitting the wrong key.					
I hesitate to use the system for fear of making mistakes I cannot correct.					
The system is somewhat intimidating to me.					
I intend to use the system in the next 12 months					
I predict I would use the system in the next 12 months.					
I plan to use the system in the next 12 months					

←-----DEMOGRAPHIC QUESTIONS-----→

Please answer the following demographic questions to the best of your knowledge

Department:

Number of courses taught (either currently or altogether):

- 0
- 1-2
- 2-5
- 5+

Ethnicity:

- American Indian or Alaska Native
- Asian
- Black or African American
- Hispanic or Latino
- Native Hawaiian or Pacific Islander
- Other (Please Explain)

Country of Origin:

We would like to be able to contact you for a short follow-up interview at your convenience. Please provide your contact information if you will be interested.

Name:

Email Address:

## **APPENDIX G (Focus group interview questions)**

### Organizational Culture

- Please describe the challenges that you face when it comes to using new technology in the classroom
  - Probe: from the department
  - Probe: from the college
- Based on your experiences or experiences that you have heard from colleagues, what suggestions do you have to facilitate the use of new instructional technology?
  - Probe: in terms of structure of the department

### Job-Related Factors

- Can you describe the average day in the life of a faculty member/TA?
- Why did you take time to use new technology in the classroom?

### Personal factors

- In terms of using new instructional technology, what are some of your personal characteristics or personal characteristics of your colleagues that helped facilitate the using new instructional technology?

### Usability

- Keeping just usability of the technology in mind, what has your experience been is using a laptop or tablet pc in the classroom?
- What would your ideal instructional technology be?

## **APPENDIX H (Expert Evaluation of Results)**

Based upon your expertise, please indicate if the following recommendations will help develop a technology-oriented organizational culture.

(+2 indicates that you strongly agree with this recommendation and -2 indicates that you strongly disagree with it.)

1. Provide annual faculty surveys that focus on their needs and requirements related to instructional technology use.
2. Based on results from above survey, make immediate attempts to discuss and rectify issues.
3. Encourage direct faculty input early in the strategic planning process.
4. Encourage open communication and 'open -door' policies.
5. Encourage trying new technologies and techniques in the classroom.
6. Allow faculty members of varying levels of experience to make more administrative decisions regarding instructional technology.
7. Provide regular reminders of strategic plan and goals.
8. Recognize faculty members who try new methods and techniques in the classroom
9. Recognize faculty members who provide informal assistance to peers through awards or monetary incentives
10. Review departmental policies with faculty members of varying levels of experience, and consider changes based on suggestions.
11. Encourage electronic documentation of required paperwork related to instructional technology use

12. Put all documentation regarding technology policies and support on the College of Engineering website.

As an expert in this domain, please briefly explain how you would facilitate developing a technology-oriented organizational culture.

Based upon your expertise, please indicate if the following recommendations will facilitate instructional technology acceptance.

(+2 indicates that you strongly agree with this recommendation and -2 indicates that you strongly disagree with it.)

1. Prior to any decision making, ease of learning and ease of use of all instructional technology should be evaluated by a team who is familiar with usability methods and has knowledge of the instructional domain
2. Based on above, evaluation reports with results should be centrally located and easy accessible, preferably on the COE website
3. All departmental system administrators should collaborate with the Instructional Technology team and act as the departmental liaison between the COE and the individual departments
4. The Faculty Activity Reports (FARS) should elicit more details of use of innovative instructional technologies/techniques in the classroom and be used as a basis for faculty awards.
5. Student course evaluations should elicit extensive information on the use of innovative instructional technologies/techniques in the classroom

6. Incentives to use technology should be provided in the form of awards based on student recommendation.
7. Graduate/Undergraduate mentors should be provided to faculty members with COE loaner computers. These mentors should have a background in instructional design and education
8. Identify faculty who use innovative technology/techniques within each department and provide them the added benefit of choice of classrooms for teaching.
9. Incorporate all levels of faculty (instructor, associate professor, etc.) input into the computer requirement decision-making process
10. Send regular newsletters to all faculties specific to instructional technology tools.
11. Redesign training modules using principles from Adult Learning Theory (Knowles, 1980) and findings from other research.

As an expert in this domain, please briefly explain how you would facilitate instructional technology acceptance.