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EMERGING AND DISRUPTIVE TECHNOLOGIES FOR EDUCATION: AN
ANALYSIS OF PLANNING, IMPLEMENTATION, AND DIFFUSION IN
FLORIDA'S ELEVEN STATE UNIVERSITY SYSTEM INSTITUTIONS

by

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in the College of Education
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ABSTRACT

The purpose of the study was to understand and appreciate the methodologies and procedures used in determining the extent to which an information technology (IT) organization within the eleven member State University Systems (SUS) of Florida planned, implemented, and diffused emerging educational technologies. Key findings found how critical it was that flexibility be given during the planning stages and not rely on standardized models which may or may not be of use any longer. Research also found that the SUS institutions have to be prepared to organize and preserve the deluge of digital data if they intended to remain relevant as a “tower” of knowledge transmissions. The literature found that institutions of higher education needed to keep abreast of the new technologies, new pedagogies, and never before open-access concepts because authors found these ideas were converging and producing an unprecedented period of innovation in learning. Furthermore, the implications of perpetual connectivity to information, peers, and teachers garnered a great deal of attention among educational technologists. However, those implications had not been gauged, especially in Florida’s SUS institutions. A survey of those institutions regarding how technologies were planned for, implemented logically, and thoroughly diffused, along with lessons learned could potentially save resources and ensure Florida’s institutions continue to be on higher learning’s forefront.

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CHAPTER ONE: INTRODUCTION

The ancient university had no campus; it owned no buildings; it was a loose community of professors and students with the professors often teaching from their apartments ... this was the University of Bologna, a virtual learning community long before it was formally recognized as an educational institution. (Rhodes, 2001, p. 2)

The founding of the University of Bologna in 1088, almost a thousand years ago, and the concepts of learning it began, has now come full circle. It took almost a millennium for institutions of higher learning, such as the University of Phoenix and Jones International University with their loose community of professors often teaching from their own homes and students learning from the confines of their apartments, for some parts of learning to evolve back into the conceptual learning community founded in Italy. It is not only possible, in large part to computers which are now able to be moved with such ease they are referred to as mobile devices, but more than likely it is the future of learning at and for every level of education. With computing technologies becoming mobile and embedded in every usable object, there is certain nearness in its application, an application that has the potential to disrupt how learning is interpreted, how it is physically situated, and how its delivery will be arranged. This close knit learning arrangement was not always so profound. Knowledge, though transmitted from teacher to student, was not always easy to conceptualize or visualize due to the lack of materials, technological instruments, and even text books.

The roots of American higher education learning were established in the Colonial era with the founding of Harvard University in 1636. John Harvard left money and his 260 book library to the fledgling college, thus introducing some of the first tools that a college needed to teach its students. Harvard was soon followed by other colleges that produced both “educated citizens and trained professionals” (Rhodes, 2001 p. 4).

Anderson (1962) researched for the U.S. Department of Education which types of materials and technology were used from 1650 through 1900. He found that the various institutions of learning, to include primary, secondary, and post-secondary levels, used various types of paper, bark, and a writing tool in order for students to visualize and understand information. However, it was not until 1810 at West Point Military Academy that the blackboard was first used in the classroom. It took twenty years, several text books written about how to use it, and many hands-on demonstrations before educators implemented this technology that changed the way information and interaction was done in the classroom, tipping it from a “curious innovation to essential technology for imparting information” (p.16-17). By 1830, educators were declaring the blackboard as “one of four essential apparatuses every school had to possess” (p. 17).

Bean (2008) found that innovative use of technologies in the classroom that could impact education also did not come easily or quickly. His research cited several examples of institutional educators resisting change:

From a teacher's conference in 1703: *“Students today can't prepare bark to calculate their problems. They depend on slates which are more expensive. What*

will they do when slate is dropped and breaks? They will be unable to write!”

From a principal's publication in 1815: *“Students today depend on paper too much. They don't know how to write on a slate without getting chalk dust all over themselves. They can't clean a slate properly. What will they do when they run out of paper?”*

From the National Association of Teachers Journal 1907: *“Students today depend too much upon ink. They don't know how to use a pen knife to sharpen a pencil. Pen and ink will never replace the pencil.”*

From the Rural American Teacher 1928: *“Students today depend upon store-bought ink. They don't know how to make their own. When they run out of ink they will be unable to write words or ciphers until their next trip to the settlement. This is a sad commentary on modern education.*

From the PTA Gazette 1941: *“Students today depend on these expensive fountain pens. They can no longer write with a straight pen and nib. We parents must not allow them to wallow in such luxury to the detriment of learning how to cope in the real business world which is not so extravagant.”*

From Federal Teachers 1950: *“Ball point pens will be the ruin of education in our country. Students use these devices and throw them away. The American values of thrift and frugality are being discarded. Businesses and banks will not allow such luxuries.”* (Bean, 2008, S4-9)

Anderson (2008) found that it took sixty years, beginning in 1948, for digital based computers to make information available to be read in plain text, and then forty years from the start of 1968 before the Internet made the readable information accessible. However, it has only been since 1998, that the first search engine made information into “a single database” (¶2). By 2008, the search engine giant Google™ introduced the mobile phone Android which was capable of accessing *petabytes* (author’s emphasis) of digitally formatted information as if it were coming from a mainframe or personal computer. Implementation of these such innovations, so much like the implementation of the standard classroom blackboard, would, according to Christensen and Horn (2008), “transform an organization” and that transformation was to be “implemented disruptively” (p. 14).

Fewer things have emerged as disruptively in the past two decades as the growth of technology in the classroom, e.g., the computer, which has and will continue to do so, according to McCain and Jukes (2001). These authors found that with the doubling of computer technological power throughout the 1990s, the United States had morphed into a high-speed, high-tech, computer resourced, and information-driven society. As a result of those changes, institutions of higher learning experienced an “ever more accelerated (learning) pace never before experienced in human history” (McCain & Jukes, p. 58-59). These authors also contended that educators were simply “unprepared for this pace, and consequently, have not been able to respond to it as quickly as the world outside of education has” (p. 58-59). By the time their research concluded, the pace picked up even

faster as the impact and emergence of mobile technology became an even more “credible and cost-effective component” of technology based learning (Kukulska-Hulme & Traxler, 2005, p. 1). These authors stated that mobile devices, “whether imbedded in the environment or carried around by their users, are redefining the nature of public and private spaces” (p. 2), were insuring that learning had become, and “is becoming more personal, and more connected to the surroundings and with more potential for connected, collaborative activity” (p. 3). Furthermore, Internet-based connected applications gave those involved in learning and teaching at the universities the ability to acquire, build, assemble, coordinate, and provide collaborative information on a more immediate timeline, thus enabling them to build new knowledge and education products (Kraemer, Sprenger, & Scheer, 2002).

In the universities of the 21st Century, new technologies offered the introduction of numerous tools and approaches to learning “to include blogs, wikis, podcasts, social bookmarking, virtual worlds, social networking services, and a myriad of mobile communication devices” (Collins, 2008, p. 52). These tools allowed learners to increase and build confidence in and over content, interaction, and they also allowed learners to be part and parcel of learning networks with experts and peers in and out of the classroom. In short, learning through the various forms of emerging technologies became ubiquitous in that learning was now an on-demand, everywhere, accessible and in-any-form by so many more people than ever thought possible (Collins).

It was clear that emerging technologies were not easy to implement into institutes of learning, but the innovations keep coming and their use outside the universities in business and government created demands for implementation inside schools. Rhodes (2001) believed that ongoing technological changes, due to their growth and daily change, would “reshape almost every aspect of our lives” (p. 207). He opined that universities, unlike businesses, industries, and governments have been “slow to apply it to their mainstream activities ... the business of learning, however remains largely untouched by this revolutionary technology ... most instruction is still a cottage industry, little influenced as yet by the benefits and support of modern technology” (p. 207). It was essential, as one researcher contended, that getting institutes of higher learning to plan, implement, and adopt emerging technologies would “allow people to work together more easily and open access to content are both the cause of change for universities, and a tool with which they can respond” (Bradwell, 2009, p. 8).

Purpose Statement

The purpose of this study was to determine the potential, readiness, and capability of State University System (SUS) institutions to assimilate and accommodate emerging educational technologies. The Florida SUS, comprised of ten universities and one college, included the following: University of Florida, Gainesville; Florida State University and Florida Agricultural and Mechanical University, both in Tallahassee; University of South Florida, Tampa; Florida Atlantic University, Boca Raton; University of West Florida, Pensacola; University of Central Florida, Orlando; Florida International

University, Miami; University of North Florida, Jacksonville; Florida Gulf Coast University, Fort Myers; and, New College of Florida, Sarasota. The SUS Board of Governors consisted of seventeen members appointed by Florida's governor and its mission was to "mobilize resources and diverse constituencies to govern and advance the state university system of Florida" (Florida Board of Governors, 2009).

In addition, the Board of Governors adheres to the following "Values" statement:

To support and advocate for high quality teaching, research and public service, we are committed to: (1) creativity, discovery and *innovation* [author's italics]; (2) student access, learning and success in the global community and marketplace; (3) collaboration, respect and appreciation of diversity; (4) transparency, shared responsibility and continuous improvement. (Florida Board of Governors, 2009)

The time for surveying how these higher education institutions assimilated and accommodated emerging educational technologies was now because it "(1) could cost less than the millions of dollars being spent on brick-and-mortar buildings; (2) could give access to more students than ever; (3) could be a driver for an economy requiring more and better educated workers; and, (4) will create a facilitating avenue for continuous learning as these technologies are 'always on, always accessible, and always in a known location because they become the classroom and the library which are never closed,'" according to Ramaswami (2009, p. 44-45). Emerging educational technologies demanded changes in ways of "thinking and doing" but educational institutions were "hesitant to embrace" them because the "implications are far-reaching and

discomforting” (p. 45). However, when changes in learning occurred in universities and colleges that cannot be ignored and, when the “scope of change is extensive” then, the change must be “planned and deliberate” (Horner, Abel, Taylor, & Sands, 2004, p. 80).

Ally (2007) found that “today’s and tomorrow’s learners were highly nomadic and continuously on the move” and as those learners moved around, they had to “be able to use the infrastructure in the different locations to access learning materials (hence) learning materials had to allow for easy access by the nomadic learners” using the emerged technology of the mobile phone “regardless of where they are located and which network infrastructure they are using to access information” (¶2). Furthermore “because of the increasing use of mobile technologies in society and by the younger generation,” Ally felt that “learners will demand course materials be delivered via mobile technologies so it could be accessed from anywhere and at anytime” (¶2). Therefore, this research was to determine if the adoption of “learn anywhere, anytime, and any place” was actively being planned, implemented, and diffused in the SUS institutions because the “proliferation of mobile technology in society, globalization, and the need to re-examine how learning materials are designed and delivered for the new generation of learners” was paramount (Ally, 2007, ¶1).

The research had a three-fold scope. The first scope was to present a perspective of why changes in emerging technologies would occur in higher education once understood and adopted; second, to determine if those same technologies could allow greater learner access through better delivery of instruction and content techniques; and,

third, to analyze what the SUS institutions were doing, have done, and will do to accommodate and integrate educational technologies into their respective institutions.

Statement of the Problem

During the 2007 Australian Society of Computers in Learning in Tertiary Education (ASCILITE) conference, presenters Kennedy, Krause, Judd, Churchward and Gray (2006) reported that “if universities were serious about enhancing learning through the use of innovative technologies, (then) much needs to be done to demonstrate how this might take place” (p. 15). The researcher examined how the Florida SUS institution’s information technology (IT) organizations were addressing how learning was and would be delivered through innovative emerging technologies and services. That research was accomplished through a survey instrument (Appendix F).

Mobile technologies are innovative because they are able to interface with ubiquitous computing platforms via the Web due to their low cost in relation to desktop computers and the spontaneous personal access provided to the resources of the Internet. When combined with wireless connectivity, it appeared that learning activities could be monitored and coordinated among a variety of locations and inputs could be received from various devices, hence, ubiquitous computing. “In fact, most now see the potential of the Web in the coming years as a tool for virtual teaming or collaboration, critical thinking, and enhanced student engagement, though not necessarily as a tool for creative individual expression,” according to authors Kim and Bonk (2006, p. 29). However, because the task of designing such activities and appropriate learner support was complex

and challenging, the impact on higher education via these technologies needed to be appraised and evaluated because “a ubiquitous learning environment is any setting in which students can become totally immersed in the/a learning process driven by the Internet, now delivered wirelessly” (Jones & Jo, 2004, p. 469). Therefore, this investigator believed that information delivered seamlessly and integrated into and by ubiquitous computer systems as learning, would be regarded as an emerging technology asset of highest value because it eliminated wasted travel, the need for newer buildings, and the destruction of forest required to publish and republish paper textbooks. Most importantly, it could very well expand the concept and implementation of lifelong access for all generations of learners.

The pervasiveness of wireless technologies and the Internet was “complete” with the entry of the fall 2008 freshmen into universities and colleges. This generation was “more at ease with online, collaborative technologies than today’s young people---‘digital natives’, who have grown up in an immersive computing environment” (Glenn, 2008. p. 5). This collaborative ease was a key to understanding that learning should come about both formally and informally, when it was most convenient, in any manner and place that facilitated lifelong learning, and it came from an institution of higher learning. Rhodes (2001) believed that this ubiquitous learning was about ideas without barriers, seamlessly integrating education into the flow of everyday life, innovating without boundaries, and exploring new technologies and interconnectivity that transforms the when, the where, and the how of the learning process. To Rhodes, it was also about reaching as many

learners as possible, providing content to them, and then having a learner create his/her own content to pass onwards.

The ubiquitous learning revolution was fed by emerging technologies such as wireless access, which in and of itself was good, but it would be better if the technology was fed by the institutions of higher learning so that the learning revolution created an environment where all could learn and teach each other. Therefore, it was important to determine if the various researched emerging technologies were able to be integrated and adopted in Florida's SUS member institutions.

Research Questions

Four questions guided this investigation:

1. Which planning strategies to incorporate educational technologies were considered by Florida's SUS institutions?
2. What are the common descriptive patterns of implementation of innovative educational technologies by Florida's SUS institutions?
3. What are the challenges and opportunities associated with the diffusion of innovative educational technologies by Florida's SUS institutions?
4. What were the most/least problematic mechanisms or factors in regards to examining innovative educational technologies by Florida's SUS institutions?

Definition of Terms

Educational Technology (also called learning technology): “The study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources” (Richey, 2008, p. 24). Educational Technology includes, but is not limited to “software, hardware, as well as Internet applications and activities” (Educational Technology Tools and Advice, 2009, ¶1).

Cloud Computing: “A collection of resources—applications, platforms, raw computing power and storage, and managed services (like antivirus detection)—delivered over the Internet” (Lasica, 2009, p. 5). The cloud refers to “virtual servers, distribution hosting and shared resources available over the Internet” (p. 6). Using National Institute of Standards and Technology (NIST) research, Foley (2009) defined cloud computing as a “model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction” (p. 34).

Disruptive Learning Innovation: Concepts, phenomena, and discoveries that have the potential to create transformative effects in education and use “a network of existing and future technologies to facilitate a transformational learning space that infuses collaborative learning, thinking, teaching/facilitation, learning tools and open educational resources beyond the course paradigm to either students or faculty” (Alsagoff, 2009,

¶26). Two specific disruptive innovations are a technology and a process, both of which threaten to be disruptive: teaching with database technology; and, wireless communications (Siemens, 2004).

Disruptive learning innovation is also defined as what happens when an emerging “technology is introduced and embraced by some. The innovation is disruptive because it champions, more than previous technologies, the efficient and agile companies/organizations more than the inefficient/non-agile groups. It then provides new opportunities for competition because it can level the playing field, allowing broader groups of people to do things that only the experts or privileged could do previously” (Reynolds, 2003, ¶3). Compact disc that contained music overtook the vinyl phonograph industry; digital cameras eliminated 35mm film production; and the mobile telephone, computer and Internet, the most disruptive technologies yet, have yet to see their full innovative potential opines Christensen, Johnson, and Horn (2008). Finally, Wittmann (2009) believed that “by definition a disruptive technology must change the cost of doing business” (p. 46).

E-learning: “The delivery of learning or training using electronically based approaches, mainly through the Internet, intranet, extranet, or Web (the e is shorthand for *electronic*, originally popularized for e-mail, the transmission of messages digitally through a communication network)” (Sloman, 2002, p. 5).

Learning: “The physical and mental process involved in changing one’s normal behavioral patterns and habits. Learning lies within the domain of the individual; which

can result in a whole range of experiences; and can be positive, negative, or neutral from the organization's point of view" (Sloman, 2002, p. 5).

mLearning: Learning that might take place independent of location and made possible through the use of mobile devices. "Mobile learning has the following characteristics: ubiquitous—anywhere, anytime access; bite sized—components are relatively short in duration; on-demand—'always on' to deliver content at the point of need; blended with other technologies—mobile technology is not the primary delivery platform; can be collaborative—most mobile devices facilitate communication; and, can be location dependent but does not have to be" (Bingham & Walsh, 2007, p. 3-4). mLearning is "spontaneous, personal, informal, contextual, portable, ubiquitous and pervasive, credible, cost-effective component of on-line and distant learning" (Kukulaska-Hulme & Traxler, 2005, p. 2).

mLearning devices: Electronic systems such as cellular phones, pocket personal computers, laptop computers, Personal Digital Assistant (PDA), tablet personal computers, MP3[®] players, devices operated via Bluetooth[®], internet "hot" spots, digital cameras, devices with multiple functions (phone/digital assistant/music and video player/camera), Radio Frequency Identification (RFID) tags, all of which are "supported by ambitious, shifting, emergent infrastructure networks of connectivity, access, and payment" (Alexander, 2004, p. 28).

SurveyMonkey.com: "SurveyMonkey is an easy-to-use tool for the creation of online surveys. Its primary strength is its intuitive Web interface, which makes it easy for

even non-technical folks to create surveys and export collected data. It has advanced features, like the ability to branch questions based on response and exporting to different formats, including HTML, CVS and SQL” (Westin, 2005, ¶ 2).

Ubiquitous Learning Environment: Also written as ULearning, it is “any setting in which students can become totally immersed in the learning process. Ubiquitous equals pervasive, omnipresent, ever present, everywhere; Learning equals educational, instructive, didactic, and pedagogical; Environment equals surroundings, setting, situation, atmosphere” (Jones & Jo, 2004, p. 469). In the future, wireless devices will “respond to information transmitted to them from countless devices embedded in the environment and generate dynamic models of the current situation, recall past situations and offer potential solutions to anticipated needs or problems” (Kukulaska-Hulme & Traxler, 2005, p. 201).

Ubiquitous Computing (UbiComp): “A new genre of computing in which the computer completely permeates the life of the user. ... Computers become a helpful but invisible force, assisting the user in meeting his or her needs without getting in the way. ... Computers are to be everywhere, unobtrusive, and truly helpful” (Weiss & Craiger, 2002, p. 44-45). The term was originated by Mark Weiser who saw “ubiquitous computing ... as the third wave in computing” (Yoon & Kim, 2007, p. 102) following the mainframe era (first wave) where the computer was shared with many people; personal computing (second wave) with “person and machine staring uneasily at each other across a desktop” (p. 102); to the era of calm technology (third wave) where technology receded

into the background and becomes unobtrusive because it is part and parcel of the wireless communication stream (Weiss & Craiger, 2002) (Rogers, 2006).

WiFi: “Wireless Fidelity, is a set of standards for facilitating wireless networks in a local area and enables those with WiFi enabled devices to connect to the internet when in range of an access point (often available in internet cafes, airports, libraries, college campuses)” (Kukulska-Hulme & Traxler, 2005, page 201).

Significance of the Study

Rhodes (2001) asserted that existing and future technologies would create and transform the landscape of higher education in that:

The traditional model of education has as its goal knowledge and a degree. The new model has as its goal competencies and skills. The traditional model of education is site-based, requiring physical classrooms and labs. The new model is unconstrained, requiring only an interactive terminal to give a virtual classroom. The traditional curriculum is standardized, with choice constrained. The new curriculum is individualized, with unlimited choices. The traditional model is based on faculty presentation. The new model is based on student discovery. The traditional model is based on a fixed calendar. The new model allows a flexible schedule. The traditional model is faculty-centered. The new model is student-centered. The traditional model is cost-intensive. The new model is cost-effective. The traditional model involves buying the “whole package.” The new model involves personal choice of particular courses or programs from many competing

institutions. The traditional model involves one-time presentations with limited interaction. The new model allows repetition of presentations and is highly interactive. (pp. 212-213)

Mobile technologies, known as hand held computers, PDAs, mobile phones, lap tops, and the i-Phone, are all part of the emerging information revolution taking place worldwide. No longer are people stuck behind large computers on desktops, or made to carry laptops and find internet connection, according to Garreau (2008), but now, knowledge and learning is literally at a person's fingertips via the mobile phone. With a greater diversity of students entering higher education, which includes even larger numbers of non-traditional students, many with full or part time jobs, the requirements for educating them and allowing them access are at odds with the traditional university schedule of classes, professors, and activities. Several decades ago, when the nontraditional student began impacting higher education, distance education, asynchronous education and open or virtual learning emerged as a way to continually educate students. Rapidly evolving technologies drove nontraditional learning, as it continues to drive it today. In short, technologically driven learning, when properly undertaken, perhaps changes an institute of higher learning from one that "exists to provide instruction" to one that "exists to produce learning" (Ally, 2007, ¶13).

Conceptual Framework

The concept of emerging disruptive innovations as researched by diffusion of innovations (DOI) theorist Rogers (2003), the adoption of process innovations by

researchers Mustonen-Ollila and Lyytinen (2003), and the tipping point concept articulated by Gladwell (2002), formed the framework of the research. These authors advocated the adoption of innovatively conceived technologies to transform education. Higher education institutions, therefore, if organizing their learning concepts around ubiquitous computing devices should realize what types of disruption, diffusion, and processes occur when implemented. Even though this research was centered upon the institutions of higher learning, businesses also dealt with emerging disruptive innovations that significantly impacted their mission and customers. This paralleled what educational institutions faced, because like institutions of higher learning, “companies can’t just import the latest fads in innovation to cure what’s ailing them. Instead, they need to conquer their existing processes for creating innovations, pinpoint their unique challenges, and develop ways to address them” (Hansen & Birkinshaw, 2007, p. 122).

Rogers (2003) innovation-diffusion theory provided a useful framework for addressing how changes could or should be implemented throughout learning-based institutions. According to his model, the diffusion of innovation followed a five stage process. The first was the “knowledge stage,” where there was exposure received by an institution regarding an innovation’s existence (p. 216). Second, the “persuasion stage” where an individual or institution formed a favorable or less than favorable (unacceptable or unusable) attitude towards the innovation (p. 216). The third stage involved the decision process, i.e., when an individual and/or institution engaged in “activities that lead to a choice to adopt or reject the innovation” (p. 216). The fourth stage,

implementation, involved the institution putting an innovation into practice. The fifth and final stage came about when the institution “confirms and seeks reinforcement for an innovation-decision already made but could reverse the decision if exposed to conflicting messages about it” (p. 217).

Mustonen-Ollila & Lyytinen (2003) investigated the adoption of process innovations in order to identify common items that would serve to integrate mobile technologies into a ubiquitous computing system. The most common items, which the researcher’s survey would reinforce, included: “the innovation factor and the ease of use; task factors which include the user need to recognize the innovation; individual factors of using the technology; environmental factors that govern the technological infrastructure; and, organizational factors, which include past experiences in implementing technologically innovative processes” (p. 286). The authors used concepts found in the diffusion of innovations theory from Rogers (2003) to consider factors that impact the adoption of innovation and then distinguished “two broad sets of activities” (p. 278). These two sets of activities included “initiation” and “implementation” which to them were key concepts to the adoption of process innovations (p. 278).

In the *Tipping Point*, Gladwell (2002) cited three change agents as a framework for understanding disruptive technologies: the “Law of the Few,” the “Stickiness Factor,” and the “Power of Context” (p. 19). In the Law of the Few, he related the concept of the “messenger” or the type of person who spreads the message of an innovation. Gladwell believed there were three types of messengers who could facilitate

change: “connectors are those who have a large circle of acquaintances, but they associate with the right kind of people—those who represent a variety of cultures and social groups. The connectors usually like most people they meet or at least willing to stay in contact with everyone they meet as they may be useful at some point” (p.48). “Mavens are those who accumulate knowledge. They are obsessive in collecting it and they want to tell everyone else about it, but they are not persuaders” (p. 60). “Salesmen are those who seduce those they communicate with and they cannot be resisted through use of verbal and non verbal cues (which are more important)” (p. 79). Key to adoption was not only who delivered the message, but how the message was conveyed by these facilitators.

The “Stickiness Factor” ensured the message was heard and that the content of the message “was so memorable that it can create change, that it can spur someone to action” (Gladwell, 2002, p. 92). The message needed to be tried several times to make it irresistible—that is, tinker with the presentation, but the content was the same. The “Power of Context” was sensitivity to the “conditions and circumstances of the times and places in which they occur” (p. 139). Not only did the time of day and the location make up the context and play a part in the speed with which something became a craze, but also “the individual receiving the message—he/she was shaped by the external environment and the features of our immediate social and physical world—played a huge role in shaping who we are and how we act” (p. 168). Therefore Gladwell opined if a group was used to incubate/disseminate the message it had to be kept below 150 members in order

to create a “tipping point.” If there were more than 150 members, Gladwell believed his framework for innovation would suffer “structural impediments to the ability of the group to agree and act with one voice” (p. 182).

Finally, Gladwell’s “Law of the Few” acknowledged that there were certain people capable of initiating and encouraging “epidemics”—finding these instrumental individuals is the only requirement. The lesson of stickiness to Gladwell was always the same, i.e., there was “a simple way to package information that, under the right circumstances, makes it irresistible” (p. 20-22). These contextual frameworks of ideas from the above mentioned authors were used to construct the survey (Appendix F) and frame the findings.

Context

The State University System (SUS) of Florida, and the institutions of higher learning that are a part of it, was the focus of the research survey. The SUS, established in 1905, was composed of eleven institutions, ten universities and one college, which supported over 300,000 students. The SUS, governed by the Florida Board of Governors, is a seventeen member organization consisting of fourteen appointed members and three permanent staff members. Table 1 shows pertinent information regarding those institutions.

Table 1

State University System (SUS) of Florida

University	Established	Carnegie Classification	FTIC Acceptance Rate	Students	Campus Area
Florida A & M University	1887	Doctoral/Research	60%	11,848	422
Florida Atlantic University	1961	Research (high)	46%	27,700	850
Florida Gulf Coast University	1991	Master (larger programs)	65%	10,221	760
Florida International University	1972	Research (high)	42%	39,146	584
Florida State University	1851	Research (very high)	46%	41,065	1,550
New College of Florida	1964	Baccalaureate	57%	785	110
University of Central Florida	1963	Research (high)	44%	53,537	1,415
University of Florida	1853	Research (very high)	57%	52,271	2,000
University of North Florida	1972	Master (larger programs)	52%	16,641	1,300
University of South Florida	1956	Research (very high)	42%	47,122	1,913
University of West Florida	1967	Doctoral/Research	69%	10,491	1,600

Note. Sourced from Florida Board of Governors: Fact books (2009) website, Carnegie Foundation for the Advancement of Teaching: Institution look-up (2009b) website, Florida A & M University, Florida Atlantic University, Florida Gulf Coast University, Florida International University, Florida State University, New College of Florida, University of Central Florida, University of Florida, University of North Florida, University of South Florida, & University of West Florida Institutional Research, About, History, and Freshman Profile (2009) websites.

The key member of an SUS institution who dealt with information technology was the targeted subject of the survey in order to discover how that institution planned, implemented, and diffused emerging technologies as tools to enhance learning.

The senior SUS institution was Florida State University, established in 1851, while the newest institution, Florida Gulf Coast University, was established in 1991. The institution with the largest enrollment, the University of Central Florida, was established in 1963. New College had the smallest enrollment and awarded only the bachelor's degree. Chapter 3 has a detailed analysis of each member of the SUS.

Limitations of the Study

The research was limited to the responses from the targeted individual employed in a Florida SUS institution and was selected by virtue of his/her responsibility for adopting innovative learning technologies. This individual was the institution's information technology (IT) organization Chief Information Officer (CIO). Results were limited by the number and quality of the returned surveys. Because of these limitations, the findings may not be generalizable to public or private community colleges, private college and universities, and institutions outside the state of Florida.

Assumptions

The study made the following assumptions:

1. The overall head of Information Technology (IT) or Chief Information Officer (CIO) within each contacted institution will participate in the survey.

2. The contacted institutions will have electronic delivery of instruction and resources.

3. Participant responses will provide accurate data regarding the institution's implementation of innovative educational technologies.

Organization of the Study

Chapter One dealt with the specific concepts and components of emerging technologies' impact on ubiquitous learning, the research questions, and research methodologies. Chapter Two presented a review of the related literature and research relevant to the research questions posed by the study. Chapter Three described methods and procedures used in the collection and analysis of data, via a survey, for the study. In addition, there was a complete description and analysis of the eleven institutions composing the State University System of Florida. Chapter Four included data analyses with an emphasis on results obtained from the survey. Chapter Five provided a summary of conclusions and recommendations for further study regarding the change and growth in technologies for education.

CHAPTER TWO: REVIEW OF LITERATURE

Introduction

A review of relevant literature provided an analysis of technology changes that were incorporated into or adapted by learning institutions since the founding of America. The review also provided a present day analysis of emerging learning technologies in education and how they are becoming synergized by innovations that now make them highly mobile and more useable. Finally the review highlights the move away from the past and current views of learning technologies individually and examined how the various emerging technologies will function in the future as a “rich, collaborative ... experience, whether in classrooms, homes, or on the streets of a city” (Naismith, Lonsdale, Vavoula, & Sharples, 2004, p. 1). In the world of emerging learning technologies, it was important to not only understand their various functions from a past and present perspective, but to understand the “strengths and weaknesses in terms of its actual application and their potential impact on higher educational institutions” (Bates, 2005, p. 2).

The Past as Prologue

From the founding of Harvard in 1636, post secondary institutions have been traditionally entrusted with the task of preparing “students for collaborative positions of responsibility and leadership in society” (Lucas, 2006, p. 104). Each of the eight colleges founded before the Revolutionary War were equally entrusted to the same principles even though the Crown’s (England) royal Attorney General “opposed funding higher

education on the grounds that the purpose of the American colony was to raise tobacco” (p. 105). Very little improvement in educational learning techniques were performed in the few existing institutions as Anderson (1962) found. From the mid-1600s to the mid-1800s, education in general and innovative technology specifically “was in a pre-industrial state.” Therefore, most “instructional apparatus” such as quills and ink were handwork products that could be produced by a semi-skilled worker in a very short time. Textbooks in that period were more dependent upon technology, i.e., water powered printing plants, than other school equipment which could still be hand manufactured. Because textbooks were in “a crude state” and everything else needed for instruction handmade, Anderson concluded that “technology had made very few inroads in the field of education” (p. 1).

However, by the mid-1800s, institutions of higher learning began to experience exponential growth due to the passage of the 1862 Morrill Act, a bill that led “to the creation in every state a new kind of college that was distinctly American” (Rhodes, 2001, p. 5). The Morrill Act, followed by the Hatch Act of 1887, provided federal funding for research and experiment stations (as did the subsequent Smith-Lever Act of 1914), and allowed higher education institutions to create “extension programs designed to bring to their communities the benefits of new campus-based research” (p. 6). Key technology tools used by these institutions included laboratories, science research, and textbooks which were able to be published and widely distributed due to the rapid growth of printing plants, typesetting and publishing, public libraries, and rapid delivery

capabilities by expanding railroads. By the end of the 19th Century these technologies helped institutions of higher learning create residential campuses which embraced all types of learning: liberal arts, sciences, graduate work, and education (Rhodes, 2001).

In the not too distant past, an earlier revolution, begun in 1900, was educator John Dewey's (1900) characterization that the rapid transformations of social, economic, and cultural worlds of learners in school, brought on by the industrial revolution's growth in technology, were so transformed that,

One can hardly believe there has been a revolution in all history so rapid, so extensive so complete. Through it the face of the earth is making over, even as to its physical forms; political boundaries are wiped out and moved about, as if they were indeed only lines on a paper map; population is hurriedly gathered into cities from the ends of the earth; habits of living are altered with startling abruptness and thoroughness; the search for the truths of nature is infinitely stimulated and facilitated, and their application to life made not on practicable, but commercially necessary...That this revolution should not affect education in some other than a formal and superficial fashion is inconceivable. (p. 9)

By 1894, the use of technology really expanded with the introduction and recognition of the "educational possibilities" of the stereopticon (Anderson, 1962, p. 50). The stereopticon was a high dollar investment not only for the equipment, but for operator training as well. However, this "slide projector was immediately recognized by the world of education as the vanguard of a new field of visual aids" (p. 50). From this "pioneer

visual aid apparatus, there developed after 1900 a number of educational devices based directly or indirectly on the same principle—the filmstrip in the 1920’s, microfilm in the 1930’s, and the tachistoscope in the 1940’s—not to mention the obvious contributions of the motion picture industry” (p. 50). Anderson further contended that these visual devices were “a voice in the wilderness prophesying a real technological revolution in education. And yet, even this device had no great impact on education in its own era” (p. 50). His conclusion was that technology from the “colonial period of 1650 to the beginning of 1900 made very few inroads into the field of education,” but then opined that the “real revolution (in education) was yet to come” (p. 50). Table 2 is a timeline of the technologies whose emergence impacted learning innovations in America’s educational institutions.

Table 2

Innovative Technologies Timeline

Date	Description
1436	Gutenberg’s use of printing presses with replaceable/moveable wooden or metal letters allow books to proliferate
1639	First official published notice for establishing postal service throughout the Colonies
1703	Slate replaces bark as primary writing tablet in schools
1812	Pencils began production in America by Monroe in Massachusetts following boycott of imported European pencils
1815	Commercially produced paper introduced into schools
1830	Blackboards proliferate after West Point Military Academy demonstrate the efficacy for delivering information

Date	Description
1873	Distance learning via correspondence courses begins; US mail becomes the primary delivery mode
1876	First use of the telephone based on United States Patent No. 174,465 issued to Alexander Graham Bell, demonstrated
1877	Edison makes first recording of a human voice on tinfoil cylinder phonograph
1894	Stereopticon introduced—glass slide projector system to aid in visual learning
1907	Commercially made pens widely available: their widespread use in classrooms eliminate the goose feather quill
1918	Radio licenses for educational purposes granted to schools
1920	Filmstrip, an improved technology for projection of materials, introduced into schools
1922	Motion picture technology, via Thomas Edison’s invention, proliferate in secondary and post-secondary schools
1928	Commercially produced ink replaces in-school brewing
1930	Microfilm technology integrated into school by libraries, expanding resource materials
1940	Tachistoscope gained widespread use in classrooms
1941	Fountain pens replaced pens, steel nibs, and barrels of commercial ink in schools
1945	Mainframe computer era launched via Mark I, ENIAC, EDVAC, and Manchester Baby computers at MIT, Harvard, University of Pennsylvania, and University of Manchester (UK)
1947	Transistors replaced vacuum tubes in mainframe computers; slave screens made available to a single user
1950	Ballpoint pens replaced fountain pens as a key writing instrument in schools
1953	Television introduced into classrooms for educational use
1958	Semiconductors replaced transistors in mainframe computers: third-generation programming languages introduced; multiple screens out of mainframes allow for access by more than one user at a time
1959	Texas Instruments introduced the solid integrated circuit, or, as it came to be called, the microchip

Date	Description
1960	Video players, tapes, recorders introduced into classrooms
1963	Philips demonstrated the first compact audio cassette
1964	Multiplexing of remote screens to mainframe computer successfully commercialized at Dartmouth
1969	First "Request for Comments" (RFC 1) published, setting Internet protocol standards in place without government regulation or interference. Internet begins with first message sent from UCLA to Stanford; two additional nodes link together to form the Department of Defense Arpanet System
1971-73	Arpanet expanded to 23 American colleges; then to University College London, making network international
1973	Cellular phone call placed by Martin Cooper, Bell Labs, to his colleagues; first in nation
1977	Computers for home and school use introduced by Apple
1980	Tele-training via computers hooked into a mainframes proliferate in colleges for teaching use
1981	Personal computer introduced by IBM
1982	Graphical user interface (GUI) created and used in Apple's personal computers
1983	Apple's Macintosh released as first large scale personal computer
1983	Microsoft releases Windows operating system using GUI and interface with IBM PCs
1984	Arpanet network added 1,000 th host site. Creates domain names, email, and file transfer protocols, newsgroups, and enabled communication functions to network
1986	NSFnet succeeded the Arpanet with release of 56Kbs speed
1987	NSFnet hosted the 10,000 th site onto the internet system
1989	NSFnet hosted the 100,000 th site on the internet system: adds Canada, Denmark, France, Iceland, Norway and Sweden to the US network, making internet global
1990	Internet hosted the 1,000,000 th site connection to network: World Wide Web, invented by Tim Berners-Lee, interfaced into the Internet. Personal Computers (PC) required by freshmen entering Drake University
1991	Microsoft Corporation released Windows 3.0 operating system and Internet Explorer for web searches

Date	Description
1995	Search engines emerged for unprecedented access to information sources using natural language
1996	Laser disc and VCRs in widespread use in schools
1997	Connecting devices to computers adopt 802.11 frequency standards for wireless networking
1997	Second generation mobile telephones achieved interface with computers via 802.11 frequency standards
2000	Web based PCs saturated the Internet; search engines and web tools proliferate; wireless hot spots opened
2001	Palm Personal Digital Assistants (PDA) required by high school students entering a school in North Carolina. All undergraduate and professional students issued a Palm PDA at University of South Dakota orientation
2007	Internet established in facilities of 1,000,000,000 users; 100,000,000 th website created
2008	3,000,000,001 st person acquired mobile phone; laptop and net books exceed PC sales. Abilene Christian becomes first university in US to provide freshmen an iPhone or iPod Touch to receive information regarding class assignments, homework, surveys, quizzes, checking account balances and access to other useful service applications
2009	Wireless hot spots available in 220,000 places within the United States. University of Missouri School of Journalism required undergraduates to acquire iPhone or its equivalent
2010	Steven Jobs, CEO of Apple, announced the iPad

Note. Sourced from Bates (2005, p. 42-43), Adelsberger, Collis, & Pawlowski (2002, p. 23-41), Cuban (1986, p. 9-50), Katz (2008, p. 7-11), Anderson (1962, p. 3-50), Crocker (2009, p. A25) and Kolowich (2009).

Up to this point the reviewed literature pointed out how slowly it took mainstream technology applications, taken for granted today, to appear in the institutions of higher education. While the general public acquires certain technological applications and uses them, there is probably a question as to why higher education does not embrace them and implement them in the institution. As demonstrated, applications did take time to make

inroads into learning institutions, but once adapted, they tended to set the bar higher, move faster, and create more application than previously envisioned.

Inroads

Bates (2005), as a researcher and practitioner in observing and working in emerging learning technologies that impact education, concluded there were three revolutions of learning taking place in the institutions of higher learning. The *first generation* (author's emphasis) was characterized by "use of a single technology and lack of direct student interaction with the institution providing the teaching" (p. 6). This first generation was usually a for-profit company that "would provide reading lists of books and articles to students who would study independently. ... The company would hire tutors ... to mark assignments ... give feedback and prepare students to take a competitive examination from a recognized or accredited institution" (p. 7). The *second generation* revolution came about with the "integrated multiple-media 'print + broadcasting' approach, with learning materials specifically designed for study at a distance, but with communication with students mediated by a third person" (p. 7). The innovative technologies used by institutions in the second generation served many students and those that enrolled over 100,000 at a time were considered "mega-universities" (p. 7). The *third generation* revolution began when education was delivered using two-way communication systems "such as the Internet or video-conferencing that enable interaction between the teacher who originates the instruction and the remote student" (p. 7). Finally, the growth of third generation for education was due to the

“expansion of the Internet, World Wide Web, digitally created materials that are interactive, e-mail, bulletin boards and digital video-conferencing” (p. 8).

An important first generation revolution milestone came in the late 19th Century when activities in higher and adult education began to surface with Anna Ticknor’s establishment, in 1873, of a school based upon correspondence instruction sent out to tens of thousands of members over more than two decades (Nasseh, 1997). Instructional materials were delivered to students via mail, the key delivery system for communication, instruction, and feedback for the faculty and students, according to Nasseh. By 1919, more than seventy colleges and universities offered instruction and degrees via correspondence and the popularity of the concept grew to the point that William Rainey Harper, president of the University of Chicago and an early enthusiast of distance learning via correspondence instruction declared, “The day is coming when the work done by correspondence will be greater in amount than that done in the classrooms of our academics and colleges; when the students who shall recite by correspondence will far outnumber those who make oral recitations” (¶4).

That prediction could have been true but for the federal government, which from 1918-1946, granted radio broadcasting licenses to over 200 colleges who used that emerging technology, sparingly, for instructional purposes (Cuban, 1986). But before the radio as an instruction system could be widely implemented, film systems arrived on campuses in 1922 and their use expanded so rapidly that Thomas Edison declared “that the motion picture is destined to revolutionize our educational system and that in a few

years it will supplant largely, if not entirely, the use of textbooks” (p. 9). Films used in classroom instruction “became a symbol of progressive teaching approaches, just as the microcomputer is today” (p.12), however, enthusiasm for film never gained a technological innovation stronghold because of four obstacles: “a teacher’s lack of skills in using equipment and film; the high cost of films, equipment, and upkeep; the inaccessibility of equipment when needed; and, the need to find and fit the right film to the class” (p. 18).

Along with motion picture technology in the educational settings, the radio was introduced. By 1920, the Radio Division of the U.S. Department of Commerce “began licensing commercial and educational stations” which led to classroom broadcasting to “enhance instruction spreading rapidly until the advent of World War II” (Cuban, 1986, p. 19). Universities were on the forefront of this technology as early as 1917 when the University of Wisconsin began broadcasting music programs. Overseas, in October, 1924, the British Broadcast Corporation (BBC) transmitted its first adult education program nationwide in an attempt to stir interest in a “broadcasting university” (Bates, 2005, p. 42). By the early 1940s, the University of Wisconsin was “a fixture in the Midwest, broadcasting eleven series of instructional programs” (Cuban, 1986, p. 21). The University of Minnesota also produced and aired programs, mostly “aimed at high-school students” and not to their own students in the college (p. 21). Hardware availability suggested there was far more accessibility to radio programs than film,

“although no one can suggest that the ultimate in technological saturation—having a radio receiver in each classroom—was ever reached” (p. 22).

In a 1941 survey, eight reasons were cited for lack of using radio in educational settings. These included: no radio-receiving equipment; school schedule difficulties; unsatisfactory radio equipment; lack of information; poor radio reception; programs not related to curriculum; class work more valuable; and, teaching staff not interested (Cuban, 1986, p. 25). By the 1950s, radio failed “to become as common in the classroom as the blackboard” (p. 26) and the promise of the technology failed to materialize by the time educational television became viable. But the innovation of radio was used as a “foundation for the development of educational television” introduced in the 1950s (p. 9).

The learning technology of television was introduced into schools in 1953 and continued until 1983. The first transmissions came from television station KUHT in Houston when it broadcasted “instructional curriculum inside classrooms” (Cuban, 1986, p. 27). Television transmission technology developed rapidly after 1961 when over “\$20 million was invested in school systems and fifty colleges across the country by the Ford Foundation for the Advancement of Education” (p. 28). With the renewal of the National Defense Education Act in 1962, Federal assistance “entered the arena of instructional technology” (p. 28). The impact of this innovative technology pivoted upon its “accessibility, purpose, and use” (p. 28) and would be highly dependent upon the teacher-as-gatekeeper as for its usefulness in instruction.

By the mid 1960s, the baby boomer generation began entering colleges in large numbers. Their ability to transport themselves to college via the automobile led to the advent of the commuter rather than a residential institution of learning. The era of the Space Age ushered in the necessity to “learn new competencies” as well as how to teach and create courses in a more non-traditional setting (Nasseh, 1997, ¶10). The television set in the classroom was revived during this time by the innovative VHS player/recorder with high quality video tapes. Fax machine technology became cheap enough for family and personal use and soon found its way into the offices of professors. Hand-held cassette tape recorder/play devices added to the ability of institutions to receive inside the classroom as well as deliver instruction outside it (Nasseh, 1997).

In the early 1980s, tele-training with mainframe computers “managing the inputs and outputs” were mature enough to be widely adopted for instructional purposes by the military, corporations, and universities, so much so that the National Teletraining Center (NTC) in Ohio was established by the American Telephone and Telegraph Company (AT&T) to “investigate, develop, and demonstrate innovative applications for state-of-the-art telecommunication technologies” (Chute & Balthazar, 1988, p. 1). These innovative delivery media included “audio, audiographic, and video, using conventional telephone lines which were controlled and networked by computers” (Chute, Balthazar & Poston, 1992, p. 9). During this 15 year period, lasting until the mid-1990s and the advent of the World Wide Web and computer enhancements, teletraining technology was totally focused on delivering educational programs that were “effective, efficient, and

affordable” (p. 11). These authors concluded that teletraining provided an alternative to face-to-face training and it was more affordable as well as effective. However it turned out that “better-faster-cheaper” was not sufficient enough. The concept of “appeal” had to be considered (p. 11).

One concern of the research conducted by the NTC was how to diffuse sophisticated teletraining (TT) technology into an institution “without adversely affecting the social environment” and if the change could be facilitated by three things: “(1) Knowledge of the client’s training needs and how those needs are being addressed in the client’s current training environment, (2) An understanding of how teletraining differs from other innovative training delivery strategies, and, (3) An awareness of the educational and psychological factors that affect the implementation of a teletraining system” (Chute & Balthazar, 1988, p. 9).

The implementation of such an innovation such as teletraining was not to “be an entirely prescriptive process” but rather a collaborative one between the “client and the change agent on how the implementation should take place” (Chute & Balthazar, 1988, p. 9). For teletraining, the considerations of “timely training, reduction of travel costs, increased productivity” were part and parcel of convincing an institution of the “effectiveness of TT as an instructional medium” (p. 9). Chute and Balthazar also found that in planning for learning innovations, mutual involvement helped the user overcome a natural resistance to attempt something innovative. They articulated a seven-stage process individuals and institutions had to attempt known as the “concerns-based

adoption model” (p. 9). The seven stages included: “(1) the awareness stage, (2) the information stage, (3) the personal stage, (4) the management stage, (5) the consequences stage, (6) the collaboration stage, and (7) the refocusing stage” (p. 9). The authors found by understanding these stages, an emerging innovative technology came under more scrutiny and this served as a “useful diagnostic tool to help identify where more focused effort was required during the implementation process” (p. 9).

However, before more thorough and complete research could be concluded on a wider scale, advancements in computer technologies overtook any further TT development and refinement. Their study ended with some very forward looking future directions that computer enabled instruction could take. Chute and Balthazar (1988) found that institutions of higher learning, as well as corporate training organizations, would be facing many challenges in “providing quality educational programs for an ever-increasing number of students who were globally dispersed because the information age and the high rate of technological change had opened up so many new job opportunities for millions” (p. 10). They called for the creation of a system that provided users with the “ability to access automated, educational data bases” (p. 10). The technology-based system had “to be easy to use, easy to support, and easy to manage (and) information should be made available, on-line databases backed by support and documentation (and) accessed through personal computers and terminals with natural language queries and commands” (p. 10). Such a system, they opined, “should also have the capability to assist users in narrowing or broadening the search for information and should have the

capability to monitor user-patterns” (p. 10). They concluded their study by proposing more research be conducted and especially focused on “message design attributes for emerging technologies” so that the development of an information management and dissemination system could be created (p. 10).

At this point in the review, three generations of learning, enhanced by emerging technologies have yet to be recognized by institutions of higher learning. Students, it appeared, made those institutions aware of more and better ways (to them) to gather information, the critical currency of any century, but even more critical for the 21st Century.

Disruptive Education

During the fall semester 1990, using a prototype learning management system, Drake University in Des Moines, Iowa “installed Apple Macintosh computers in all its freshman dormitories, a first in the United States” and began delivering educational curriculum through those computers (Brubacher & Rudy, 1997, p. 416). The university’s goal was to give “every student and teacher direct access to computers whenever they are needed because according to Bob Lutz, Drake’s director of computing and telecommunications, “you can’t leave here and go to work anyplace and not use a computer. It is a necessary part of the education process” (Lewis, 1990, p. 1).

The knowledge gained by Drake’s students and faculty by fully investing themselves and their institution into personal computers was diffused through other universities by the Biology Department to other institutional biology departments via the

publication of Swanson's (1990) work. His use of the computer to acquire and manipulate biological and physiological data and subsequent research demonstrated that using it to perform such concepts was "practical and feasible" (p. S23). Swanson was an early adopter and first to publish the results of using the personal computer as a teaching tool with laboratory sciences. His article in the Journal of the American Physiological Society, in which he reviewed the hardware, software, peripheral equipment, and connection to instruments, was considered a milestone publication by the Society.

By 1996 and later, other pioneering technologies involving laser disc and video systems were implemented by institutes of higher education to improve teaching and learning, but "none were more widely utilized than those involving computers" (Brubacher & Rudy, 1997, p. 415). University and college libraries were first to adopt the wide use of computers to not only upgrade the laborious manually maintained card catalog system, but to "link campus researchers to (the) swiftly growing national and even international networks of computerized information" (p. 415).

As the use of computers proliferated throughout institutions of higher learning, the price of that technology fell to the point that there was an exponential growth in the purchase of personal computers. That same year saw the rise in better and more responsive online electronic learning (eLearning), which after nearly failing in the early 1990s, was reinvigorated with the advent of "high speed computer modems, greater storage systems, and high quality audio and video reception" (Sloman, 2002, p. 33). Sloman's research found the most dramatic change to eLearning was the growing use of

synchronous voice capabilities that were now possible by an innovation called voice-over Internet protocol (VOIP), allowing for “real-time voice transmission via the computer” (p. 34). Boettcher (2004) found that learning changes would occur in the next few years and that it “will be a time of tremendous transformation with new technologies creating more types of dialogues and learning experiences that are available anywhere and at anytime” (p. 2), while Ally (2007) found the issues being brought about by technology based learning were “timely because of the proliferation of mobile technology in society, globalization, and the need to re-examine how learning materials are designed and delivered for the new generation of learners” (¶1).

Present Implementation of Emerging Technologies

In 1999 the CEO of Cisco Systems, John Chambers, told an audience of information technology and communication specialists that “the next big ‘killer application’ for the Internet is going to be education ... it is going to be so big it will make Email usage look like a rounding error in terms of the Internet capacity it will consume” (Brown, 2002, p. 577). However, research conducted by Brown found that the “killer application could only be achieved through the integration of implementation strategies with wider institutional policy, planning, and objectives” (p. 578). It was important for researchers and users to have an understanding that the growth of information technology based higher education innovations be driven by three key factors: “accessibility; knowledge economy; and, globalization” (p. 578). So despite the tremendous growth in

potential of using the new emerging technologies for learning innovations, Motiwalla (2004) reported that the Internet as a learning tool was not feasible.

While Sloman (2002) was finding that electronic based learning was most effective when it was part of an overall strategy involving the classroom as well as experiential learning, he became aware of an emerging learning innovation: the mobile phone, which to him was “the biggest assault to date on the training facility ... and that the imminent convergence of mobile telephones and the Internet was to be dreaded greatly by classroom instructors” (p. 107). This development, as Sloman and others found, led to more innovations in higher education institutions and caused “the creation of stand alone educational institutions based solely on electronic delivery” (Bates, 2005, p. 16).

As the emergence of learning innovations through mobile technologies and computing grew, so did the demand to have different organizational structures from those of conventional educational organizations (Bates, 2005). The implementation of the World Wide Web resulted in the emergence of different educational institutions, ones created from stronger and more robust technologies because the Web’s direct application allowed for less complicated and almost immediate access. By 2000, computer companies had overcome the challenge of process definition in web-time by creating software configuration management tools that then allowed for the delivery of asynchronous as well as synchronous web-based instruction and instructors (Koch, 2001).

Silvio (2001) wrote that mobile learning was that intersection of computing and e-learning in which learning by both students and workers would be independent of location in time or space. He hoped that one day there would “be no distinction” between the various learning styles (p. 8). Silvio believed that learning technology be developed with the specific requirements of a mobile workforce in mind, but it had to also become “one of the main missions of universities” and also become “the real need for the entrepreneurial sector in a society which more and more dependent on human knowledge as a production factor” (p. 8). His research discovered the mobile worker and the mobile student were not only at an intersection of learning, but were themselves the new outcome of lifelong learning strategies. Other authors understood the intersection as a combination of “individualized (or personal) learning with any time and any where flexibility... [and] that combination was facilitated by a convergence of internet, e-learning, and mobile technology devices” (Abernathy, 2001, p. 20) (Quinn, 2000, ¶8).

Researchers Stone, Alsop, Briggs, and Tompsett (2002) found that the emerging mobile learning technologies “will have one large applications—but the potential of what can already be achieved has hardly been explored” (p. 1). Those authors suggested that these learning technologies were already prevalent throughout educational and business organizations because people found and used “appropriate technology to engage in their work” and the most “prevalent of these technologies were the mobile communication devices” (p. 2).

Gallagher (2002) studied institutions of higher learning which had transitioned to emerged, i.e. diffused, mobile technology delivery of instruction to their student populations. He found a tipping point was achieved when the technology platform, support for all students, and faculty support was fully integrated, and “easy to use and master, while balancing ease of use with a robust level of functionality that provided for the creation of engaging learning experiences and advanced course management” (p. 7). Thus, a major reason why the World Wide Web became such a powerful technology was best summarized by Bates (2005) in that he found it was “the only technology that combines text, audio and video, and all four structural characteristics of technology: broadcast and two-way communication; and synchronous and asynchronous communication” (p. 45). It would not be long, Bates opined, before learning institutions would capitalize on these concepts.

Internet as Disruptor

With the advancement of Internet technology foremost in the mind of its leadership, Jones International University (JIU) was founded in 1993 as a way to “extend education’s reach globally, become a pioneer in the field of online education, and enable students to learn from anywhere in the world, at any time” (Bates, 2005, p. 23). By 1995, JIU was established as a private “fully online university” (p. 23) and in 1999 it became the first on-line university to achieve accreditation by the Higher Learning Commission. Every JIU academic course was delivered entirely via the Internet, along with “an electronic library, academic advising, and technology support” (p. 23). By 2003, JIU

“offered two bachelor’s degrees, three master’s degrees, and six certificates, mainly in business and information technology” (p. 23) and by 2009, according to their website, Jones touted two associate’s and undergraduate, eighteen master’s, two doctoral, a specialist, and three certificate programs.

Internationally, the first fully online public university was the Open University of Catalonia (UOC), established in 1996. By 2003, it had grown to “over 25,000 students, with enrollments continuing to increase around ten percent a year while enrollments in conventional Spanish universities were declining” (Bates, 2005, p. 19). The university was unique in that all of its initial course offerings were developed in the Catalan language. Its online courses offered “19 bachelor’s degrees, 9 master’s programs and a unique Ph.D. program on the information society” (p. 19). UOC developed their online courses through a team approach that included professors, instructional designers, project managers, and Web/multimedia designers, according to Bates.

Since 1996, the University of Maryland University College, as one of the first American institutions of higher learning to blend traditional and Web based learning, offered more than “500 courses and 80 undergraduate and graduate certificates and degree programs completely online” (Bates, 2005, p. 21). Bates also found that their student population was heavily geared towards enrolling US military personnel which in 2003 accounted for 23,000 students, all of them online.

In 1999, the University of Phoenix Online organization was spun off of the Apollo Group Corporation to become a “wholly Internet-based operation” (Bates, 2005,

p. 23). In 2003 it had enrolled 26,000 students and in 2004 “offered one associate degree, 14 undergraduate degrees, 26 Master’s degrees, and four Ph.D. programs, all completely online” (p. 23). The educational programs offered by the university focused on “business, technology, health care, education and the social science courses” (p. 23). By 2009, Phoenix was offering 106 programs ranging from AA/AS, BA/BS, and MA/MS to doctoral degrees (University of Phoenix, 2009).

Sloman’s (2002) research on the impact of fully online institutions of higher learning, found they were, by nature, a “disruptive technology” because they were something that overturned a traditional model and made it harder for an established institution to embrace due to its “own cultural inertial” (pp. 4-5). Clarifying the concept, Bleed (2007), of Maricopa Community College, wrote that in “higher education, growth of on-line learning, for-profit universities, and community colleges was early evidence of differentiation of demand for extra educational services” (¶2). His research found when demand could not be accommodated because of an institution’s limiting admittance of potential customers due to high costs or other factors (such as buildings and growth space), it thereby allowed for innovations to provide educational services which could disrupt the marketplace. Ryan, Scott, Freeman, and Patel (2000) wrote in *The Virtual University* how institutions of higher education should have the most responsible role to play in the interface between mobile technologies and all encompassing computing capability because the “Internet may well prove extraordinarily important for the delivery

of information and education to members of the world's communities at all ages, levels and stages" (p.178).

Up to this point, the reviewed literature pointed to the implementation of tying the Internet to better and faster hardware devices that allowed for web access. Learning style and content become some of the more significant issues addressed by institutions of higher education. The rise of the fully on-line-always-available higher learning institution was inevitable as learning moved from fixed institutions to web-based universities and colleges, according to the next reported research literature.

The Emergence of Mobile Ubiquitous Computing

Jones and Jo (2004) suggested that the past decades of improving information and communication technologies have now led the world of educators to look at ways to use all the various available technologies. For example, the advantages of mobile learning compared to eLearning were better due to "flexibility, cost, size, ease of use and timely application" (p. 469). What was even more timely, the authors found, were that all the developments in "distance" learning, coupled with the benefits of the computer revolution, had led to the emerging concept of a "ubiquitous learning environment (which) is any setting students can become totally immersed in the learning process" (p. 469). Their stated conceptual definition follows:

Ubiquitous = pervasive, omnipresent, ever present, everywhere.

Learning = educational, instructive, didactic, pedagogical.

Environment = surroundings, setting, situation, atmosphere.

So, a ubiquitous learning environment (ULE) is a situation or setting of pervasive (or omnipresent) education (or learning). Education is happening all around the student but the student may not even be conscious of the learning process. Source data is present in the embedded objects and students do not have to DO anything in order to learn. They just have to be there. (Jones & Jo, p. 469)

In researchers Kukulska-Hulme and Traxler's (2005) handbook that focused on mobile technologies, they acknowledged the impact emerging technology had because they foresaw then (in the year 2005) that "over 77 percent of the world's population was in reach of a mobile phone network" (p. xiv). The authors concluded that the mobile technology revolution was, and would be, more involved than any outside the classroom instruction because it evolved from the "possibilities opened up by portable, lightweight devices, some small enough to fit in a pocket, a palm, or small shoulder bag" (p. 1). Their research also revealed how mobile learning technology was "rapidly becoming a credible and cost-effective component of on-line and distant learning" (p. 2). Finally they opined that colleges and universities "must consider carefully what [mobile learning] has to offer" (p. 2). Their research was based on the premise that learning had become, and "is becoming more personal, and more connected to the surroundings and with more potential for connected, collaborative activity" (p. 3).

Wagner (2005) described mobile learning technology primarily in terms of mobile laptops and handheld computers and as something that would define "new relationships and behaviors among learners, information, personal computing devices, and the world at

large” (p. 41). However, he conceded that by the early months of 2005 notebook computers were being rapidly displaced by cellular telephones. Wagner thought the heightened interest in using mobile technologies possibly for teaching, learning, and researching could be attributed to a number of factors including, “the continuing expansion of broadband wireless networks; the explosion of power and capacity of the next generation of cellular telephones; and the fact that mobile telephones, a familiar tool for communications, were already fully engrained in contemporary life as part of social practice” (p. 42).

Mobile learning technologies coupled with ubiquitous computing, according to Shih and Mills (2007) were the next steps in the emerging evolution of technology-mediated teaching and learning because these innovations would “connect people in information-driven societies effectively and offer the opportunity for a spontaneous, personal, informal, and situated learning situation” (p. 2). However the authors presaged these innovations would create a challenging need for strategies, applications, and resources in order to support the concept of “anywhere-anytime” connections in both formal and informal learning situations” (p. 2). Innovative technologies were promised to be the best way to deliver high quality instruction to a customer directly to the desktop, whether that was in the workplace or the home. However, some technologies, conceived as practical, developed major policy and practical issues that failed to maximize the strengths of what was supposed to be delivered as Zemsky and Massy (2004a) discovered.

In the beginning of the 21st century, there was a synergistic merger of eLearning and mobile technology which produced mLearning (Ellis, 2003). The proliferation and constant use of mobile devices within the population pushed these emerging technologies into having even more sophisticated capabilities. Studies by the InformationWeek Research staff (Doherty, 2006) found that seven out of 10 businesses were using mobile technologies for their workforce personnel to access the Web, enterprise applications, and business data (p. 1). Higher education, it appeared, was reluctant to embrace mobile technologies, according to Naismith, et al. (2004) who asked, “How much sense does it make to exclude from schools the powerful technologies that are seen as a normal part of everyday life?” (p. 1).

Sharma and Kitchens (2004) did find a number of evaluation studies regarding pedagogical changes underway via the use of text-based and voice based instructions. Furthermore, it appeared there was an environmental shift in that learning could successfully “occur in the field or while mobile” (p. 206). They further opined that the use of emerging mobile technologies “forced a pedagogy paradigm shift in when, where, and how school instruction can be delivered” (p. 207). What previously had been the learning method of desk-top delivery of instruction, which consisted mainly of time-delayed e-mail where students needed to check e-mails or websites for communication, shifted to an environment where students received “instant announcements of email delivery, instant communication vice passive communication and interactive and spontaneous communications instead of time-delayed asynchronous communications” (p.

206). The authors also found that the goal of many institutions was to “develop student-centered, network-centered mobile computing oriented flexible environments that allowed students to access course content whenever they needed it and in whatever form they needed it” (p. 211). Their definition of this form of emerging technological learning included devices that did anything “from job aides and courseware downloaded on personal digital assistants to net-based instructor-facilitated training via laptops” (p. 211).

Sloman (2002) and Rivera, Trierweiler and Sugrue (2005) defined the developments between institutional learning and organizational training as a social and education cohesion factor in that emerging mobile technologies were a personal, private, direct method of delivered learning. The research of Sloman (2002) and Rivera, et al. (2005) assisted Ling (2008) in expanding the concept of learning and all of the researchers were an integral part of the literature regarding the growth and use of emerging technologies. Nyíri (2002) found there were two additional approaches regarding the issue of mobile technologies to be considered. The first approach was that since the dominant mode of access to the internet would soon be through wireless devices, “electronic learning simply becomes mobile learning, without any particular changes in content” (¶13). The second approach stressed learning that would be characteristically aimed at specific kinds of knowledge like that used by businesses which was “namely knowledge that was location-dependent and situation-dependent” (¶13). Nyíri noted the objection that emerging technology learning was “likely to provide mere information, rather than knowledge,” missed the mark (¶13). Edwards (2005) confirmed

that a significant proportion of the workforce was already mobile and that trend was on the rise. He wrote a key issue was not “should mobile learning be a part of a learning strategy, but how mobile learning should be focused” (p. 1).

The Emergence of Mobile Technology

The mobile phone has become one of the most widely used tools in modern society (Cobb, 2007b). With the arrival of an ultra-fast type of wireless service called WiMax, download speeds have matched or are faster than today’s desk top computers that use DSL or cable TV modem. Higher education and business organizations are rapidly bringing the emerging technology onto the campus and into the buildings because WiMax is capable of providing on-the-go communications by giving mobile phone users higher-performance access than today’s devices. Beyond mobile phones, WiMax was expected to be used in portable computers and with new devices that will be able to fit in a pocket, but have bigger screens and keyboards than current handsets. WiMax would enable users to break the wired bonds tethering them to their computers, according to Cobb (2007b).

Attewell (2004) demonstrated that in the near future, two to three billion people would have cell phones and not have a personal computer because, “The mobile phone will become their digital life” (p. 2). An executive vice-president at Intel[®] disagreed on the grounds that “hundreds of millions of people are not going to replace the full screen, mouse, and keyboard experience with staring at a little screen” (p. 2). Clearly, researchers have not decided which view is completely objective, but Attewell believed

that the debate was an indication of how powerful and sophisticated the emergence of mobile learning devices had become and were becoming.

Alexander (2004) emphasized that emerging mobile technology had three results that were immediately applicable to colleges and universities. First, there was a growing interest in mobile chairs, desk, and displays; second, an increased interest in blended or hybrid learning as access and collaborative learning were enhanced by the technology; and, third, was the rising interest in “new learning spaces such as an information commons, where wireless, mobile connectivity admitted the full informatics range of the internet into any niche or conversation” (p. 31).

McLean (2003) wrote that from a business perspective there was “nothing particularly unique about mobile learning technology in the business world, but it was rare to find that it could be used in a comprehensive management approach” (p. 9). Mobile technology integration, using business guidelines, had to be proven in terms of “costs; systems design; choice of technology; roles for initiating and supporting mLearning; procedures and strategies management; equipment; training and technical support; collaboration; and, flexibility” (p. 9). Metcalf (2006), a research professor with the University of Central Florida’s Institute for Simulation and Training, suggested that emerging mobile technologies were being embraced by the corporate community on a much faster basis than institutions of higher learning because “it encompassed learning content that integrates with mobile applications and provides learning and performance in a just-in-time, just-in-place dynamic” (p. 2). He opined that corporations were more

likely to embrace disruptive innovations quicker because of the dynamics of getting ahead of competitors.

Like Metcalf, Ling (2008) researched the dynamics of emerging mobile technologies and found how it altered the way “social situations develop and the way that they are carried off” (p. 3). He found that with mobile communication technology, a person could talk directly, i.e., specifically target another person regardless of where he/she was located. This concept of information being “personally accessible” was a very complex educational paradigm shift (p. 3). Ling (2008) ascertained that:

Mobile (devices) did undermine prior definitions of social situations, but they also define new technosocial situations and new boundaries of identity and place. To say that mobile (devices) cross boundaries, heighten accessibility, and fragment social life is to see only one side of the dynamic social reconfiguration heralded by mobile communications.

Mobile (devices) create new kinds of bounded places that merge infrastructure of geography and technology, as well as technosocial practices that merge technical standards and social norms. (p. 4)

The British Council for School Environments [BCSE] (2007) undertook the challenge of using emerging mobile technologies in the classroom by expanding their use for early year education to post secondary educational settings. Their research found that the use of a personal mobile learning device and its onboard tools equipped a learner with a “digital pencil case to record video and audio clips, take notes, create animations, read

(and comment on) e-books, upload work onto pages, get feedback on assessments and access the internet, and it all fit in the person's pocket" (p. 8). Furthermore, the use of a mobile technology for learning, in both a business and educational context, caused another learning institution, this one in Japan, to sponsor a cyber school. Cyber University began offering all their classes on mobile phones, starting with a course on the mysteries of the pyramids. The head of Cyber University, Sakuji Yoshimura, said the institution provided educational opportunities for people who found it hard to attend "real-life universities, including those with jobs and those who had disabilities" (Kageyama, 2007, ¶11). When questioned about the efficacy of learning via the internet and cell-phones, he noted that "attendance for the course was at 86% and that the university monitored lecture downloads to see if they were read to the end" (¶11).

Authors Ryan, et al. (2000), Rosenberg (2001) and Strauss (2003) called for the elimination of the delivery barrier among training, knowledge, and performance management systems. In addition, Tonge (2003) also called for a shift in responsibility between those who do training and those who are trained. Authors such as Zenger and Zenger (1999), Trentin (2004), and Zemsky and Massy (2004a), predicted that the transition from electronic learning to learning through mobile technologies and beyond would blur the boundaries between educational institutions and external providers of training, i.e., businesses. Based on the definitional concepts of emerging mobile technologies, these authors predicted, as did Laouris and Eteokleous (2005) there would be a "need for an educationally relevant definition for it and once understood, institutions

would incorporate the concept in order to facilitate the transfer and acquisition of knowledge” (p. 2).

Rooney and Scott (2003) found that technology-based training for business organizations, like those found in higher education, had to adopt strategically planned goals in order to garner the benefits of mobile learning. Their research concluded there were three common goals that organizations used to understand, implement, and benefit from emerging mobile learning. These included the ability to “obtain training cost efficiencies” from implementation, “provide training to a distributed work force” for rapid information diffusion, and “recruit and retain key employees” because e-learning provided a more flexible approach for responding to “changing requirements for knowledge and skills” (pp. 4-5).

Sharma and Kitchens’ (2004) research also asserted that mobile technology was a new paradigm in that it created new learning environments especially in a business setting. Mobile devices represented a “ubiquitous communications technology and intelligent user interface” which had unique elements in that,

Its facility to communicate with individuals or learning communities, either transient or well established, at any time or location; the ability to provide learning content dynamically dependent on a learner’s location, wider context and the device being used by a learner; and, the ability to record discrete acts as the learner moved through space and time, for later use, and to provide recorded elements of previous learning episodes at any time or location. (p. 205)

In retrospect, the emergence of trends towards mobile learning, according to Zemsky and Massy (2004b), would garner its full potential as an electronically mediated instruction when “teachers and trainers came to believe that they should substantially improve the educational quality of their instruction” (p. B7). These authors concluded by restating their optimism for mobile learning and that a different future was already emerging with “campuses spending money on building smart classrooms, and allowing instructional personnel the time and resources to bring electronically mediated learning into the classroom” (p. B7).

Cobb (2007a) reported that the use of emerging mobile technologies, while not a substitute for teaching, actually enhanced learning. Case studies documenting the emergence of mobile learning demonstrated a direct effect not only training organizations, but institutes of higher learning as well. Those case studies, most notably by Traxler (2007), examined technology-driven mobile learning, miniature but portable e-Learning, connected classroom learning, informal, personalized, situated mobile learning, mobile training/performance support, and remote/rural/development mobile learning, as emerging technologies that are, or could be exploited for educational and training purposes.

The ability to adopt and use the current tools (mobile computing devices) fundamentally changed the ways in which individuals learned and acquired knowledge (Kramer, 2007). A scholarly debate has been framed over how those tools translated into the ability to learn anytime, anywhere---in short, a form of pervasive mobile learning.

The frames however were not easy to piece together, according to Kramer. The emergence of mobile technologies was a driving force towards the adoption of mobile learning, but the other half of the frame concluded Herrington and Herrington (2007), was the “acceptance and adoption of mobile learning practices clearly demonstrated a socially constructed nature” (§13). In short, it was individuals who chose to harness emerging technologies to support their own personal learning which fueled an open debate as to whether mobile learning was socially determined or technologically determined. Diffusion of innovation individuals, the “early adopters”, were willing to “use new technologies for pedagogical purposes,” but it was “not yet clear that there (were) sound theoretical reasons for the use of mobile devices in learning” (§12).

Keegan (2005) also questioned why mobile learning had yet to emerge from being a “project” to a mainstream education and training tool. He believed that until mobile learning entered the mainstream, it would remain “a fragile and research-based undertaking” (p. 9). He opined the problem was applications were being developed for wireless devices for all types of people, e.g., gaming, ring-tone and music downloads, but learning and training did not figure in those developments and furthermore, learning and training did not seem to be high on the list of applications that were currently receiving attention. In addition, he believed it was essential for mobile learning that developments in education to keep pace with developments in the business community.

Smith, Salaway and Caruso’s (2009) survey of undergraduate students’ use of information technology found most “would like to see higher education institutions

provide for their handheld devices” (p. 100). The survey respondents, who owned Internet-capable handheld devices, said they wanted the following services from their institution:

The service selected by the largest percentage of respondents is e-mail; nearly two-thirds (63.4%) of the respondents who owned Internet-capable handheld devices said they are likely to use their institution’s e-mail service. Close to half the respondents (46.8%) said they are likely to use student administrative services (official grades, registration, etc.) from a handheld device if offered as an IT service from their institution.

About half (45.7%) said they would be likely to use a course or learning management system (CMS) from their handheld device. The other class-related IT services they would be likely to use from their handheld device were selected by fewer respondents: 20.8% said they would use them to download/stream course lectures (podcasts), and 17.6% said they would use their devices as clickers for course polling and quizzing.

Looking up campus information (news, events, map, directory, bus routes, handbook, etc.) is a service that 29.6% of respondents chose, whereas paying for things on campus (for example, vending machines, food services) was selected by 16.9%, and fewer respondents selected library services (14.8%) as one of the three institution IT services they would most likely use from an Internet-capable handheld device. (pp. 100-102)

What the EDUCAUSE Center for Applied Research (ECAR) Survey researcher uncovered was a larger number of students using mobile technologies than expected. Researchers Smith, et al. (2009) concluded “these numbers could mean an approaching storm for institutions that are not prepared” (p. 102). Furthermore,

In the 2009 ECAR study *Spreading the Word: Messaging and Communications in Higher Education*, ECAR Fellow Mark C. Sheehan found that although three-quarters of responding institutions agreed at some level that the ubiquity of Internet-capable handheld devices would cause their institution to make significant changes to online services in the next three years, a “troubling lack of preparation by higher education to handle growing demand for mobile services” was apparent. Only half the respondent institutions reported they had adapted any preexisting web-based services for mobile services, and 6 in 10 said they had developed no new services.

In the 2009 student survey, we found that an overwhelming majority of respondents (85.6%) said they have never contacted IT for technical support for their handheld device, so it appears that IT departments are able to adequately support the current level of student ownership and use of Internet-capable handheld devices. But for how long? How will this level of student ownership and use...change over the next three years, and will higher education institutions be equipped to handle it? (p. 102)

Perspectives

Overall, the majority of the reviewed literature had two perspectives, positive and while not negative, cautionary according to Carnevale (2004). But, from a thematic viewpoint, all of it discussed the emergence of technology on learning's potential growth and use by both business and educational organizations. Alexander (2004) concluded that the growth of technology for learning would be even greater as students became "personally intimate" with their mobile devices (p. 28). He also stated that mobile learning technologies intensified and extended multi-tasking by students as it allowed them to "move between applications, hardware, and classroom elements" (p. 30).

Siemens' (2004) conceptual framework, connectivism, was his learning theory for the present emerging digital age because it succinctly captured five distinct characteristics for the present learning trends. These characteristics included the concepts that "learning and knowledge rested in diversity of opinions; that learning may reside in non-human appliances; that capacity to know more was more critical than what was currently known; that nurturing and maintaining connections was needed to facilitate continual learning; and, finally, that currency (accurate, up-to-date knowledge) was the intent of all connectivist learning activities" (¶12).

Sharples, Taylor, and Vavoula (2005) agreed with those characteristics and drew upon the conceptual framework of activity theory to explain the rationale for using emerging learning technologies. They concluded that to have any useful framework of its interface with ubiquitous computing, it would have to be tested against certain criteria.

These criteria included an examination of how the technology would affect learning in the context of the following questions: “Is it significantly different from current theories of classroom, workplace or lifelong learning?; Does it account for the mobility of learners?; Does it cover both formal and informal learning?; Does it theorize learning as constructive and social process?; and, Does it analyze learning as a personal and situated activity mediated by technology” (¶13)?

Traxler (2007) argued that while mobile learning technology was being touted as important because of its mobility, the concept did not have “any theoretical conceptualization... (nor) any evaluation methodologies specifically aligned to its unique attributes” (p. 1). Ally, McGreal, Schafer, Tin and Cheung (2007) disagreed with Traxler because their research found that the use of wireless mobile technologies (defined as PDAs, cellular phones, iPods or ultra notebook computers) made learning more flexible so students could learn from anywhere and at anytime. Their research, conducted with ESL adults, concluded that mobile learning (mLearning) was novel in that it “facilitated delivery of learning to the right person, at the right time, in the right place using portable electronic devices” (p. 2).

Christensen and Horn (2008) succinctly stated that to employ portable electronic technology driven innovations so they could completely change an educational organization was to “implement it disruptively---not by using it to compete against the existing paradigm and serve existing customers, but to let it compete against ‘non-consumption,’ where the alternative is nothing at all” (p. 14). Their research found that

by 2019 about fifty percent of all college courses will be delivered electronically and at that time, the “world will be poised to begin adopting computer-based learning at a much more rapid pace” (p. 17). This emerging disruption, according to the authors, occurred as a two-stage process. First, an initial integrated concept (i.e., delivery to a wireless computer device) is sold through the existing commercial system. As that technology innovation matured, they found that “less expensive solutions emerged,” which at that point of the disruption, the system then enabled the cheaper solutions to “reach new markets and take root” (p. 18).

Likewise, Rogers’ (2003) diffusion of innovation (DOI) theory described how an emerging technological innovation spreads throughout a social system. Gladwell’s *The Tipping Point* (2002) presented a theory on how innovations become accepted and pervasive. Mustonen-Ollila and Lyytinen (2003), when analyzing why organizations adopt information system process innovations, distinguished two broad sets of activities in the innovation process: initiation and implementation. These concepts, according to the various authors, augured well for institutions of higher learning since their research demonstrated the supported nature and direction of the shift in philosophical, theoretical and procession dimensions in learning. By using such authors, especially Rogers (2003), a practical framework for implementing a disruptive learning innovation was accomplished by the University of Texas at Austin School of Nursing as that institution underwent a complete change in curriculum development by placing all teaching and learning practices into formats which were accessible on demand by faculty, staff, and

students through a variety of emerging technologies (Horner, et al., 2004). In their research, as well as that done by Fozdar and Kumar (2007), Rogers' innovation diffusion outline of the five stages inherent in implementing and understanding innovative technologies was the first consideration of the Nursing School's conceptual framework.

Researchers Sharples et al. (2005) identified and reported a shift in the use of emerging technologies—ones that were “personal, user centered, mobile, networked, ubiquitous and durable” (§11). They also pointed out that “while there are many practical reasons to adopt mobile learning strategies and technologies in higher education, theoretical justification is arguably even more important” (§11), while authors Herrington and Herrington (2007) noted that for a conceptual framework to not “leave its mark on archival journals but leave the world of classrooms virtually untouched” it would have to be a theory “situated in education” (§25). They concluded that a theory of emerging technologies for mobile learning “would require further research and development to form a model or framework for teaching, with practical higher education applications” (§25). They believed the “affordances of mobile technologies and appropriate theoretical frameworks have the potential to enable teachers to adopt mobile learning in sound and significant ways” (§26). In more ways than one, the Herringtons alluded to a much larger question: “How long can post secondary institutions continue to add technology to learning before they fundamentally reconsider the entire educational process, including the spaces and structures of learning?” (§9)

The real challenge facing the emergence of technologies for education was “about learning directly in the course of real world engagement and in real world time frames” (Millea, Green & Putland, 2005, p. 63). Laouris and Eteokleous (2005) agreed that direct learning was something that had to be “reconsidered in the context of the appearance of electronic mobile devices” (§4). They considered two issues: “the word ‘learning’ demanded at least as equal attention as the word ‘mobile’, while the second issue was the mere appearance of mobile devices called for the redefinition of many other terms and concepts” (§4). To them, the emergence of mobile learning meant that no learner was made “immobile by the restrictions of desktop computer technology” (§4).

Keegan (2005) found that the literature regarding emerging mobile technology devices used for learning was growing exponentially. His research asserted that “never in the history of the use of technology in education (or business) had there been a technology written about that was as available to citizens” (p. 3). And while mobile learning over the last several years primarily focused on taking existing content and putting it on mobile devices, Edwards (2005) believed it was a concept important enough to rethink how people communicated, collaborated and learned, especially as those learners were expected to use technologies that “enable just-in-time, just-for-me and anytime, anyplace learning” (p. 1). In business, Ally (2007) found that there was an “increasing use of mobile technologies for individuals to conduct their business anywhere and anytime” (§1). This should result in more effective learning that aligns with business processes and workflows, with much greater business impact than traditional training

because, Ally also wrote, the use of mobile technology is a “21st Century skill that students and workers must have to function in society” (¶1).

This 21st Century skill was the result of emergent mobile learning because it marked the start of another revolution—a revolution, according to Lockwood (2005), that involved “access to, usability of, and the pedagogic application of hand-held devices that exploit the power of modern computing, wireless communication, and which bring different media and resources to the fingertips of learners at almost any spot on the planet – at a cost substantially less than a conventional desktop machine” (p. xiv-xv). Caudill (2007) believed it was more than a revolution, it was a paradigm shift “in learning locations and learner access to information” (¶3). He wrote that access had been driven both by demand and by advances in technology that made “mobile technologies access a practical option for the average person” (¶3).

More importantly, Ally et al. (2007) found that mobile learning advanced the use of information technologies for education and it fostered a culture of innovation by providing a new evidence-based research into the activities of independent adult learners which included post-secondary students and adults in business organizations. These authors concluded that “in the near future mobile learning would become a normal part of lifelong education and self-directed learning” (p. 2). However, as Australian researchers Litchfield, Dyson, Lawrence, E., and Zmijewska (2007) summarized, they hoped that universities were serious about a future of “enhancing learning through the use of

innovative technologies, as much needs to be done to demonstrate how this might take place” (§12).

Livingston (2009) echoed those same sentiments as his research found that “mobile phone usage among our students has become virtually universal. Isn’t it time for us to stop ignoring and start taking advantage of this fact?” (§2). He further opined that for higher education, it was time,

...for the story to begin. Multimobile services have the potential to improve the educational environment in substantial ways. That we’ve ignored this potential for 10 years, and continue to ignore it today, is a blind spot we simply must correct. A billion mobile phones will be sold this year. *A billion*. This isn’t a case of handwriting on the wall — this is a case of a revolution having occurred while we weren’t looking. The information appliance of the future isn’t the future anymore; it’s here today, in astonishing numbers. All of your students, and all of your prospective students, own one of these appliances. (§52)

Up to this point in the review of literature, the past and present concepts of what constituted emerging mobile technologies and innovations in education, delivery of information, and implementation by institutions of higher learning have been presented. The opening ideas of a fourth revolution in learning were underway and being absorbed by some, but other institutions of higher learning continued to take a wait and see attitude, hoping to understand all the implications of implementation.

The Future: Which Emerging Technology Next?

Naismith et al., (2004) found that after years of research, the literature was now “rich with understanding what the future might hold” for learning with the various emerging technologies (p. 1). It was also enriched by better research into the ubiquitous computing concepts which encompassed “a wide range of disparate technological areas brought together by a focus upon a common vision” (Bell & Dourish, 2006, ¶1). This appeared to be the beginning of an era of focusing that vision into an eternal stream of information to be processed because of the “advent of ubiquitous computing, of cheap GPS [global positioning satellite] chips in our cell phones, cameras and cars, of RFID [radio frequency identification] tags in everyday objects, and of tiny, networked sensors that surround us” (Mayer-Schönberger, 2007, p. 5). Even though an understanding about mobile learning technology and ubiquitous computing was fundamentally new, the growing associated literature explored the advantages, disadvantages, and implementation by both higher learning organizations and businesses. Scholarly literature on the emergence of mobile learning technologies had its roots sunk deeper with the research gathered by Kukulska-Hulme and Traxler (2005). Their initial research, like those of Woodill and Pasian (2006) gave impetus to a few scholarly articles, and substantial ephemeral materials which included company brochures, corporate white papers, conference presentations and speeches, blog commentaries, and on-line articles which have not been published in print format.

One of the first on-line journals with a complete issue devoted to emerging technologies for learning and its potential impact on education and training was published in June, 2007 by the International Review of Research in Open and Distance Learning (IRRODL). The issue contained key articles which examined various emerging learning technologies and how that innovation would help educators and trainers “be better prepared for the use of mobile technology in education and training” (Ally, 2007, p. 1).

Ally (2007) opined in the IRRODL editorial section that educational institutions were behind business and government sectors in using and developing “mobile technology to deliver learning materials and interact with students” (p. 2). The author called for the accelerated use of mobile technology in education and the need for higher learning institutions to work with mobile device/technology developers to create devices for use in the education sector due to its criticality in the coming century.

Kukulska-Hulme’s (2007) research into mobile learning technologies reflected upon the progress in approaches to usability and upon the many developments that emerged from mobile learning projects based at The Open University in the United Kingdom in 2001 and 2005. Those projects concluded that for mobile learning technologies and the appropriate ubiquitous computing to emerge as the real future, then it “should also take into account the evolution of uses over time and the unpredictability of how devices might be used” for both education and business applications (p. 1). Kukulska-Hulme agreed that mobile learning technologies were proving to be a fertile ground for innovation in educational context, but cautioned that it would only be as good

as “human factors in the use of new mobile and wireless technologies” (p. 1) and that it was only now that the “challenges of mobile learning on a larger scale, and with diverse populations of students, are beginning to be understood” (p. 1). The challenge for the future of mobile learning technologies would be how those concepts and systems could be used for “improving access, exploring the potential for changes in teaching and learning, and alignment with wider institutional and business aims” (p. 4).

Emergent Futures

Traxler (2007) pointed out that with the increased access to information and knowledge “anywhere, anytime, the role of education, perhaps especially formal education, is challenged and the relationships between education, society, and technology are now more dynamic than ever” (p. 1). The emergent future would see, according to his research, various categories of mobile learning technologies to include:

Technology driven mobile learning – Some specific technological innovation is deployed in an academic setting to demonstrate technical feasibility and pedagogic possibility.

Miniature but portable e-Learning – Mobile, wireless, and handheld technologies are used to reenact approaches and solutions already used in ‘conventional’ e-Learning, perhaps porting some e-Learning technology such as a Virtual Learning Environment (VLE) to these technologies or perhaps merely using mobile technologies as flexible replacements for static desktop technologies.

Connected classroom learning – The same technologies are used in classroom settings to support collaborative learning, perhaps connected to other classroom technologies such as interactive whiteboards.

Informal, personalized, situated mobile learning – The same technologies are enhanced with additional functionality, for example location awareness or video- capture, and deployed to deliver educational experiences that would otherwise be difficult or impossible.

Mobile training/performance support – The technologies are used to improve the productivity and efficiency of mobile workers by delivering information and support just- in-time and in context for their immediate priorities.

(pp. 3-4)

Traxler also emphasized that mobile devices and technology were “pervasive and ubiquitous” in many modern societies and were “increasingly changing the nature of knowledge and discourse in these societies (whilst being themselves the products of various social and economic forces)” (p. 4). He reasoned that mobile technologies altered the nature of work, which for him was the driving force “behind much education and most training” and since mobile technologies in the future would alter the balance between “training and performance support,” it meant that mobile was not “a new adjective qualifying the timeless concept of learning” but rather, mobile learning is in the process of emerging as “an entirely new and distinct concept alongside the mobile workforce and the connected society” (p. 4).

Finally, Traxler (2007) argued that mobile technologies would become the “pre-eminent vehicle not only for learning, but also for wider social change” (p. 6). But, he warned, they may have “no chance of sustained, wide-scale institutional deployment in higher education in the foreseeable future” because educational institutions have different “strategic factors that are different from those of technology and pedagogy” (pp. 9-10). This translated into an understanding that institutional staffs had different expectations and standards from students and the wider community which included businesses and professional organizations. Therefore, before any planning, implementation, or diffusion could occur, he opined that higher education institutions “must address these social, cultural, and organizational factors” because coping with this or any disruptive learning innovation only pointed to considerable hurdles with infrastructure and support (p. 10).

Rekkedal and Dye (2007) researched what the next generation of learning could be by performing a series of projects that sought to develop mobile learning solutions wherein students and teachers, using wireless PDAs (personal data access) and Pocket PCs (personal computers) could benefit from an always-online environment. Their aspects of an always on-line solution, which they determined would be necessary to increase the quality of service for those teaching and learning in a mobile technology and ubiquitous computing environment included:

Access to high bandwidth networks, which enable faster uploading and downloading of course content and use of streaming audio, video, and advanced graphics

Mobile technologies that are not tied to and operate independent of students' and tutors' desktop PC

Access to the Internet, 24/7

Access to email, 24/7

Access to online assessments, assignments, course activities

Options that enables group collaboration

Options that support synchronous communication such as chat and IP telephony

ADSL or free access to WLAN, needed to make mobile learning affordable. (pp. 11-12)

Caudill (2007) found that because growth of mobile computing through mobile devices was such a new field, the research was in a stage where the different categories of mLearning pedagogy was still being developed, identified, and researched. He felt that the very existence of mobile technologies was the key to the growth, understanding, use, and implementation of learning. The advantages, he asserted, of learning delivered through mobile technologies was the advantage of access, but institutions had to remember that the demands for designing and administering came at a price. However, the connectivity allowed by mobile technologies gave learners not only “access to static instructional materials, but to dynamic discussion environments and updated information from an instructor” the key component to ubiquitous learning (p. 6). This connectivity should be carried out by the leading candidate for mobile technology and to Caudill, that

was the “IEEE 802.11 wireless communication standard, commonly called WiFi” and to a “lesser extent, the IEEE 8802.15.1 wireless communication standard, commonly call *Bluetooth®*” [italics added] (p. 2). He believed that it was important for institutions of learning and training to recognize how critically important the wireless communication standards were in order to facilitate mobile learning environments.

Furthermore, Caudill (2007) maintained that in the future, mobile learning would be advantageous to entire groups of learners that maintained connectivity through digital devices and ubiquitous computing capabilities because the ultimate objective was for “learning to become an integrated part of our daily life, that is no longer recognized as learning at all” (p. 6). He concluded that once learners of the future were “connected to digital media devices at all times of their day, and were comfortable accessing information through these devices, they no longer require a particular location or environment to review educational material” and that meant the elimination of the classroom, the need for tables, or even elbow room on a train, bus, or airplane because the “thumbs or a stylus have supplanted the need to type on a traditional keyboard” (p. 6).

Kadirire (2007) reported that instant messaging (IM) technology also created a viable means of communicating and learning in higher education establishments and predicted its future use would surpass older technologies and become a disruptive learning innovation. The potential of IM was growing because the mobile devices that used the capability had “truly become ubiquitous and pervasive” (p. 1). In his research with the phenomenon of IM, Kadirire noted that it had helped to foster a “greater sense of

‘online community’ that no other application has done previously” and this technology was “becoming widespread in universities and is now being used for online discussions, chatting, file transfer, library access and usage, and so forth” (p. 2). In business organizations, Kadirire found that it was the latest employee productivity tool. Research conducted by him at Wake Forest University found student mobile phone use was moving away from more traditional messaging, like email, to the newer trend, i.e., mobile technologies with IM and short message service (SMS). That trend, he asserted, “encouraged students to become more engaged with course material outside the classroom, and help them communicate better among themselves” (p. 2). Additional research also showed a way forward for mobile learning in formal education settings would be the “introduction of handheld devices” (p. 2). Research conducted on the University of North Carolina – Wilmington Campus found that “students enjoyed the technology and became more active in their learning when handheld pocket computers were used in the classroom” which suggested that there was every “indication that in the near future, wireless data devices will be as widespread as wireless voice devices are now” (p. 2).

In her IRRODL article, Peters (2007) asserted that mobile information and communication technologies were important “enablers” of the new social structure, that is, the structure of the future, i.e., the “first generation of truly portable information and communications technology (ICT) with the relatively recent advent of small, portable mobile devices that provide telephone, Internet, and data storage and management in

products such as: *i-Mate*, *O2*, *Palm*, *HP*, and *Bluetooth*[®] [author's italics] (all registered trademarks) that combine mobile telephony, removable memory chips, diaries, email, Web, basic word processing and spreadsheets, and data input, storage, and transfer" (p. 1). Peters believed that the input of communication and data transfer possibilities created by mobile technologies would significantly lessen the dependence on fixed locations, like those required by electronic learning devices (desktop computers), for work and study, and "thus have the potential to revolutionize" the way all people work and learn (p. 1). Her research, based on three surveys conducted with three distinct populations of mobile technology users (business, education and training, and manufacturers and software developers), found there was "potential future trends in mobile learning that affected each of the groups surveyed" (p. 2) and that mobile devices (handheld computers) "produce unique educational affordances which are: a) Portability; b) Social interactivity; c) Context sensitivity, the ability to 'gather data unique to the current location, environment, and time, including both real and simulated data'; d) Connectivity, to data collection devices, other handhelds, and to networks; e) Individuality, a 'unique scaffolding' that can be 'customized to the individual's path of investigation'" (pp. 3-4).

Nigerian educators Aderinoye, Ojokheta, & Olojede (2007) researched six nomadic tribes within key regions of their country. They found that the future of educating tribal young people was more certain to have advantageous effects when the use of mobile learning, specifically mobile phones, was implemented. An important

finding in their research was that mobile learning technologies encouraged flexibility by educators so that “students no longer had to be identified by a specific age, gender, or member of a specific group or geography, to participate in learning opportunities (because) restrictions of time, space and place have been lifted” (p. 4). The researchers found that by delivering education content strictly by mobile learning technologies to the various nomadic tribes, in lieu of the older technology of radio, television, and cassette recordings, they were able to see highly beneficial returns for the future which included:

Mobile learning will afford Nigeria’s nomadic people the opportunity to acquire literacy skills with little disruption to their nomadic lifestyles and livelihoods.

The establishment of nomadic schools, in fixed locations, appears to be a misguided educational policy ... Therefore, one viable option available for these wandering people is to learn through a mobile learning system. (p. 13).

Evolution Next

Shih and Mills (2007) confirmed that mobile communication technologies were rapidly emerging and evolving, and as such, the application of mobile technologies in learning represented “an exciting new frontier in education and pedagogy” (p. 1). Their research into “wearable” computing and multimedia content delivery via mobile technologies, found that learning with mobile technologies became feasible because it offered “many new benefits, such as ubiquitous learning that connects instructors and learners in both traditional classroom and online settings” (p. 1). Like earlier work by Alexander (2004), Shih and Mills also suggested that “the combination of wireless

technology and mobile computing is resulting in an escalating transformation of the educational world” (p. 1). Their specific research centered on the rapid evolution and interface with learners of “local area wireless connections using WiFi, Third Generation (3G) mobile communications, and Worldwide Interoperability for Microwave Access (WiMax), and related mobile computing devices such as smart phones, pocket PCs, table PCs, and various Personal Data Assistants (PDAs) handheld devices” (p. 1). They concluded that further study was necessary to ascertain if their areas of specialty could be supported or rejected. These areas of concern and their future work raised several questions which included:

Mobile technologies come with limitations for use in educational settings, such as different form factors in mobile devices, communication coverage, and potential security issues. For instance, what instructional design strategies are needed in mobile learning courses that better address limitations of mobile technologies?

Mobile learning provides “just in time” help and “just for me” features that supports various learning styles. How can instructional design be individualized to support students with special needs?

Messaging capabilities are, such as SMS and multimedia messages, are some of the most powerful ‘push’ features of mobile technologies. However, while it is evident that such push communication can effectively facilitate and motivate learners in collaborative learning activities, it may also intrude upon

student's personal space. Therefore the question must be asked: What new "netiquette" and instructional design strategies are needed?

Social implications in the progress and development of mass communications, plus related cost factors may lead to (in) accessibility (sic) issues in mobile learning. How can we maximize the potential of mobile technology in educational contexts, without creating another digital divide? (p. 8)

Shih and Mills (2007) contended that mobile learning, which had a wide range of attributes that could not be ignored, was entering into not only business, but within the institutions of higher learning with alacrity because it was "highly portable, personal, and contextual" and that "learning using mobile devices is informal, spontaneous, situated, and ubiquitous" all of which made it a system where appropriate pedagogical instructional design modeling, teaching strategies, learning styles, and effective learning activities would remain "crucial to ubiquitous mobile learning environments" (pp.8- 9).

Fozdar and Kumar (2007) found that "technology-supported" teaching and learning was always an enormous help in "overcoming the physical distances between teachers and students, enabling the flexible delivery of education at a distance, anyplace, anytime" (p. 2). They were able to compare the various learning concepts, "Generations of Distance Education," (p. 3) in their research, with each of the five they uncovered. The First Generation was based on the correspondence model in which the delivery technology was print and mail. The Second Generation's model was multi-media which consisted of delivering learning through "print, audio tapes, video tapes, computer based

learning (e.g. CML/CAL/IMA), interactive video (disc and tape)” (p. 3). The Telelearning Model was an integral part of the Third Generation and consisted of delivery by “audio teleconferencing, videoconferencing, audio-graphic-communication, and broadcast TV/Radio” (p. 3). The Fourth Generation, the Flexible Learning Model, was delivered by the technology of “Interactive multimedia (IMM) online, internet based access to www resources, and computer mediated communications” (p. 3). The Fifth Generation was composed of the Intelligent Flexible Learning Model and was based on “Interactive multimedia (IMM) online, internet based access of www resources, computer mediated communication, using automated response systems, campus portal access to institutional process and resources” (p. 3). Key to their findings was that regardless of the generation of learning being used outside the classroom, the concept of *access*, having and giving, was paramount. They opined that while many learners might not be able to afford a personal computer, they were very likely “to own a mobile phone, which in turn will become their ‘digital life’” (p. 4).

Evolution Future or Future Revolution

For other researchers, the future of empowering technologies for learning arrived faster than anticipated. Norris and Soloway (2006) found technologies were moving “from the periphery...to being integral, primary to the way we conduct our lives” (p. 2353). These researchers found that there were two fundamental types of technology:

Sustaining technology: This is an extension of, albeit more clever, most cost-effective, and more capable, an existing technology. For example, in the area of storage, we are seeing hard disks with higher capacity and lower cost.

Disruptive technology: This technology breaks with the past and provides new functionality and thus new opportunities. For example, flash memory has come on the scene like gangbusters and enabled all sorts of new gadgets, from MP3 players to video cameras.

We will argue that the emerging technologies from the first type – sustaining – simply reinforce the existing pedagogical strategies in schools. While these technologies do have benefits, they will not result in a dramatic turnaround in learning. On the other hand, the emerging disruptive technologies do hold out the promise for dramatic change – but is the educational system ready to make the changes that these disruptive technologies need in order to be effective? (p. 2354)

Brown's (2002) research saw educational institutions being classified in the near future by their response to their use of learning innovations which would be driven by either new and/or improved technologies. These classifications included monikers such as:

“Mega-University (any university that exceeded 100,000 students), Global Universities (The British Open University), University Brokers (Western Governor's University), Commercial Universities (University of Phoenix, Jones International University), Corporate Universities (Qantas Airlines, McDonald's,

IBM, PeopleSoft, Disney), Virtual Universities (Melbourne University Private Ltd, NYU Online, California Virtual University, University of Texas), Consortia Universities (Eurospace 2000, Fathom-Columbia University, London School of Economics), and Hybrid Universities (schools that offered some courses or course components online).” (pp. 581-582)

While these categories of schools would grapple with the various disruptive learning innovations, others would never come to terms with technology because Brown (2002) found that while successive waves of new technology created unique technical challenges, there were underlying issues that institutions of higher learning had to overcome regardless of the nature of the innovative technology. Those issues included “failure to exploit new media; failure to integrate; failure to generalize; failure of pedagogy; failure of professionalism; failure of institutional strategy; failure of infrastructure; failure of production; failure of rewards; failure to develop staff skills; and, failure to develop student skills” (pp. 586-590). And unless these “access” points were properly addressed, Brown opined that it was unlikely that any disruptive learning innovation would “succeed, no matter how ingenious it or its champions are” (p. 586). He concluded that universities were under pressure to respond to the reality and needs of the market place by understanding the need for “cost-effective, rapid retraining of the workforce and increasing numbers of individuals need to access educational opportunities, especially at any given time and/or place” (p. 579).

Daly (2007) described the “new reality” of mobile learning and the associated technologies as a competitive situation in that the public-education system was “no longer the only, or the paramount, place where we go to learn” (§7). He believed the shift in technology, where a student had access anywhere, anytime, and any place, represented a fundamental and futuristic restructuring of “what public education is all about” (§7). His research succinctly stated that learning institutions should make the leap into understanding the volumes of information provided by businesses, international groups, and the media and should undertake a new role, i.e., one of being “an assembler of the collective intellect” (§8) because it would be the things to prepare the universities for the next generation of disruptive learning innovations.

At this point in the review, the institutions of higher learning were beginning to embrace the key disruptive innovations and to see how each would be beneficial to the end goal of delivering and discerning information. The rest of the literature review’s focus was on the forthcoming key technologies that would not decrease the stature of higher education but rather, enhance and edify it well into the 21st Century and beyond.

Future Learning Innovations On and Beyond the Horizon

It was with great hope that future learning innovations would be brought about by the methods used by higher education institutions and business organizations to perform the applicable implementation schemes. However to obtain and implement innovative ideas, especially those that disrupted the status quo, it would be necessary to share quality ideas. Very few universities shared with other institutions their approaches,

implementation strategies, or even results of a disruptive learning innovation. This problem was compounded, according to innovation researcher McKeown (2008), by the people in organizations, including those in public higher education organizations, who had “become trapped in their own success so that fewer think and more just do what worked in the past” and which resulted in “fewer ideas traveling from the center of the organization to be implemented” (p. 30).

Horizon 2004

To find what was truly being implemented into institutions of higher learning, the New Media Consortium (NMC), composed of over 300 universities and colleges, including Florida A&M University, University of South Florida, University of West Florida, and the University of Central Florida, developed the *Horizon Report*, a research-oriented effort that identified and described emerging technologies “likely to have a large impact on teaching, learning, or creative expression within higher education” (Horizon Report, 2004, p. 2). Critical for NMC’s research was discovering the impact disruptive learning innovations would have on higher learning in the immediate following year, then within two to three years out, then its adoption within four to five years, and finally sharing results among the consortium membership. In the 2004 report, the NMC identified six disruptive learning innovations that were in use in a rapidly growing number of universities. These six technologies included:

Learning Objects. Learning objects are assemblies of audio, graphic, animation and other digital files and materials that intended to be reusable in a variety of

ways, and easily combined into higher-level instructional components such as lessons and modules.

Scalable Vector Graphic (SVG). SVG uses XML for describing two-dimensional graphics, holding the information needed to draw an image in a text file ... SVG is an especially powerful tool for instructional developers on college and university campuses, with potential applications in virtually any discipline, but especially the sciences and engineering.

Rapid Prototyping. Rapid prototyping refers to what amounts to 3-D printing, e.g., building three-dimensional physical objects from digital data files ... This technology already is widely used for a variety of manufacturing, design, and engineering applications, but as cost decreases, is finding new applications in the arts and the classroom.

Multimodal Interfaces. Multimodal interfaces provide ways for humans to interact with computers beyond the traditional mouse and keyboard, using inputs and outputs that target not only each of the five senses, but also take advantage of nonverbal cues common in human conversation.

Context-Aware Computing. Context aware computing refers to computing devices that can interpret contextual information and use it to aid decision-making and influence interactions. Contextual cues may include what the user is attending to, the user's location and orientation, the date and time of day, lighting conditions, other objects and people in the environment, accessible infrastructure

in the immediate vicinity, and so forth. Context-aware applications can make decisions based on such information without the need for user input.

Knowledge Webs. Knowledge web is a term that describes a dynamic concept of individual and group knowledge generation and sharing, with technology used to make connections between knowledge elements clear, to distribute knowledge over multiple pathways, and to represent knowledge in ways that facilitate its use. Work in knowledge webs overlaps considerably with that going on around communities of practice, and holds the potential to help such communities share, create, analyze, validate, and distribute existing and emerging technologies.

Technology is providing learners with an ever greater access to learning materials, and because of the rich variety of interaction pathways being developed, these materials are becoming more “real” and more responsive all the time. As computing becomes more ubiquitous and embedded in more and more everyday objects, the potential applications that are emerging will draw more on contextual cues. These cues will feel at once more invisible and more pervasive, with the result that users will be able to generate, use, and share knowledge in ways we can only imagine today. (pp. 2-3)

Horizon 2005

The technologies researched for Horizon Report 2005 also used the same timelines as the 2004 Report, i.e., an assumption that there would be a high likelihood of

broad adoption within one year; adoption within two to three years; and, adoption within four to five years. Extended Learning and ubiquitous wireless were choices for the first category, while intelligent searching, educational gaming, social networks and knowledge webs, and context-aware computing augmented reality were in the two to five year timeframes. As in the 2004 findings, the Horizon Report 2005 (2005) found six technologies which posed “interesting possibilities for teaching and learning, and early experiments with all of them seem quite promising” (p. 3). The six technologies detailed included:

Extended Learning. On some campuses, traditional instruction is augmented with technology tools that are familiar to students and used by them in daily life. Extended learning courses can be conceptualized as hybrid courses with an extended set of communication tools and strategies. The classroom serves as a home base for exploration, and integrates online instruction, traditional instruction, and study groups, all supported by a variety of communication tools.

Ubiquitous Wireless. With new developments in wireless technology both in terms of transmission and of devices that can connect to wireless networks, connectivity is increasingly available and desired. Campuses and even communities are beginning to regard universal wireless as a necessity for all.

Intelligent Searching. To support people’s growing need to locate, organize, and retrieve information, sophisticated technologies for searching and finding are becoming available. These agents range from personal desktop

search “bots,” to custom tools that catalog and search collections at all individual campus, to specialized search interfaces like Google™ Scholar.

Educational Gaming. Taking a broad view of education gaming, one finds that games are not new to education. Technology and gaming combine in interesting ways, not all of which are about immersive environments or virtual reality. What is evolving is the way technology is applied to gaming in education, with new combinations of concepts and games appearing on the horizon.

Social Networks and Knowledge Webs. Supplying people’s need to connect with each other in meaningful ways, social networks and knowledge webs offer a means of facilitating teamwork and constructing knowledge. The underlying technologies fade into the background while collaboration and communication are paramount.

Context-Aware Computing/Augmented Reality. These related technologies deal with computers that can interact with people in richer ways. Context-aware computing uses environmental conditions to customize the user’s experiences or options. Augmented reality provides additional contextual information that appears as part of the user’s world. Goals of both approaches are increased access and ease-of-use.

The potential applications of these important technologies were further explored by higher education practitioners who were either knowledgeable about them, or interested in thinking about how they might be used. (pp. 3-5)

Horizon 2006

The technologies featured in Horizon Report 2006 (2006) reported on their potential and how they were still developing, and how the six selected disruptive learning innovations “will have significant impact on college and university campuses within the next five years” (p. 5). These included:

Social Computing. The application of computer technology to facilitate interaction and collaboration, a practice known as social computing, is happening all around us. Replacing face-to-face meetings with virtual collaboration tools, working on a daily basis with colleagues a thousand miles away, or attending a conference held entirely online is no longer unusual. An interesting aspect of social computing is the development of shared taxonomies—folksonomies—that emerge organically from like-minded groups.

Personal Broadcasting. With roots in text-based media (personal websites and blogs), personal broadcasting of audio and video material is a natural outgrowth of a popular trend made possible by increasingly more capable portable tools. From podcasting to video blogging (vlogging), personal broadcasting is already impacting campuses and museum audiences significantly.

The Phones in the Pockets. A little further out on the horizon, but rapidly approaching, the delivery of educational content and services to cell phones is just around the corner. Among the keys that will unlock the true potential of this technology are improved network speeds, Flash Lite, and video: as new features

that take advantage of the capabilities of these appear in phones, barriers to delivery of educational content will vanish.

Educational Gaming. A recent surge in interest in educational gaming has led to increased research into gaming and engagement theory, the effect of using games in practice, and the structure of cooperation in gameplay. The serious implications of gaming are still unfolding, but we are not far away from seeing what games can really teach us.

Augmented Reality and Enhanced Visualization. Currently in use in disciplines such as medicine, engineering, and archaeology, these technologies for bringing large data sets to life have the potential to literally change the way we see the world by creating three-dimensional representations of abstract data.

Context-Aware Environments and Devices. Advancements in context-aware computing are giving rise to devices and rooms that respond to voice, motion, or other subtle signals. In the ultimate application of these technologies, the “computing” part simply disappears, leaving an environment transparently responsive to its human occupants. (pp. 5-6)

The researchers noted that some of the technologies had been identified in earlier editions of the Horizon reports and the “fact that they again have risen to the top of the rankings for 2006 is a strong indication of the impact they promise for campuses” (Horizon Report 2006, p. 6).

Horizon 2007

Horizon Report 2007 (2007) researchers and practitioners found that each of the following six disruptive learning technologies would have significant impact on colleges and university campuses within the following five years:

User-Created Content. It's all about the audience, and the "audience" is not longer merely listening. User-created content is all around us, from blogs and photostreams to wikibooks and machinima clips. Small tools and easy access have opened doors to almost anyone to become an author, a creator, or a filmmaker. These bits of content represent a new form of contribution and an increasing trend toward authorship that is happening at almost all levels of experience.

Social Networking. Increasingly, this is the reasons students log on. ... Social networking may represent a key way to increase student access to and participation in course activities. It is more than just a friends list; truly engaging social networking offers an opportunity to contribute, share, communicate, and collaborate.

Mobile Phones. Mobile phones are fast becoming the gateway to our digital lives. Feeding our need for instant access, mobile phones ... offer a connection to friends, information, favorite websites, music, movies, and more. From applications for personal safety, to scheduling, to GIS, photos, and video, the capabilities of mobile phones are increasing rapidly, and the time is

approaching when these little devices will be as much a part of education as a bookbag.

Virtual Worlds. Customized setting that mirror the real world—or diverge wildly from it—present the chance to collaborate, explore, role-play, and experience other situations in a safe but compelling way. These spaces offer opportunities for education that are almost limitless, bound only by our ability to imagine and create them. Campuses ... increasingly have a presence in the virtual world, and the trend is likely to take off in a way that will echo the rise of the web in the mid-1990s.

The New Scholarship and Emerging Forms of Publication. The nature and practice of scholarship is changing. New tools and new ways to create, critique, and publish are influencing new and old scholars alike.

Massively Multiplayer Educational Gaming. Like their non-educational counterparts in the entertainment industry, massively multiplayer games are engaging and absorbing. ... In the coming years ... we are likely to see educational titles along with commercial ones.

We have watched these returning and related technologies move closer, develop offshoots that have moved faster or slower than their parent topics, and become so much a part of daily life that the technology is transparent and the content shines through. (pp. 6-7)

Horizon 2008

Horizon Report 2008 (2008) was a blunt warning and challenge to educators as the authors felt that colleges and universities were facing a “growing expectation to deliver services, content and media to mobile and personal devices” (p. 5), but were falling short. The advent of the Apple *iPhone* and LG Electronics *Voyager* made content “almost as easy to access and view on a mobile as on a computer” (p. 5). The report concluded there were important opportunities for higher education to reach its constituents wherever they may be. For 2008, the Report covered six technologies that “will significantly impact the choices of learning-focused organizations” (p. 3) and those were:

Grassroots Video. Virtually anyone can capture, edit, and share short video clips, using inexpensive equipment (such as a cell phone) and free or nearly free software. ... it is very common now to find news clips, tutorials, and informative videos listed alongside the music videos and a raft of personal content ... Custom branding has allowed institutions to even have their own special presence within these networks, and will fuel rapid growth among learning-focused organizations who want their content to be where the viewer are.

Collaboration Webs. Collaboration no longer calls for expensive equipment and specialized expertise. ...Colleagues simply open their web browsers and they are able to edit group documents, hold online meetings, swap information and data, and collaborate in any number of ways without ever leaving

their desks. Open programming interfaces allow users to author tools that they need and easily tailor them to their requirements, then share them with others.

Mobile Broadband. Each year, more than a billion new mobile devices are manufactured. ... In this market, innovation is unfolding at an unprecedented pace. Capabilities are increasing rapidly ... Indeed, mobiles are quickly becoming the most affordable portable platform for staying networked on the go. New displays and interfaces make it possible to use mobiles to access almost any Internet content—content that can be delivered over either a broadband cellular network or a local wireless network.

Data Mashups. Mashups—custom applications where combinations of data from different sources are “mashed up” into a single tool—offer new ways to look at and interact with datasets.

Collective Intelligence. The kind of knowledge and understanding that emerges from large groups of people is collective intelligence. In the coming years, we will see educational applications for both explicit collective intelligence—evidenced in projects like the Wikipedia and in community tagging—and implicit collective intelligence, or data gathered from the repeated activities of numbers of people, including search patterns, cell phone locations over time, geocoded digital photographs, and other data that are passively obtained.

Social Operating Systems. The essential ingredient of next generation social networking, social operating systems, is that they will base the organization of the network around people, rather than around content. This simple conceptual shift promises profound implications for the academy and for the ways in which we think about knowledge and learning. (pp. 3-4)

The expectation of the collective research was that “advances in technology over the next twelve to eighteen months will remove the last barriers to access” and these and other disruptive learning innovations would be brought “into the mainstream of education” (p. 5). Horizon Report 2008 was the fifth such research report and the authors reflected on their research efforts by identifying three “metatrends” which were clear conceptual threads of innovative and technological evolution affecting the long-term practice of teaching, learning and creative expression (p. 7). The three metatrends were “collective sharing and generation of knowledge”; “connecting people through the network” via ubiquitous wireless enabled technologies; and, “moving the computer into three dimensions” through the emergence of vector-based animation tools (pp. 7-8).

Horizon 2009

Horizon Report 2009 (Johnson, Levine & Smith, 2009), like past editions, reported six technologies that were or would have a significant impact on learning-focused organizations within the next five years. They noted that some technologies had carried over from past reports, like mobiles, but that was because that particular

technology was having an “unprecedented” impact on campuses (p. 4). The six impact technologies for 2009 were:

Mobiles. Already considered as another component of the network on many campuses, mobiles continue to evolve rapidly. New interfaces, the ability to run third-party applications, and location-awareness have all come to the mobile device in the past year, making it an ever more versatile tool that can be easily adapted to a host of tasks for learning, productivity, and social networking. For many users, broadband mobile devices like the iPhone have already begun to assume many tasks that were once the exclusive province of portable computers.

Cloud Computing. The emergence of large-scale “data farms” — large clusters of networked servers — is bring huge quantities of processing power and storage capacity within easy reach. Inexpensive, simple solutions to offsite storage, multi-user application scaling, hosting, and multi-processor computing are opening the door to wholly different ways of thinking about computers, software, and files.

Geo-Everything. Geocoded data has many applications, but until very recently, it was time consuming and difficult for non-specialists to determine the physical coordinates of a place or object, and options for using that data were limited. Now ... devices can automatically determine and record their own precise location and can save that data along with captured media (like photographs) or can transmit it to web-based applications for a host of uses. The

full implications of geo-tagging are still unfolding, but the impact in research has already been profound.

The Personal Web. Springing from the desire to reorganize online content rather than simply viewing it, the personal web is part of a trend that has been fueled by tools to aggregate the flow of content in customizable ways and expanded by an increasing collection of widgets that manage online content. The term *personal web* was coined to represent a collection of technologies that are used to configure and manage the ways in which one views and uses the Internet. Using a growing set of free and simple tools and applications, it is easy to create a customized, personal web-based environment — that explicitly supports one’s social, professional, learning, and other activities.

Semantic-Aware Applications. New applications are emerging that are bringing the promise of the semantic web into practice without the need to add additional layers of tags, identifiers, or other top-down methods of defining context. Tools that can simply gather the context in which information is couched, and use that context to extract embedded meaning are providing rich new ways of finding and aggregating content. At the same time, other tools are allowing context to be easily modified, shaped, and redefined as information flows are combined.

Smart Objects. Sometimes described as the “Internet of things,” smart objects describe a set of technologies that is imbuing ordinary objects with the

ability to recognize their physical location and respond appropriately, or to connect with other objects or information. A smart object “knows” something about itself — where and how it was made, what it is for, where it should be, or who owns it, for example — and something about its environment. While the underlying technologies that make this possible — RFID, QR codes, smartcards, touch and motion sensors, and the like — are not new, we are seeing new forms of sensors, identifiers, and applications with a much more generalizable set of functionalities. (p. 4)

Cloud computing was placed on the near-term horizon by the Horizon authors because it had emerged during their research as the “unifying technology supporting grassroots video, collaboration webs, and social operating systems” (p. 5). Cloud computing, accordingly, had the potential “to change the way we think about computing ... (and) to recognize how profoundly different it is” (p. 5). This technology had so much “disruptive potential” that the Horizon researchers decided to make it a stand alone technology to “watch on its own merit” (p. 5).

Horizon 2010

Horizon Report 2010 (Johnson, Levine & Smith, 2010), like past editions, reported six technologies that were or would have a significant impact on learning-focused organizations within the next five years. They noted that the trends and technologies they had reported on the past years were “having a profound effect on the

way we experiment with, adopt, and use emerging technologies” (p. 5). The six impact technologies for 2010 were:

Mobile computing, by which we mean use of the network-capable devices students are already carrying, is already established on many campuses, although before we see any widespread use, concerns about privacy, classroom management, and access will need to be addressed. At the same time, the opportunity is great; virtually all higher education students carry some form of mobile device, and the cellular network that supports their connectivity continues to grow. An increasing number of faculty and instructional technology staff are experimenting with the possibilities for collaboration and communication offered by mobile computing. Devices from smart phones to netbooks are portable tools for productivity, learning, and communication, offering an increasing range of activities fully supported by applications designed especially for mobiles.

Open content, also expected to reach mainstream use in the next twelve months, is the current form of a movement that began nearly a decade ago, when schools like MIT began to make their course content freely available. Today, there is a tremendous variety of open content, and in many parts of the world, open content represents a profound shift in the way students study and learn. Far more than a collection of free online course materials, the open content movement is a response to the rising costs of education, the desire for access to learning in

areas where such access is difficult, and an expression of student choice about when and how to learn.

Electronic books have been available in some form for nearly four decades, but the past twelve months have seen a dramatic upswing in their acceptance and use. Convenient and capable electronic reading devices combine the activities of acquiring, storing, reading, and annotating digital books, making it very easy to collect and carry hundreds of volumes in a space smaller than a single paperback book. Already in the mainstream of consumer use, electronic books are appearing on campuses with increasing frequency. Thanks to a number of pilot programs, much is already known about student preferences with regards to the various platforms available. Electronic books promise to reduce costs, save students from carrying pounds of textbooks, and contribute to the environmental efforts of paper-conscious campuses.

Simple augmented reality refers to the shift that has made augmented reality accessible to almost anyone. Augmented reality used to require specialized equipment, none of which was very portable. Today, applications for laptops and smart phones overlay digital information onto the physical world quickly and easily. While still two to three years away from widespread use on campuses, augmented reality is establishing a foothold in the consumer sector, and in a form much easier to access than originally envisioned.

Gesture-based computing is already strong in the consumer market and we are seeing a growing number of prototypical applications for training, research, and study, though this technology is still some time away from common educational use. Devices that are controlled by natural movements of the finger, hand, arm, and body are becoming more common. Game companies in particular are exploring the potential offered by consoles that require no handheld controller, but instead recognize and interpret body motions. As we work with devices that react to us instead of requiring us to work with them, our understanding of what it means to interact with computers is beginning to change.

Visual data analysis, a way of discovering and understanding patterns in large data sets via visual interpretation, is currently used in the scientific analysis of complex processes. As the tools to interpret and display data have become more sophisticated, models can be manipulated in real time and researchers are able to navigate and explore data in ways that were not possible previously. Visual data analysis is an emerging field, a blend of statistics, data mining, and visualization that promises to make it possible for anyone to sift through, display, and understand complex concepts and relationships. (p. 5-7)

The Horizon Report 2010 researchers summarized their work by stating that all six of their reported technologies “taken together, will have a significant impact on learning-focused organizations within the next five years” (p. 7). The research from all the Horizon Reports is summarized in Table 3.

Table 3

Horizon Report Emerging Technologies Timeline

Publication Date	Priority / Description	Implementation Dates
January 2004	<ol style="list-style-type: none"> 1. Learning Objects 2. Scalable Vector Graphics (SVG) 3. Rapid Prototyping 4. Multimodal Interfaces 5. Context Aware Computing 6. Knowledge Webs 	2005 (one year) 2005 (one year) 2006 – 2007 (2-3 years) 2006 – 2007 (2-3 years) 2008 – 2009 (4-5 years) 2008 – 2009 (4-5 years)
January 2005	<ol style="list-style-type: none"> 1. Extended Learning 2. Ubiquitous Wireless 3. Intelligent Searching 4. Educational Gaming 5. Social Networks & Knowledge Webs 6. Context-Award Computing/Augmented Reality 	2006 (one year) 2006 (one year) 2007 – 2010 (2-3 years) 2007 – 2010 (2-3 years) 2009 – 2010 (2-3 years) 2009 – 2010 (4-5 years)
January 2006	<ol style="list-style-type: none"> 1. Social Computing 2. Personal Broadcasting 3. The Phones in the Pockets 4. Educational Gaming 5. Augmented Reality and Enhanced Visualization 6. Context Aware Environments and Devices 	2007 (one year) 2007 (one year) 2008 – 2009 (2-3 years) 2008 – 2009 (2-3 years) 2010 – 2011 (4-5 years) 2010 – 2011 (4-5 years)
January 2007	<ol style="list-style-type: none"> 1. User-Created Content 2. Social Networking 3. Mobile Phones 4. Virtual Worlds 5. The New Scholarship and Emerging Forms of Publication 6. Massively Multiplayer Educational Gaming 	2008 (one year) 2008 (one year) 2009 – 2010 (2-3 years) 2009 – 2010 (2-3 years) 2011 – 2012 (4-5 years) 2011 – 2012 (4-5 years)
January 2008	<ol style="list-style-type: none"> 1. Grassroots Video 2. Collaboration Webs 3. Mobile Broadband 4. Data Mashups 5. Collective Intelligence 6. Social Operating Systems 	2009 (one year) 2009 (one year) 2010 – 2011 (2-3 years) 2010 – 2011 (2-3 years) 2012 – 2013 (4-5 years) 2012 – 2013 (4-5 years)

Publication Date	Priority / Description	Implementation Dates
January 2009	1. Mobiles	2010 (one year)
	2. Cloud Computing	2010 (one year)
	3. Geo-Everything	2011 – 2012 (2-3 years)
	4. The Personal Web	2011 – 2012 (2-3 years)
	5. Semantic-Aware Applications	2013 – 2014 (4-5 years)
	6. Smart Objects	2013 – 2014 (4-5 years)
January 2010	1. Mobile Computing	2011 (one year)
	2. Open Content	2011 (one year)
	3. Electronic Books	2012 – 2013 (2-3 years)
	4. Simple Augmented Reality	2012– 2013 (2-3 years)
	5. Gesture-Based Computing	2014 – 2015 (4-5 years)
	6. Visual Data Analysis	2014 – 2015 (4-5 years)

Note. From Horizon Reports 2004, 2005, 2006, 2007, 2008, 2009, & 2010

Cloud Computing Horizon

The Tower and the Cloud: Higher Education in the Age of Cloud Computing (Katz, 2008) was research regarding the rapid pace of technological changes affecting the tower (Higher Education), and examined the emergence of the “cloud”. Katz and his researchers tackled the questions, “How are ‘cloud’ technologies and applications already affecting us?” “What does that say about how they are likely to evolve and impact us in the future?” “What might colleges, universities, and higher education overall look like as a result?” (p. ix). The final question raised by Katz was, “What (is the) impact the breathtaking rise of online social networking will have for building and sustaining community in higher education?” (p. x).

In answering that particular question, Katz examined the various parameters of change in the uncertain period he felt the institutions of higher learning were going through. Table 4, a summary of key trends in the history of Western higher education,

was developed as the story of information and communication technology and “a quest to put thinking and communicating power everywhere and in everything and to connect it all” (p. 7).

Table 4

Key Trends in the History of Western Higher Education

From	To
Teaching is a small-scale craft and learning is personalized.	Instruction is a scalable craft and can be standardized, personalized, or self-guided.
The governing power of colleges and universities is derived from church or state.	Colleges and universities are largely self-governing.
The academy is isolated from society.	The academy is enmeshed in communities served.
College or university education is accessible to an elite student body.	College or university education is accessible to all capable.
The college and university service base is local.	The college or university service base can be local, regional, or global.
The college or university is a place.	The college or university is situated in a place and virtually enhanced.
Scholars and academic resources are scarce and inaccessible.	Scholars and academic resources are plentiful and easily accessible.
Colleges and universities are purveyors and collectors of knowledge.	Colleges and universities are creators of knowledge.
Colleges and universities are local.	Colleges and universities are increasingly global.

Note: Table from Katz (2008, p. 7).

The “cloud” is a penultimate solution for placing disruptive learning innovations into a structure, according to Katz, because by making “computers faster, cheaper, better,

more reliable, smaller, and more personal; by making communication ubiquitous and fast; and by making connections persistent” (p. 7), the institutions of higher learning would continue to serve society. Furthermore Katz used the “cloud” concept as a most appropriate metaphor because,

... Not only is the *rate* [author’s emphasis] of change accelerating, but the *form* that change is assuming is becoming indistinct. The form that change is assuming is that of a cloud. Cloudiness denotes heterogeneity, dynamism, shape shifting, indistinctness, and the capacity for expansion and reorganization. Cloudiness also denotes confusion and lack of clarity. We are at the change’s borders and we cannot fully envision the territory that lies ahead. We are at a cusp—an interregnum that separates innovation and socialization. We are making the leap from one innovation curve to another. ...Our uncertainty makes sense. Technological changes typically outpace people’s ability to socialize those changes. (p. 12)

Because cloud computing remained an emergent concept and development, it was the subject of “hype, definitional disputes, and inevitable fits and starts” (p. 14), but it was clear to Katz that it was all leading to a clear and definitive understanding of the nature of disruptive learning innovations like the three “disruptive forces ... bearing down on higher education at this very moment: unbundling; demand-pull; ... and ubiquitous access” (p. 14). The explanation of these disruptive forces follows:

Unbundling, or disintermediation, makes it possible for the consumer to acquire only the blurb rather than the book, the cut rather than the album, or perhaps the course rather than the academic program. It is now possible for traditional colleges and universities to offer coursework in learning centers, on campuses, online, and in a variety of hybrid forms. For still others, the availability of virtualized services will make it possible to rebundle elements of educational infrastructure (tutors, library materials, assessments, and so forth) in ways that are experientially rich while being scalable and enjoying very different economies from their place-based alternatives. Not only does the cloud enable the unbundling of higher education's service offerings, it facilitates a world of "mashed up" IT application, expression, ideas, and scholarship. Ideas move through the cloud at the speed of light. They are mashed together with other ideas, commented on, transmuted, embedded, enlivened, debased as they circle the globe. ... It is increasingly likely over the long term that core higher education processes will be available as cloud services.

Demand-Pull relates to the capabilities, preferences, and behaviors of consumers in a cloudy world. In the context of higher education generally, the emergence of a robust tool set for configuring our world is enormously powerful and beneficial. We are able to consume more relevant information, faster, and share insights within purposeful communities more effectively than ever before. Higher education, like many industries, is organized today in a producercentric

fashion. We are *supply-push* based institutions. In an unbundled cloud in which the consumer has been fully empowered, we run the risk that students will lose confidence in our ability to construct curricula that meet their needs. For the college or university administrator and IT leader, the move to a demand-pull economy is similarly disruptive. When the forces of unbundling and demand-pull combine, the results are easy to visualize. The growing availability of low-cost, easy-to-use devices and cloud services makes it possible for today's student or new faculty member to arrive on campus with an intelligent phone, portable digital music player, laptop computer, router, social networks, e-mail accounts, network data storage, RSS reader, and perhaps open source office productivity tools and web development environment. These students—and tomorrow's faculty—will have little use for or patience with college or university offerings that underperforms or force them to lose precious connections to people and processes that they have accumulated since childhood.

Ubiquitous Access. The importance of having more than 1 billion people and nearly all published information online cannot be overstated. Such milestones suggest the arrival at tipping points—in the roles played by traditional libraries and in the roles played by academics. ... The nature of scholarship has changed and indeed must change in light of ubiquitous access. The emergence of the networked information economy has made information and knowledge central to human development and progress. The premium on information and

knowledge—and on processes for creating and socializing this information and knowledge—carries with it the potential for colleges and universities to occupy places of increasing centrality. (pp. 14-19)

Finally Katz (2008) postulated that because of the emergence of new technological capabilities and the disruptive nature of those capabilities, a new set of priorities needed to be ascertained for the institutions of higher learning. He called for research into how colleges and universities were coping or would cope with the immediate and long range future and believed it was another opportunity to visit “what John Henry Newman called ‘the idea of a university’” (p. 21).

Emerging Educational Technologies

Siemens and Tittenberger’s (2009) research on emerging technologies as a resource for educators planning to incorporate them into their teaching and learning activities concluded that universities which recognized the value of mobile technologies, ubiquitous computing, and disruptive learning innovations, and are able to get the model right, “would be well positioned to respond creatively to developing pressure changes”(p. *i*). These changes would challenge universities and colleges to understand the “duality of change – conceptual and technological – which faces higher education” (p. 1). The authors lamented on one aspect of their research which found technology and the prominence of mobile technologies and social networking services had not been matched by their “adoption of educational technology in universities” (p. 6). They questioned “how rapidly should universities respond to larger social and communication technology

trends in society” because they found that impact of “communication technology on learners and the learning process is still underdeveloped” (p. 6).

Their research grouped new technologies into six categories, each based on their disruptive innovativeness, or “action potential,” which were “access, presence, expression, creation, interaction, and aggregation” (Siemens & Tittenberger, p. 41). These categories each had specific technologies associated with them for learning, starting with:

The Blog, a basic web page with posts presented in reverse chronological order and as a teaching tool, something that could be “used by educators to update learners on course activities, post reflections on in-class or on-line conversations, and other course resources”; Wikis, collaborative writings on the web, while “chaotic” and considered “informal knowledge,” could be used to enable individuals to create collective resources with the most well known, and “increasingly referenced, is Wikipedia”; Social Bookmarking, a way “to store and organize bookmarks (favorites) on the web with one of the most prevalent web site services is managed by Delicious which allows users to tag the resource, select it for private/public view, and share it with others in a network”. Other managed services, Diigo and Stumble Upon, allow “users to rate, tag, and comment on specific web pages.” Social bookmarking has become invaluable for researchers and students “slaving away on your dissertation”; Audio and Podcasting, as distributed through RSS, allowed educators to record and distribute

audio files with only a computer, microphone, and internet access. Learners could listen to podcasts (lectures, external presenters, evaluations, learner created reflections, interview with contributors, news or course-related updates, and short introductions to new subject areas) via their computer or iPod, or any similar audio device; Image sharing (with Flickr[®]) is similar to audio and podcasts, but it dealt with images and the sharing of those images. Learners and teachers “upload, tag, share, annotate, and discuss images and photos” and each photo can have a geotag attached to it so viewers would know which part of the world it originated. (pp. 43-45)

Siemens and Tittenberger (2009) also found that video, while no longer considered a *disruptive* learning innovation, nevertheless had been upgraded and revamped because increased bandwidth made it useable and streamlined on most computers. The increased bandwidth allowed learners to view lectures in either asynchronous or synchronous time frames. Open Education Resources (OERs) were also included in Siemens and Tittenberger’s research because of “their potential to influence higher education” (p. 46). OERs were “materials made freely available online for educators and learners to use, repurpose, and extend” and because the materials are accessible online, educators could “link to and incorporate simulations, videos, lectures, and other learning activities” (p. 47).

Their research into Microblogging, a process for “sharing resources and engaging in short conversations with other users of the service,” (p. 47) was being provided by

Twitter, Tumblr, and Plurk. Users were limited to text messaging of only 140 characters which then provided immediacy and direct communication with another individual or group within that network. Educators found that using Microblogging to ask learners to “follow” prominent people who had also established microblogs, formed social networks with other like learners, shared resources, tracked current events, followed conferences within a field of study, or had an alternative avenue for student-instructor interaction turned into a learning experience (p. 47). Social Networking Software had many of the aspects of Microblogging, but the user was able to go beyond the 140 character space limitation by adding images, status updates, events, emails, and videos, all of which could be shared with those invited to be a part of the network. The most popular of the “social networking sites include MySpace™, Orkut, and Facebook, all of which were easy to use and connect and have resulted in rapid adoption” (p. 48). While educators have been reticent to use social networks in courses, there was no reluctance to use Web Conferencing, according to the authors.

Web Conferencing was used to “facilitate groups meetings or live presentations over the Internet” (p. 49). It was also used as a text messaging site, or at its most complex iteration, a videoconferencing site completely viewable from a desktop, handheld, or mobile computing device. Because Web conferencing was synchronous, most sites had record, playback, and email capability as well. For the educator, the web conferencing software allowed for “group meetings, virtual classes, office hours ...

students meeting with mentors, guest lecturers, recording classes or meetings, (and) online conferences” (p. 49).

To Siemens and Tittenberger (2009), games, virtual worlds, and simulations represented unknown but still emerging learning innovations for higher education use. However, their focus on Second Life[®], an alternative learning experience where learners interacted “with peers and educators through avatars, explore course material (often in a more interactive manner than only reading text), and express personal learning through visual means” (p. 50) showed that some educational institutions were engaged in its use. The University of Central Florida’s College of Medicine, which opened Fall, 2009, assigned each entering medical student a virtual patient, an avatar, which could display certain symptoms, give medical history, request certain lab test, give a medical student the chance to diagnose, and then treat it as a “patient” was the first known use of this emerging technology (Debolt, 2008, p. A6). The capabilities of all these emerging learning innovations would be more evident as they were proliferated and became even more ubiquitous, according to Siemens and Tittenberger.

Ubiquitous computing was about more than just devices that allowed a user 24/7/365 access to information, video, websites, real time synchronous conversation and visuals. Ubiquitous computing, especially the research on it, was characterized “by a concern with potential future computational worlds” (Bell & Dourish, 2006, ¶2). Ubiquitous computing has continued to transform the way people perform work and still maintain and/or obtain the required skills to stay current with technological changes,

according to Ling (2008). He postulated that people were experiencing a time when educational institutions were on the decline, the pendulum was “moving in the direction of the individual” and as “brick and mortar institutions wane” more advanced institutions of learning, via a wide variety of technologies, were “on the rise” (p. 38).

Summary

Literature about emerging educational technologies, learning innovations, and ubiquitous computing no longer questioned whether educational organizations would implement them for learning, but whether they would learn to do it well (Harry & Khan, 2000). This idea was centered on much discussion about the concept of “active learning” (Huffaker & Calvert, 2003, p. 331) while Voithofer (2005) found active learning as the convergence of the “computer, media, communication, information, social, visual” discourses (p. 3). Traxler (2007) pointed out that the concept of mobile technology impact on learning was visible mainly through dedicated international conferences rather than through any dedicated journals. What had developed less confidently within the mobile technologies community was “any theoretical conceptualization of mobile learning and with it any evaluation methodologies specifically aligned to the unique attributes of mobile learning” (¶2). He found that some advocates of mobile learning attempted to define and conceptualize it in terms of devices and technologies, while others defined it in terms of the mobility of the learner. What he advocated was the development of a “base” that would provide the starting point for evaluation methodologies (¶5). He urged the institutions of higher learning to look at technology

driven learning in a wider context and to recognize that “mobile, personal, and wireless devices were now radically transforming societal notions of discourse and knowledge, and were responsible for new forms of art, employment, language, commerce, deprivation, and crime, as well as learning” (¶7).

A major challenge was the need to investigate how low-cost solutions could be implemented so that technology driven learning would be sustainable. Litchfield et al. (2007) lamented the lack of studies on how to develop strategies for effective learning about these technologies as did Peters (2007) who found the “need for a contemporary perspective meant that there was very few research articles on mLearning available and therefore, limited reference had been made to peer-reviewed academic publications” (¶4). The Harvard University sponsored Handheld Devices for Ubiquitous Learning (HDUL) project sought to “understand the potentials and limitations, problems and possibilities” wireless handheld devices posed for “teaching in and learning in the 21st Century” (Dieterle, 2005, ¶4). Herrington and Herrington (2007) concluded that mobile learning technologies challenged many of the fundamental assumptions made for decades about higher education. They believed research was needed to “establish” these assumptions in the context of “appropriate theoretical underpinnings and pedagogical application” (¶26).

The era of pervasive technology has significant implications for higher education, learning, and the dissemination of knowledge and Glenn (2008) believed more study was appropriate. Research showed the technological innovations underway in institutions of higher learning would “have a major impact on teaching methodologies over the next five

years” (p. 5). His work with Henderson, vice president of institutional advancement with New York City-based Queens College, argued that “technology allows students to become much more engaged in constructing their own knowledge, and cognitive studies show that ability is key to learning success” (p. 5), but more study would have to show the efficacy of that success. Those sentiments were echoed by Kukulska-Hulme (2007) who called for a systematic review of all the available sources a university possessed as a “valuable exercise” in understanding the technology usability issues that pertain to education (¶4).

Siemens and Tittenberger (2009) summarized that the “greater use of emerging technology can serve as an important bridging process between the traditional role of education and the not yet clearly defined future” and as this happened, the institutions of higher learning “will emerge as a prominent sensemaking [sic] and knowledge expansion institution, reflecting the needs of learners and society while maintaining its role as a transformative agent in pursuit of humanity’s highest ideals” (p. 53).

CHAPTER THREE: METHODOLOGY

Introduction

Chapter Three provided the methodologies and procedures used in determining the extent to which IT organizations, within the eleven SUS institutions, planned, implemented, and diffused emerging educational technologies. These determinations were arrived at through the survey (Appendix F). Data collected from the survey determined:

1. Planning strategies to incorporate educational technologies as considered by Florida's SUS institutions;
2. Descriptive patterns of implementation of innovative educational technologies used by Florida's SUS institutions;
3. Challenges and opportunities associated with the diffusion of innovative educational technologies by Florida's SUS institutions; and,
4. The most/least problematic mechanisms or factors after examining innovative educational technologies by Florida's SUS institutions.

Population and Setting

The eleven Chief Information Officers/equivalents associated with the institutions of the State University System (SUS) were the surveyed population. These individuals were most aware, most involved, and most responsible for ensuring the proper planning, implementation, and diffusion of emerging educational technologies was accomplished. The SUS was established in 1905 with University of Florida (UF) and Florida State

University (FSU) as initial members and the remaining nine higher learning institutions added over the years. The most recent addition was New College of Florida in 2001. Two members, UF and Florida Agriculture and Mechanical University (FAMU) are land grant colleges. FSU is the oldest state university and was originally founded as an all female institution. The institutions of the SUS have the following Carnegie classifications (Carnegie Foundation for the Advancement of Teaching, 2009b):

University of Florida	Research University (very high research activity)
University of South Florida	Research University (very high research activity)
Florida State University	Research University (very high research activity)
Florida International University	Research University (high research activity)
University of Central Florida	Research University (high research activity)
Florida Atlantic University	Research University (high research activity)
University of West Florida	Doctoral/Research University
Florida A & M University	Doctoral/Research University
Florida Gulf Coast University	Master's University (larger programs)
University of North Florida	Master's University (larger programs)
New College of Florida	Baccalaureate College – Arts & Sciences

In 2009, all of the SUS institutions are governed by individual boards of trustees who in turn are answerable to the Board of Governors of the State of Florida. Members of the Board of Governors are appointed by the Governor. The budget for all eleven SUS institutions in 2009-2010 was about \$3.1 billion, with approximately \$1 billion coming

from student tuition. The remaining portion of the budget was used to implement programs and directives to keep Florida's institutions of higher learning in the forefront of teaching (State University System of Florida 2009-2010 Budget, 2009). What follows is an analysis of each institution's inclusion of technology in their mission/strategic plan.

The SUS Institutions of Higher Learning

University of Florida (UF) included technology in both its mission statement as well as its strategic plan (University of Florida, 2009e). An awareness of emerging educational technologies was included as well (University of Florida, 2009b). Structurally, the Office of Information Technology (University of Florida, 2009a) fell under the Sr. Vice President for Administration (University of Florida, 2009c) (University of Florida, 2009d) and included the distance education group and the e-Learning Task Force, both of which give direction and implement strategy. The goal of the Task Force is to "improve quality, analyze the number of offerings, effectively use resources, identify a portfolio of programs that address the growing needs, process to coordinate portfolio, gather infrastructure and support for delivery needs, meet state requirements, and ensure sustainability" (University of Florida, 2009f).

University of South Florida (USF) included technology in its mission and strategic plans (University of South Florida, 2009b) with ideas regarding the importance of emerging educational technologies. The USF Faculty Senate's technology committee also provided inputs (University of South Florida, 2009a) while the university's overall

technology needs were under the Administrative Services for Human Resources organization.

Florida State University's (FSU) overall mission statement has a clearly defined idea regarding technology. The importance of technology was also articulated in the FSU strategic plan (Florida State University, 2009b), but there was no mention of emerging educational technologies. The Associate Vice President/CIO (Florida State University, 2009a) administered the Office of Technology Integration with four reporting directorates responsible for IT integration: Director ACNS; Director AIS; Director IRM/ISM; and, User services.

Florida International University (FIU) referenced technology on their home Web page, but had no mention of emerging educational technologies (Florida International University, 2009d). Under FIU's overall organization (Florida International University, 2009c), there is a Vice President/CIO who supervised the Division of Information Technology organization and whose mission was, "To support FIU in its pursuit to become a national academic institution by providing leadership, consultation, service and secure access for the use of technology" (Florida International University, 2009a, ¶1). FIU's Vision Statement articulated the idea of advancing FIU as a leader in using emerging technologies for learning, teaching, research and administration. This vision was implemented under the guidance of the University Technology Services which also supported the Training Center, Academic Technology and Support Services, and Instructional design area (Florida International University, 2009e). The Faculty Senate

also demonstrated their commitment to innovation with a Technology Committee and an On-line Review Committee. These committees were considered an integral part of the academic governance of the University (Florida International University, 2009b).

University of Central Florida (UCF) has a well defined technology mission statement, but it is not included in its strategic plan (University of Central Florida, 2009e). Emerging educational technologies are not mentioned, but there is involvement in information technologies by the Faculty Senate committee on information technology resources (University of Central Florida, 2009a). The Information Technologies and Resources Division (University of Central Florida, 2009b and 2009c) fall organizationally under the Provost's Office (University of Central Florida, 2009d).

Florida Atlantic University's (FAU) mission statement included knowing about emerging educational technology advancements and that concept was also included in the overall strategic plan (Florida Atlantic University, 2009d). Under the school's organizational (Florida Atlantic University, 2009c) there was an Associate Provost for Information Resources Management/CIO and that person was responsible for Computing, Distance learning, Learning resources, and Telecommunications (Florida Atlantic University, 2009a) (Florida Atlantic University, 2009b).

The University of West Florida (UWF) staff wrote a most complete technology mission and strategic plan (University of West Florida, 2009c) which not only included emerging educational technologies, but wireless (WI-FI) technologies as well (University of West Florida, 2009a). Under the direction of the Executive Vice President and Chief

Operating Officer (University of West Florida, 2009d), the Senior Associate Vice President and Chief Information Officers oversees the Assistant Vice President for Information Technology (ITS), who is responsible for providing institutional computing and network services. The IT Strategic Plan established six strategic goals for the use of emerging educational technologies. The first three goals concentrated on the utility and transforming nature of information technology in using technology in support of the University's strategic goals, while the final three goals concentrated on the prudent management and effective use of information technology to address the associated risk and expense. The strategic goals included:

Use of information technology to enrich the instructional educational experience of students by enhancing the quality of learning, access to learning, student services, and student engagement in the University community; Use emerging information technology to provide an environment that enables leading-edge scholarship and research by faculty and students; Use information technology to enable the University to provide high-quality information and services to its clients and partners, and to conduct University operations effectively and efficiently; Provide a quality, reliable, sustainable, consistent, and secure educational and informational technology infrastructure that enables contemporary teaching, learning, research, service, and administrative operations to flourish; and, Ensure that all staff are skilled to be able to productively use emerging information technology appropriately and effectively; Ensure the

effective governance, design, deployment, and management of information technology resources, guided by institutional priorities and stakeholder needs. (University of West Florida, 2003, p. 2)

In addition, UWF has an Academic Technology Center (ATC) which served as a catalyst for the application of new technologies to support teaching, learning, and creative expression by:

Aligning all strategies to the mission of the university and its strategic priorities; Assisting in the development of quality distance and distributed curriculum using digital media aligned to pedagogical methods of teaching and learning; Providing extensive faculty support services; Collaborating with campus service units to provide excellent student support services in this highly mobile environment; and, Engaging in continuous improvement through data collection, analysis and cyclical improvements. (University of West Florida, 2009b, ¶4)

Florida Agricultural and Mechanical University (FAMU) included technology innovations on their web page, but did not mention any emerging educational technologies. FAMU does include technology in their strategic plan by stating, “From a technological perspective, FAMU plans to increase its educational technology resources and help close the gap with emphasis on minority populations in Florida. The University will build on its existing distance learning programs. ...The Media Center will intensify its role in faculty development via the use of educational technology in preparation for additional distance learning programs. Developing more effective distance learning

programs during the years ahead will lead to the recruitment of a greater number of non-traditional students, thus contributing to the University's emphasis on diversity" (Florida Agricultural and Mechanical University, 2004, p. 4). They completed an environmental scan which included emerging educational technologies and one part of their strategic plan called for expanding on-line education by providing faculty with training modes for delivering distance learning. FAMU's Vice President for Information Technology/CIO is charged with the goal of "providing cost effective, efficient and reliable access to cutting edge Information Technologies of hardware, software, networking, and telephony for the students, faculty, staff and stakeholders of Florida A&M University" (Florida Agricultural and Mechanical University, 2009a, ¶1). Also under the organization is the campus Computer Center, all Telecommunications, Network Services, and EIT (Enterprise Information Technology) Services (Florida Agricultural and Mechanical University, 2009b).

Florida Gulf Coast University (FGCU) has no mention of emerging educational technologies as a part of the mission statement, but the strategic plan did (Florida Gulf Coast University, 2005). In the university's organization chart (Florida Gulf Coast University, 2009c) under the Provost and Vice President Academic Affairs, there was a Division of Academic and Media Technology Services (Florida Gulf Coast University, 2009a). This organization operated Web and e-Learning publications, and with the Academic and Event technology Department, was chartered to provide technology services to faculty, staff and students as it related to the delivery of courses and

“developing academic, research, and service solutions that utilize the full potential of the Web” (Florida Gulf Coast University, 2009b, ¶1). In addition, there is a Vice President Administrative Services who has an Associate VP responsible for Computing services, Information systems, and Telecommunications.

University of North Florida (UNF) included high technology in both its mission and strategic plans (University of North Florida, 2005), to include emerging educational technologies. A Vice President for Administration and Finance and Information Technology Services (University of North Florida, 2009a) (University of North Florida, 2009b) is responsible for overseeing all aspects of the university’s technology resources. UNF also had an active university wide technology committee (University of North Florida, 2009c).

New College of Florida (NCF) is an honors college that awards only undergraduate degrees. The mission statement included emerging educational technology concepts as did the strategic plan (New College of Florida, 2008). There were two key organizations that oversee the development and implementation of technology for the college (New College of Florida, 2009b): Educational Technology Services (New College of Florida, 2009a) and the Technology Advisory Committee (New College of Florida, 2009c).

Sample and Sample Limitations

One of the first problems this researcher encountered with the study was it not being a true sample but rather a census of a population. However, this was a non-random

or purposive sample and the results were not intended to be generalized to any other population other than the SUS institutions. This may be construed as a weakness, but the research was not concerned with institutions outside of the Florida system.

A concern of a non-random purposive sample might be its “representativeness” (Fraenkel & Wallen, 1996, p. 101). These authors discussed several problems surrounding samples. One of their concerns as it related to this study would have been the non-random/purposive character of the sample. When this was the case, the researcher used caution when generalizing study results to a larger population or assuming the sample was representative of a larger population.

Another concern was the small size of the study sample. This was of concern since there is a greater chance for error and measurement of such a small group will not be as precise. When there is such a small sample size, it is necessary that participation rate be as high as possible. This researcher determined that a sample size over 60% would be considered an excellent return.

Internal validity threats included “selection bias, loss of subjects (mortality), location threat, instrumentation decay, data collector characteristics, data collector bias, testing threat, history threat, maturation threat, attitudes of subjects (such as the Hawthorne effect), and implementer threat” (Fraenkel & Wallen, 1996, p. 242-250). From these, the researcher believed that only those participants who did not respond to the survey might impact internal validity because those who do not respond may be significantly different than those who did. To overcome this problem, authors Fraenkel

and Wallen suggested researchers make an extraordinary effort to encourage participation of those who did not respond initially. The authors also suggested that through standardization of study conditions, the obtaining of more information about participants and a wise choice of an appropriate survey design, there could be minimal threats to internal validity.

External validity referred to the extent to which “researchers generalize ... the finding of a particular study to people or settings that go beyond the particular people or settings used in the study” (Fraenkel & Wallen, 1996, p. 106). The authors further opined that “if the results of a study only apply to the group being studied and if that group is fairly small or is narrowly defined, the usefulness of any finding is seriously limited” (p. 107). Furthermore, the authors stated that “the extent to which the results of a study can be generalized determine the external validity of the study” (p. 107). This meant for the study there was no external validity, but this researcher was not attempting to generalize the results to any larger population. It was meant to explore planning, implementation, and diffusion of educational technology of the SUS institutions.

Design of the Study

Questionnaires as Instruments or Tools for Research

A survey is a common system used to gather information, data, and opinions from all manner of people, in all manner of occupations. Surveys are generally formatted as questionnaires with which the researcher can distribute via mail in hard copy, or through the Internet through a variety of commercial survey companies, e.g., SurveyMonkey, or

sent directly by the researcher via the Internet. Surveys may also be administered via telecommunications (Wright, 2009). Wright's research for the Accrediting Commission for Senior Colleges and Universities of the Western Association of Schools and Colleges, found that surveys had some inherent disadvantages. These disadvantages included:

Construction of a survey requires expertise, time, clarity about purposes; hiring consultants and purchasing survey services can be costly; surveys run the danger of being too long, too broad; response rate may be very low; low response rate reduces representativeness, usefulness of results; structured format reduces chance of unanticipated findings; institutions often over-survey, leading to survey fatigue, wasted resources; collected data are often not used, shared; telephone surveys can be slow, expensive; and, surveys are becoming less popular. (Wright, 2009, ¶ 3)

Wright (2009) however found there were more advantages of surveys than disadvantages because:

Surveys are well-known, broadly accepted; are adaptable to many different kinds of research questions; are adaptable to different audiences (students, alums, employers, non-completers); items can vary in format, e.g., yes/no, rating scales, lists, open-ended questions; can reveal the "why" and "how" behind the "what"; results allow statistical analysis, reporting; self-reports are generally truthful, accurate; many surveys are commercially available, usually can be customized, e.g., NSEE, CCSSE, CSEP, CCSEP, CIRP, Noel-Levitz; purchased surveys

provide norms, benchmarks, detailed reports; software programs are available, e.g., SurveyMonkey, Zoomerang™; software and email make surveys swift, cheap to administer; and, data are easy to store and analyze. (¶ 2)

Wright (2005) examined the advantages and disadvantages of conducting electronic surveys and found that while online electronic survey capability was “young and evolving, it was nonetheless making surveys for research purpose much easier and faster” (p. 2). The advantages associated with conducting survey research online included “access to individuals in distant locations, the ability to reach difficult contact participants, and the convenience of having automated data collection, which reduces researcher time and effort” (p. 2). Disadvantages of online survey research included, “uncertainty over the validity of the data and sampling issues, and concerns surrounding the design, implementation, and evaluation of an online survey” (p. 2).

Instrumentation

After significant research, it was decided to modify a survey (Appendix F) created by Ahmed, Daim, and Basoglu (2007), researchers who formulated an instrument to garner an understanding of information technology diffusion in higher education. Their survey examined information technology’s (IT) planning, implementation, and diffusion effects in an academic environment. They examined how an institution of higher learning kept pace with the latest technologies by anticipating and implementing new technology solutions in efficient and effective deployments. Ahmed et al. developed the

survey from issues derived from results of prior research. Permission to use and modify the survey was granted by Daim (Appendix H).

The survey contained four sections. Section 1, Planning, contained nine specific statements which the participant rated using a 5 point Likert scale. Question 10 was open-ended, which allowed respondents to elaborate or identify issues in writing regarding planning. Section 2, Implementation, contained eleven specific statements for the respondent to rate using the Likert scale. Question 22 was a problem identification area which could take written comments by the respondent if he/she wanted to elaborate on implementation issues. Section 3, Diffusion, contained ten specific statements to be rated by the respondent also using the same scale. Question 33 was a problem identification area which could be used to allow the respondent to elaborate on diffusion issues.

The Likert scale instructed the respondent to select:

- 1 – If the item is never a problem (0% of the time);
- 2 – If the item is rarely a problem (1 to 30% of the time);
- 3 – If the item is sometimes a problem (31 to 60% of the time);
- 4 – If the item is frequently a problem (61 to 90% of the time); and,
- 5 – If the item is almost always a problem (91 to 100% of the time).

Section 4, Solutions, contained three open-ended questions to be answered by the respondent regarding strategies their institutions used to resolve or address problems

encountered during the planning, implementation and diffusion stages of the educational technology adoption process.

The survey instrument received a Flesch Reading Ease score of 62.2 and a Flesch-Kincaid Grade Level rating of 8.0. According to Hogan (2009), “the most readable things in the world are in the high 60s” and “the most dismally thick writing scores in the 20s and below.” The author concluded that “most writing in the known universe fall somewhere in between ...because most people who write aren’t gods and most aren’t dismally thick” (¶5-6). Readabilityformulas.com (2009) stated, “If we were to draw a conclusion from the Flesch Reading Ease Formula, then the best text should contain shorter sentences and words. The score between 60 and 70 is largely considered acceptable” (¶3).

Threats to Validity of Survey Research

Fraenkel and Wallen (1996) found there were “four main threats to internal validity in survey research: mortality, location, instrumentation, and instrument decay” (p. 383). Mortality threats arise only in longitudinal studies and will not pertain to this study. Location threat occurs when collection of data is done in locations that could affect responses. This did not apply to the study since it was taken on a computer in a respondent’s chosen location. Instrumentation threats come from defects in the instrument itself. However, to insure this was not a threat to validity, a pilot study was provided to a small sample similar to the potential respondents. Fraenkel and Wallen believed a “pre-test” of the survey could “reveal ambiguities, poorly worded questions,

questions that are not understood, and unclear choices and can also indicate whether the instructions to the respondents are clear” (p. 376). Instrument decay, another threat to validity, may happen when interviewers are employed and they in turn are tired or rushed. However, no interviewers were used in the pilot study, and no interviewers were used in the survey.

Dillman (2000) alluded to “challenges” faced when using survey research. These challenges are the “four cornerstones of survey precision or accuracy—coverage, sampling, non-response, and measurement—are each a distinct source of error” and ultimately impact the external validity of the findings (p. 197). The study used a non-random and very small sample which jeopardizes or eliminates the possibility of this survey possessing external validity. But it was not the intent of the study to generalize, but rather explore the current state of technology and its diffusion in the institutions of the SUS. In addition, Dillman stated that “as of yet there is no accepted way of providing a meaningful combined measure of the effect of these four sources of error on overall accuracy” (p. 198).

Research Questions and Their Relationship to Survey Questions

The following details the relationship between the questions in the Survey and their relationship to the four research questions. Each research question related to a specific section of the questionnaire. The response items in each section of the Survey addressed the research questions. This, along with the statistical procedures performed for each group of questionnaire items, is listed below.

Research Question 1. Which *planning* strategies to incorporate educational technologies were considered by Florida's SUS institutions? Data from questions 1.1 through 1.10 addressed this research question. The data were loaded into SPSS and the report showed frequencies and percentages as calculated by the software.

Research Question 2. What are the common descriptive patterns of *implementation* of innovative educational technologies by Florida's SUS institutions? Data from questions 2.1 through 2.12 addressed this research question. The data were loaded into SPSS and the report showed frequencies and percentages as calculated by the software.

Research Question 3. What are the challenges and opportunities associated with the *diffusion* of innovative educational technologies by Florida's SUS institutions? Data from questions 3.1 through 3.11 addressed this research question. The data were loaded into SPSS and the report showed frequencies and percentages as calculated by the software.

Research Question 4. What are the most/least problematic mechanisms or factors in regards to examining innovative educational technologies by Florida's SUS institutions? Data from all sections were used to address this question.

Section four contained statements 4.1 through 4.3 (the *solutions* section of the survey), and depending upon the responses was used by respondents to address any or all of the research questions. Responses are reported in Chapter Four as stand-alone

information/results. The relationship of the research questions to survey questions is detailed in Table 5.

Table 5

Relationship of Research to Survey Questions

	Survey 1.1-1.10	Survey 2.1-2.12	Survey 3.1-3.11	Survey 4.1-4.3
Research Question 1	X			X
Research Question 2		X		X
Research Question 3			X	X
Research Question 4	X	X	X	X

Pilot Study

Using the five contact tailored-design method by Dillman (2000), with slight modifications, the Chief Information Officers (CIOs) of fifteen Florida community colleges were contacted to participate in a pilot study. This group was deemed by the researcher to be most like the sample and population for the final study. During the first week of September 2009, unlike the tailored design method which would require a letter sent via the postal service, an email was sent (in the interest of time) to each CIO to inform him/her that a survey would be arriving in about a week. Each email contained the reason the participant was selected for the pilot study, identified the researcher and the purpose of the study, the value of their participation, time necessary to complete the survey, anonymity of responses, and contact information for the researcher. A week later, another email with similar content was sent to the CIOs, but this contact included a link to the pilot survey via SurveyMonkey.com. The pilot study survey was identical to

the survey that will be used in the actual study of the Florida SUS CIOs with the following exceptions: (1) the title was changed to include the words “pilot study” at the end of the survey title, and (2) at the end of the survey, participants were asked to provide his/her comments regarding the ease of use and/or any problems associated with completing the instrument. The third and fourth email contacts, sent two and three weeks after the initial contact, thanked those who responded and for those who did not respond, the email reiterated the importance of individual participation to the overall results of the study and included a link to the survey. The fifth contact method was omitted as unnecessary.

Eleven of fifteen contacted respondents completed the survey, providing a 73% response rate which is considered optimum for electronic surveys (Instructional Assessment Resources (IAR), 2007). One respondent accessed the survey, but did not respond to any questions. Upon eliminating this survey, the final response rate was 67%. While not considered optimum, it was still acceptable enough for the pilot study.

Next, the data were loaded into Statistical Package for the Social Sciences[®] (SPSS) Version 17.0 to test the reliability of the instrument. Reliability was defined by Fraenkel and Wallen (1996) as the “consistency of the scores obtained ...from one administration of an instrument to another” (p. 160). Most methods to test reliability require two administrations of the instrument such as test/re-test and equivalent form. Cronbach’s alpha is a “reliability (consistency) coefficient which can be obtained through one administration of the instrument. Cronbach’s alpha reliability coefficient normally

ranges between 0 and 1. ... The closer Cronbach's alpha coefficient is to 1.0 the greater the internal consistency of the items in the scale" (Gliem & Gliem, 2003, p. 87).

According to George and Mallery (2003) a score of .9 or higher is considered excellent, from .8 to .9 is good, .7 to .8 is acceptable, .6 to .7 is questionable, and less than .6, unacceptable. When Cronbach's alpha was performed on the data from the ten respondents to the pilot study using the thirty Likert-scale items, a reliability coefficient of .953 was obtained. Performing factor analysis to determine which items might be eliminated to improve reliability was not necessary as it only improved reliability to .955.

Two respondents commented on the survey's ease of use and clarity. One commented that it was easy to use and understand, but responses might vary depending on whom (students/faculty) was being considered. This is understandable and true, but beyond the scope of this study. Another respondent commented that he/she missed the word "problematic" in the first section and answered all the questions in the opposite manner. He/she went back and corrected his/her responses once he/she realized the mistake. The survey was modified to bold and capitalize those important words so they were not missed by the SUS CIOs. Two other respondents commented they would like to see the results of the completed study.

Survey Software

An electronic mail survey (e-survey) was defined as a "relatively easy, low cost, and fast method of conducting marketing surveys in which potential respondents are sent the questionnaire by group mail. Respondents e-mail the completed questionnaires back

to the researchers. Evidence suggests that e-mail surveys produce a faster, but lower response rate than mail (postal) surveys” (Dictionary of Business and Management, 2006, ¶1). This researcher found that using an electronic mail survey as most efficient, especially when combined with a company specializing in electronic surveys.

SurveyMonkey (2009) was an online e-survey tool with a ten year history of development and use. Its mission was centered on a universal usability factor so that people in all occupations can create and use surveys to make informed decisions. SurveyMonkey was selected over other on-line companies (e.g., Zoomerang™) for several reasons: no long-term commitment or hidden charges; a cost of \$19.95 monthly versus \$599 yearly upfront for Zoomerang™, and canceling the account was easy to do; there was no software installation required since all calculations and software are stored in the SurveyMonkey cloud computing storage system; all the data collected was secure, residing behind multiple layers of firewall security; SurveyMonkey analyzed participant responses and provided graphs and charts to the researcher; the researcher downloaded survey results in a convenient and relevant format; and, SurveyMonkey was ranked as the leading survey tool on the web. This researcher used SurveyMonkey previously and was familiar with the templates for creation of the survey. Zoomerang™ would have been the next choice if a change had been required.

Since the survey was designed to be answered and sent to IT professionals, mailing out a paper survey would be, in most cases, self-defeating. IT professionals most probably want to take a survey about computer based technologies on-line. Using the

post office could create time delays not only in mailing out the survey, but in the return of the survey in a prompt and efficient manner. Electronic surveys are now well-known and are generally accepted across the institutions of higher learning as purposeful and timely.

Data Collection Plan

Dillman's (2000) tailored-design method outlines the survey's administration using the "system of five compatible contracts" methodology (p.151). First, a personalized pre-notice letter (Appendix A) was sent via first class mail to each CIO. The letter introduced the survey's purpose, reasons for individual participation, anonymity and privacy, and alerted the participant to a forthcoming e-mail containing a link to a particular Web site. This personal communication to participants served to allay some concerns survey professionals have with electronically based surveys, i.e., electronic based surveys are too impersonal and some participants view the email invitation as spam (which may cause them to delete rather than respond to the survey). This letter also included instructions on how the participant could contact the researcher via e-mail if he/she encountered difficulty or had questions.

Second, two weeks after the pre-notice letter mailing, participants were sent an e-mail (Appendix B) that included a brief introduction and contained the link to the Educational Technology Implementation Survey. By clicking on the link to the survey, the participant affirmed and acknowledged his/her agreement to take part in the research study. This survey technique was best because of its "cost-savings, ease of editing/analysis, faster transmission time, easy use of pre-letters, higher response rate,

more candid answers, and potentially quicker response time with wider magnitude of coverage” (Survey Research, 2009, p. 1). The strength of using the media of an electronic survey outweighed the potential weaknesses such as “demographic limitations, lowered levels of confidentiality, layout and presentation issues, the possible need for additional orientation/instructions, potential for technical problems with hardware and/or software, and lower response rates if respondents do not respond within the first few days” (Survey Research, 2009, pp. 1-2).

A third contact (Appendix C) was sent via e-mail one week after the second contact. This contact thanked the participants who responded to the survey and provided the web link again for those who had not yet responded. The fourth contact (Appendix D) was sent out and it contained a brief cover letter and a link to the survey. The fifth and final contact (Appendix E) was made through priority mail two weeks after the last e-mail contact. The mailing included a cover letter, paper version of the survey, and a return self-addressed stamped envelope addressed to the researcher.

Confidentiality and Anonymity

Confidentiality was maintained by the researcher in several ways. First, data were reported or illustrated as aggregate and summary only. Second, the invitation to participate was sent through the researcher’s personal GroupWise account. Each invitation included a specifically coded unique ID web link to allow the researcher to track who had responded, but not which responses were associated with a particular participant. Third, responses were SSL (Secure Sockets Layer) encrypted. This meant

there was a secure connection between the client and the server. URL link and survey pages were encrypted during transmission from account to respondent and back to researcher's account. Exports of data from the survey company were delivered to the researcher's computer in encrypted format (Verisign Certificate Version 3-128bit). These steps, taken by the researcher, ensured the confidentiality, anonymity, and security of respondents to the survey.

Data Return

In determining an acceptable response rate, several factors were used. The first was the purpose of the research which concluded that “response rates are more important when the study's purpose is to measure effects or make generalizations to a larger population, less important if the purpose is to gain insight” (Instructional Assessment Resources (IAR), 2007). The second factor was the survey's administration. IAR considers an acceptable response rate for a survey sent out via email or administered electronically to range from 40% as average, 50% as good, to 60% as very good. This researcher strove to achieve a return rate greater than 50% (acceptable), but given the small size of the sample, a return rate of 60% or more was considered optimum.

Statistical Procedures and Data Analysis

Variables

There were two variables—one quantitative and one categorical. A quantitative variable “exists in some degree ...along a continuum from ‘less’ to ‘more’ and we can assign numbers to different individuals or objects to indicate how much of the variable

they possess” (Fraenkel & Wallen, 1996, p. 51). In this study, the size of the SUS institution by student headcount was considered. For example, the SUS institutions vary in headcount from New College’s 785 to the University of Central Florida’s 53,537 students.

A categorical variable considered in this study was each institution’s Carnegie Classification. According to Fraenkel and Wallen (1996), “categorical variables do not vary in degree, amount, or quantity, but they are qualitatively different from each other” (p. 52). Carnegie classifications are categorized based on the “mix of students enrolled” (undergraduate, graduate and professional) at the institution which reflected “differences in educational missions” (Carnegie Foundation for the Advancement of Teaching, 2009a, ¶1). There are seven classifications including “exclusively undergraduate two-year, exclusively undergraduate four-year, very high undergraduate, high undergraduate, majority undergraduate, majority graduate/professional and exclusively graduate/professional” (¶2). Carnegie classifications were also based on the types of degrees granted at an institution and therefore, the amount of research performed. Additional classifications by degrees and research include “research universities (very high research activity), research universities (high research activity), doctoral/research universities, master’s colleges and universities (large programs), master’s colleges and universities (medium programs), master’s colleges and universities (smaller programs), and baccalaureate colleges—arts and sciences” (Carnegie Foundation for the Advancement of Teaching, 2009c, ¶6).

Data Analysis for the Educational Technology Implementation Survey

The first section of the survey sought information regarding the planning stage for new educational technologies at a respondent's institution. It consisted of nine questions for a respondent to answer using a Likert scale. Based on the respondent's perceptions, he/she was asked to rank problematic areas using: (1) if the item is never a problem (problem 0% of the time); (2) if the item is rarely a problem (problem 1 – 30% of the time); (3) if the item is sometimes a problem (problem 31 – 60% of the time); (4) if the item is frequently a problem (problem 61 – 90% of the time); or, (5) if the item is almost always a problem (problem 91 – 100% of the time). In addition, the tenth question was open-ended and asked the respondent to list any additional problems (not mentioned in questions 1-9) he/she encountered during planning for educational technologies.

The second section of the survey sought information regarding the implementation stage for new educational technologies at a respondent's institution. It consisted of eleven questions for a respondent to answer using a Likert scale. Based on a respondent's perceptions, he/she was asked to rank problematic areas using: (1) if the item is never a problem (problem 0% of the time); (2) if the item is rarely a problem (problem 1 – 30% of the time); (3) if the item is sometimes a problem (problem 31 – 60% of the time); (4) if the item is frequently a problem (problem 61 – 90% of the time); or, (5) if the item is almost always a problem (problem 91 – 100% of the time). The final question of the section was open-ended and asked the respondent to list any additional

problems (not mentioned in the previous questions) he/she encountered during the implementation stage of educational technologies.

The third section of the survey sought information regarding the diffusion stage of new educational technologies at a respondent's institution. It consisted of ten questions for a respondent to answer using a Likert scale. Based on the respondent's perceptions, he/she was asked to rank problematic areas using: (1) if the item is never a problem (problem 0% of the time); (2) if the item is rarely a problem (problem 1 – 30% of the time); (3) if the item is sometimes a problem (problem 31 – 60% of the time); (4) if the item is frequently a problem (problem 61 – 90% of the time); or, (5) if the item is almost always a problem (problem 91 – 100% of the time). The eleventh question of this section was open-ended and asked the respondent to list any additional problems (not mentioned in previous questions) he/she encountered during the diffusion stage of educational technologies.

The fourth section of the survey contained three open-ended questions to be answered by a respondent regarding strategies their institutions used to resolve or address problems encountered during the various planning, implementation and diffusion stages of the educational technology adoption process.

Descriptive statistics and frequencies were used to analyze data from all the items on the survey and address the four research questions. While it would have been valuable to perform a factor analysis, varimax rotation, and regression to determine if

implementation was a function of planning and diffusion was a function of planning and implementation, the sample was too small to make valid assumptions from the results.

Authorization to Conduct the Study

Individuals doing research on human subjects are required to meet an institutional review board (IRB). These boards are responsible for reviewing research methodologies and instruments of investigators to insure their compliance with federal, state and institutional laws and guidelines. Such boards and laws were established to prevent unethical treatment of human subjects during the course of a research study.

The University of Central Florida IRB required the primary investigator and his/her advisor (if the investigator is a student) to complete a basic course through the Collaborative Institutional Training Initiative (CITI). The course discussed the many aspects of research protocol including: history, ethical principles, relevant law, definition of research, human subjects, risk to human subjects, vulnerable groups/subjects, informed consent, confidentiality and anonymity.

This study's methodology and survey instrument were submitted to the university's IRB. There were many areas reviewed by the IRB which included: informed consent, confidentiality, and anonymity. Informed consent took place on the first page of the survey (delivered via SurveyMonkey.com). In addition, the initial contact letter included a copy of the Informed Consent Document approved by UCF IRB. Each participant was informed that participation in the study was strictly voluntary, that the participant may choose to withdraw at any time during the survey and that by clicking the

“NEXT” button, the participant agreed to participate in the study. The IRB waived the requirement to document informed consent because the collected data and SurveyMonkey.com contained appropriate safeguards of and for participant confidentiality and anonymity. The instruction page of the survey contained the following statement: “The results of the survey will be strictly confidential and reported only as summaries where no individual answers might be identified. Transmission of results within SurveyMonkey.com and to the researcher will be encrypted for additional security” (Appendix F). The IRB reviewed these items and the risk to the participants and the protocol received an exempt status. This determination meant that there was minimal or no risk to participants. The IRB approved the study protocol (Appendix G), and the initial contact letter and the Informed Consent Document were mailed to the identified participants.

Originality Score

The University of Central Florida’s Graduate College “requires all students submitting a thesis or dissertation as part of their graduate degree requirements to first submit their electronic document through Turnitin.com for advisement purposes and for review of originality” (Thesis and Dissertation Policies, 2009, ¶14). The dissertation chairperson determined that an originality score of less than 10% would be the accepted norm.

The first three chapters were submitted to Turnitin.com. All pre-content materials, appendices, and reference list were omitted from submission to avoid

unnecessary findings of duplicated material. The initial originality score was 30%. The initial score was reduced by eliminating quoted material. Quoted material amounted to 11% which thereby reduced the overall score to 19%. The score was further reduced by individually evaluating each of the remaining matches. There were 197 matches with the following breakdown: one was 2%, 4 were 1% and the remaining 192 were less than 1%. Overall the matches consisted of 55 student papers (not accessible by the researcher), 17 internet links that did not function (error messages), 9 reference or bibliographic citations included within the document, 20 matches to generic phrases or common word patterns (such as State University System, list of university names, names of acts, names of government department, or organizations) which should be removed or reviewed by the advisor for elimination from the overall score. Finally, there were 13 matches that were attributable to long quotations that are indented, cited, and do not require quotation marks. The resulting overall score was less than 8% and the document was therefore approved by the chairperson as original work.

Chapters Four and Five were also submitted to Turnitin.com. The initial originality score was 3% which was immediately reduced by 2% by eliminating quoted materials. The score was further reduced by individually evaluating each of the remaining matches. There were 6 matches with the following breakdown: one was 1% and the remaining 5 were less than 1%. The same codes listed above were used to label the remaining matches from chapters four and five. The matches consisted of 3 student papers (not accessible by the researcher) which should be removed or reviewed by the

advisor for elimination from the score. These procedures eliminated 50% of the matches. The resulting overall score was approximately 1% and the document was therefore approved by the chairperson as original work.

Summary

After researching a variety of electronic surveys, this researcher determined that using SurveyMonkey had the best cost-benefit for the research being considered. The pilot survey, sent to fifteen community college key IT professionals, yielded a response rate of 67%. By loading the returned data into a statistical modeling program, a Cronbach's alpha reliability coefficient of .953 was achieved. These results allowed the researcher to implement the IRB approved survey and its release in accordance with the milestones established by Dillman (2000).

CHAPTER FOUR: FINDINGS

Introduction

The results of the data analyses, as presented below, clearly linked the Survey (Appendix F) with the research questions stated in Chapter One in that planning, implementation, and diffusion of educational improvements were recognized by the Florida SUS intuitions as critical components to successful adoption of emerging technologies. The 64% response rate, which exceeded the acceptable minimum established by the researcher and as articulated in Chapter Three, was sufficient to ensure the research was credible and allowed for the conclusions in Chapter Five. Graphic depictions (figures) of data are located throughout the research statement analysis and at the end of each research question. Percentages were rounded off.

Analysis of Demographics

The survey (Appendix F) contained an area to capture pertinent demographic information from respondents. This was not to identify them, but rather to garner an understanding of the level of experience the respondent had in information technology (IT) both in and out of higher education. There were five demographic questions. The first question requested information concerning how many years a respondent had been at his/her current institution. Data collected showed a range from six months to 33 years. Collectively, the seven respondents had 83 years of being with their current institution for an overall average of 11.8 years. The next question in the demographic data collection area asked how many years a respondent had been employed in a higher education

institution. Data collected from this question showed a range of nine years to 44 years. Collectively, the seven respondents had 184 years of employment in higher education for an average of 26.2 years. Respondents were then asked how many years he/she had been a professional in the information technology (IT) field. Data collected from this area showed a range from 13 to 42 years. Collectively, the seven respondents had 185 years as IT professionals for an average of 26.4 years each. The next question in the demographic data area requested the respondent to cite his/her institution's current enrollment. Data collected from this showed a range from 10,000 to 53,594 students enrolled in the seven respondent's institution. The final part of the demographic data section asked the respondent to identify his/her institution's Carnegie Research classification (Table 1). One respondent was in a very high research activity institution, three respondents were in high research activity institutions, two respondents were Master's larger programs, and one respondent was a Master's medium institution.

In addition, it is appropriate to note that certain types of Carnegie classification institutions and certain size institutions did not respond to the Survey. Given the anonymous nature of the Survey, it was difficult to pinpoint these institutions with one significant exception: New College of Florida. New College had the smallest enrollment of the SUS institutions and awarded only the bachelor's degree and therefore could be identified from the demographic information.

Analysis of Research Questions

Each of the four research questions were represented in the Survey by a series of statements. There was an established relationship between the research questions and the Survey's organization of statements as demonstrated in Table 5. As stated in Chapter Three, two variables were identified as possibly having impact on institutional planning, implementation, and diffusion of educational technologies. In the Carnegie Foundation Classification of Institutions, schools were categorized by their level of research capabilities. Three respondents came from universities with master's classification and four respondents worked at universities with research classification. The second variable was the size of the institution based on enrollment making it a continuous variable. Comparisons of the largest respondent institutions, 53,594 students, and the smallest respondent institution with 10,000 (or less) students, were compiled and are presented below.

Research Question 1

Data for Research Question 1, "Which planning strategies to incorporate educational technologies were considered by Florida's SUS institutions?" were captured on the Survey (Appendix F) by the respondents inputting Likert scaled responses to statements 1.1 through 1.10. In addition, question 4.1 was posed in the SOLUTIONS section of the Survey and was used as part of the analysis of Research Question 1. Statements 1.1 through 1.10 were areas of Research Question 1 which opened the Survey

with the question, “When PLANNING new educational technologies, how PROBLEMATIC is each of the following (areas)?

Statement 1.1

The data from planning statement 1.1 found that four respondents (57%) rated gathering specific education technology needs across departments as frequently problematic while two respondents (29%) rated the statement as sometimes problematic and one respondent (14%) rated the statement as rarely problematic (Figure 1). The mean of 3.43 demonstrated it was sometimes problematic.

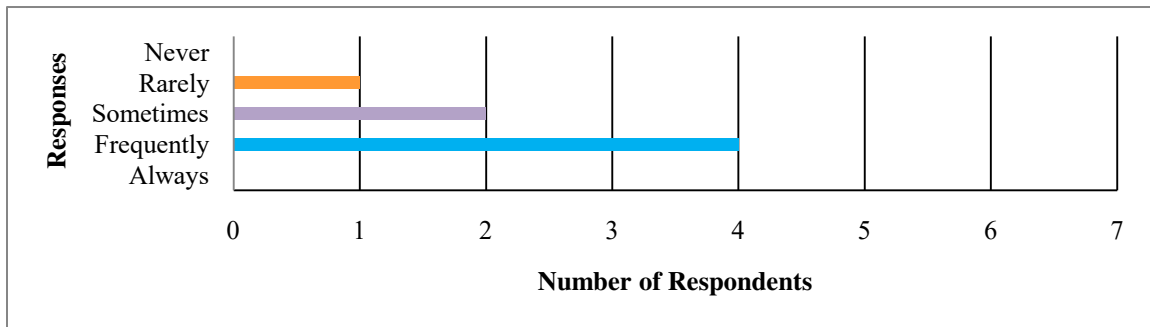


Figure 1: Planning Statement 1.1—Gathering Technology Needs

Three respondents (100%) from Carnegie Master’s institutions rated statement 1.1 frequently problematic. The mean of 4.0 demonstrated gathering specific education technology needs across departments was frequently problematic. One respondent (25%) from a Carnegie Research institution rated statement 1.1 as rarely problematic, two (50%) rated it sometimes problematic, and one (25%) rated it as frequently problematic (Figure 2). The mean 3.0 demonstrated this planning statement was only sometimes problematic.

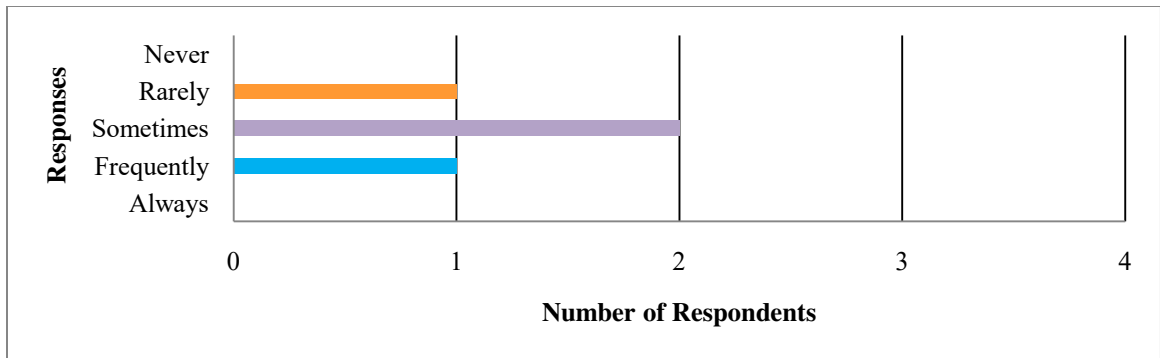


Figure 2: Planning Statement 1.1—Carnegie Research Institution Responses

Master’s institutions indicated this was frequently (4.0) problematic, while Research institutions stated it was only sometimes (3.0) problematic. The respondent at the institution with the lowest enrollment stated it was frequently problematic, while the respondent at the institution with the largest enrollment stated it was rarely problematic.

Statement 1.2

Planning statement 1.2 asked how problematic it was in considering the relevancy of emerging technologies. Two respondents (29%) considered it rarely problematic, one respondent (14%) considered it sometimes problematic, and four respondents (57%) considered it frequently problematic in considering relevant emerging technologies (Figure 3). The mean of 3.29 demonstrated it was only sometimes problematic.

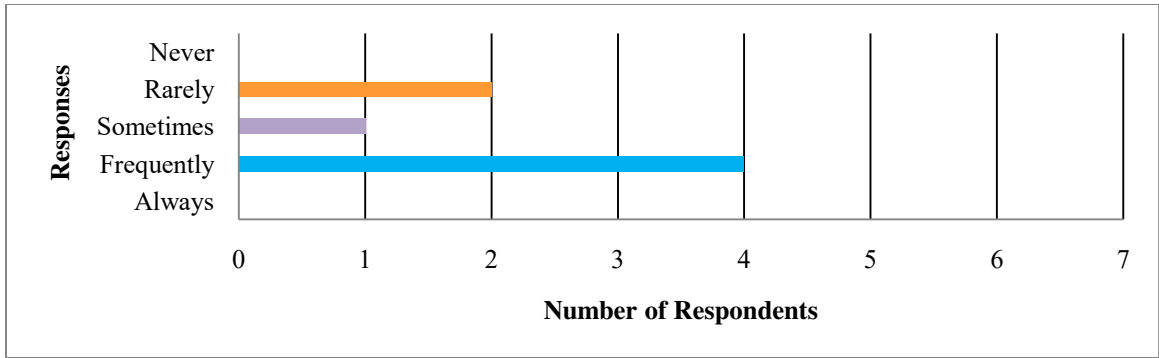


Figure 3: Planning Statement 1.2—Considering Relevant Technologies

One respondent (34%) from a Carnegie Master’s institution rated statement 1.2 sometimes problematic, while two (66%) rated it frequently problematic (Figure 4). The mean of 3.67 demonstrated when respondents from these institutions were to consider the relevancy of emerging technologies it was sometimes problematic, bordering on frequently problematic.

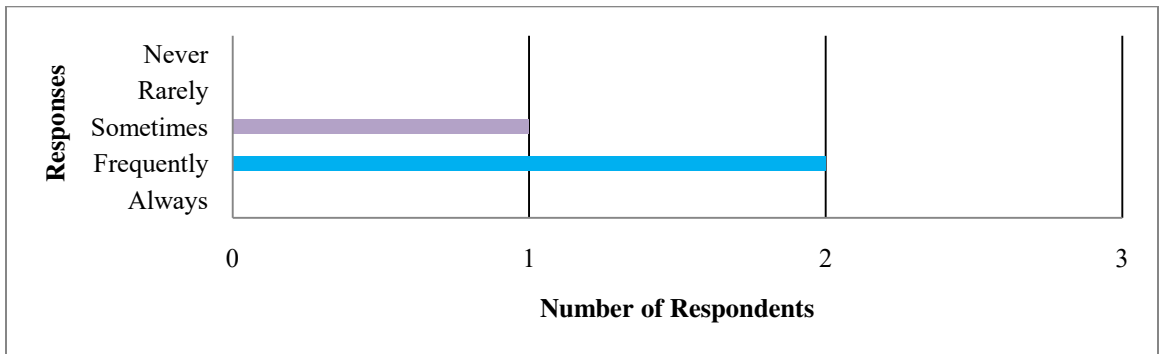


Figure 4: Planning Statement 1.2—Carnegie Master's Institution Responses

Two respondents (50%) from Carnegie Research institutions rated statement 1.2 rarely problematic, while two other respondents (50%) rated it frequently problematic (Figure 5). The mean 3.0 demonstrated this planning statement was only sometimes problematic.

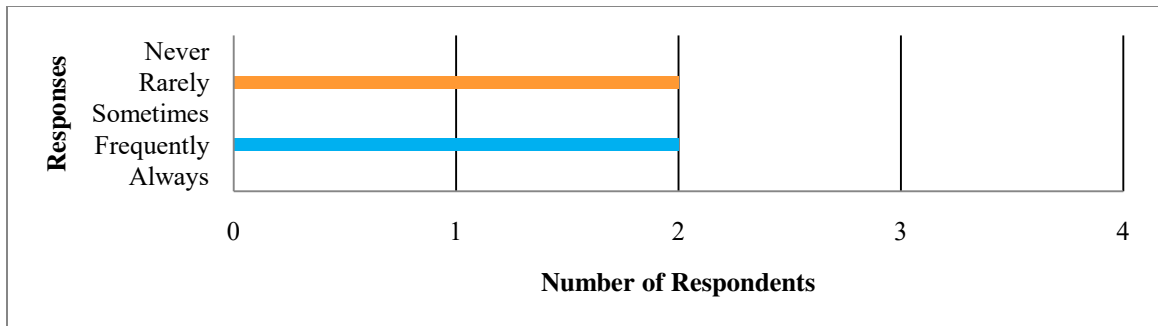


Figure 5: Planning Statement 1.2—Carnegie Research Institution Responses

Master’s institutions indicated this was frequently (3.67) problematic, while Research institutions stated it was sometimes (3.0) problematic. The respondent at the institution with the lowest enrollment stated it was frequently problematic, while the respondent at the institution with the largest enrollment rarely encountered it as problematic.

Statement 1.3

Planning statement 1.3 asked how problematic being pressured for quick solutions to complex educational problems requiring an IT solution was to planning. Four respondents (57%) found it was frequently problematic, two (29%) found it sometimes problematic, and one respondent (14%) never found it problematic (Figure 6). The mean of 3.29 demonstrated it was sometimes problematic.

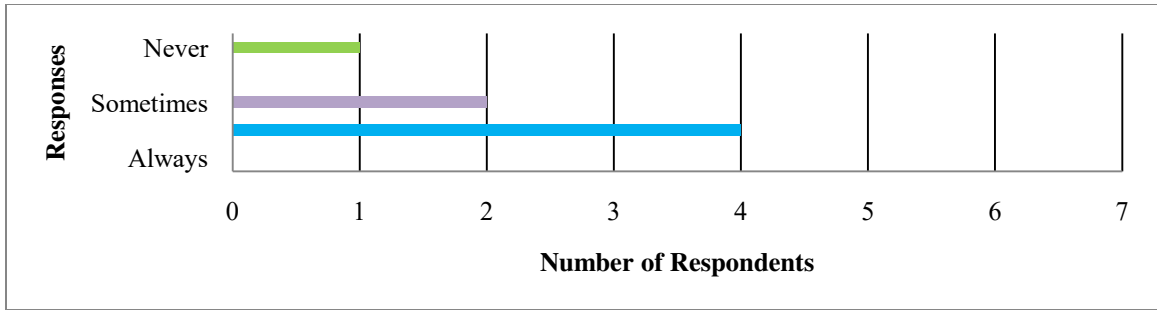


Figure 6: Planning Statement 1.3—Quick Solutions to Complex Problems

Three respondents (100%) from Carnegie Master’s institutions rated statement 1.3 frequently problematic. The mean of 4.0 demonstrated being pressured for quick solutions to complex educational problems requiring an IT solution was frequently problematic. One respondent (25%) from a Carnegie Research institution rated planning statement 1.3 as never problematic, two (50%) rated it as sometimes problematic, and one (25%) rated it as frequently problematic (Figure 7). The mean of 2.75 demonstrated this planning statement was close to being sometimes problematic.

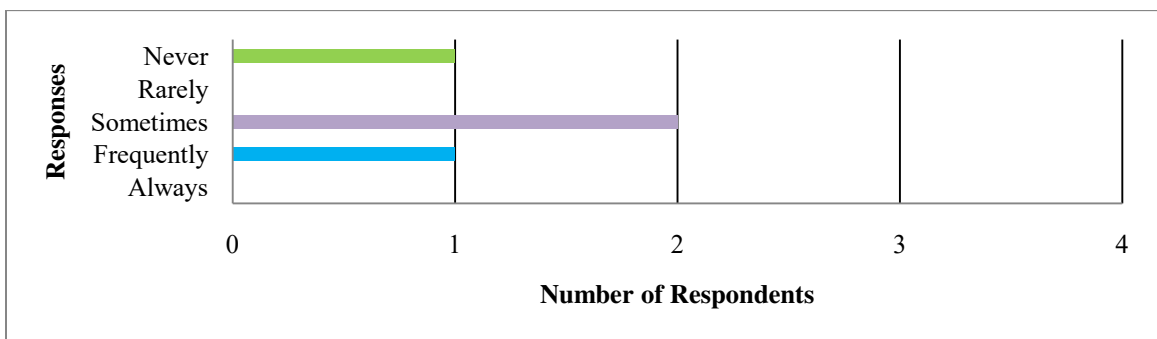


Figure 7: Planning Statement 1.3—Carnegie Research Institution Responses

Master’s institutions indicated this was frequently (4.0) problematic, while Research institutions stated it was sometimes (2.75) problematic. The respondent at the

institution with the lowest enrollment stated it was frequently problematic, while the respondent at the institution with the largest enrollment never found it problematic.

Statement 1.4

Statement 1.4 asked how problematic the use of a standardized model was when planning new educational technologies. Two respondents (29%) found it was always problematic, three respondents (43%) found it was frequently problematic, but two respondents (29%) found it was rarely problematic (Figure 8). The mean was 3.29 for all respondents which meant overall it was sometimes problematic.

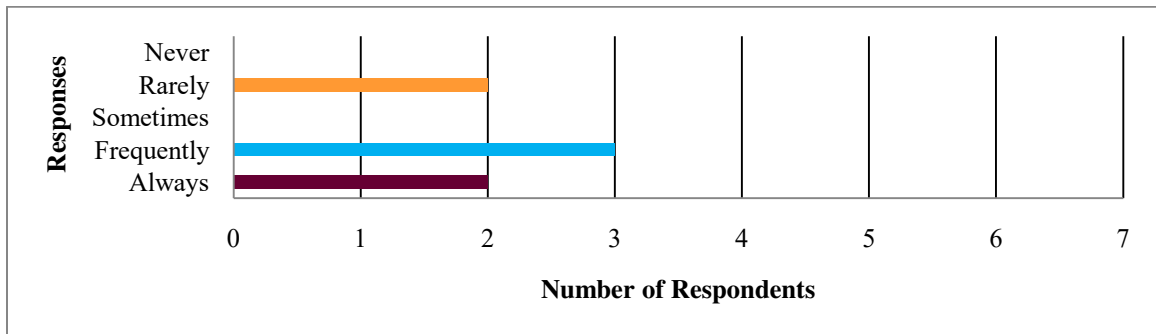


Figure 8: Planning Statement 1.4—Standardizing Planning Models

One respondent (34%) from a Carnegie Master’s institution found planning statement 1.4 frequently problematic, while two (66%) found it was always problematic to use a standardized model when planning for a new educational technology (Figure 9). The mean of 4.67 (rounded to 5.0) demonstrated trying to use a standardized planning model was always problematic.

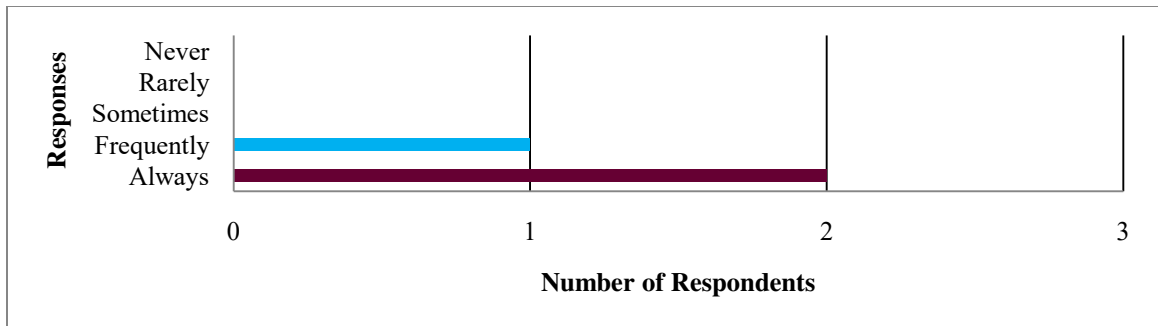


Figure 9: Planning Statement 1.4—Carnegie Master's Institution Responses

Of the four Carnegie Research institution respondents, two (50%) rated it rarely problematic, while the other two respondents (50%) rated it frequently problematic (Figure 10). The mean of 3.0 demonstrated that this planning statement was only sometimes problematic.

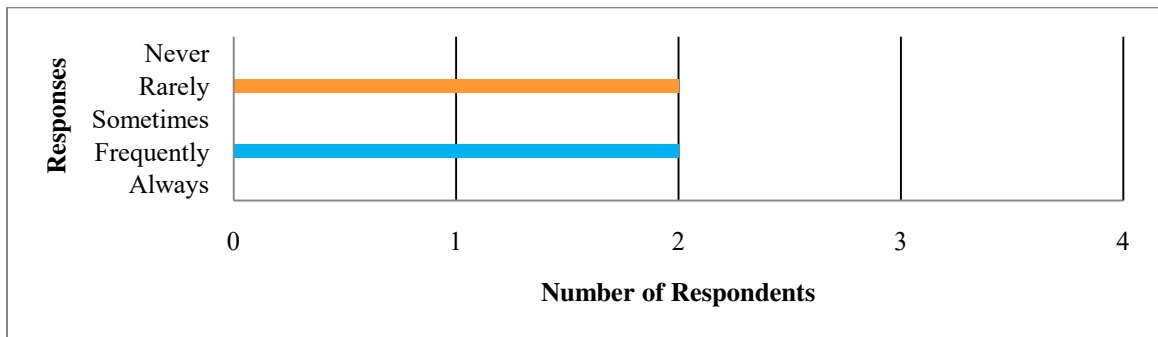


Figure 10: Planning Statement 1.4—Carnegie Research Institution Responses

Master's institutions indicated this was always (4.67) problematic, while Research institutions stated it was sometimes (3.0) problematic. The respondent at the institution with the lowest enrollment stated it was always problematic, while the respondent at the institution with the largest enrollment rarely found it problematic.

Statement 1.5

Planning statement 1.5 asked how problematic it was to define and measure the costs/benefits when planning for new educational technologies. One respondent (14%) found it always problematic, four respondents (57%) found it frequently problematic, one (14%) found it sometimes problematic and one respondent (14%) found it rarely problematic (Figure 11). The mean of 3.71 demonstrated it was frequently problematic.

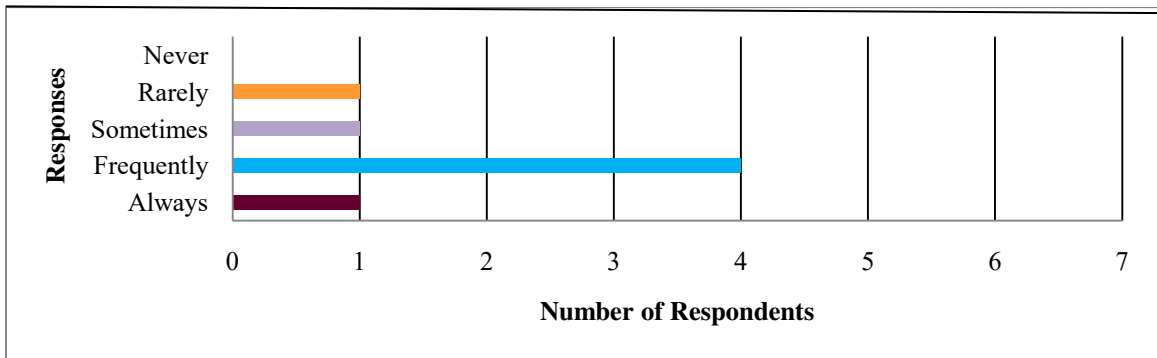


Figure 11: Planning Statement 1.5—Defining and Measuring Benefits for Budget

Two respondents (66%) from Carnegie Master’s institutions rated statement 1.5 frequently problematic, while one (34%) rated it always problematic (Figure 12). The mean of 4.33 demonstrated defining and measuring the cost/benefits when planning for new educational technologies was frequently problematic.

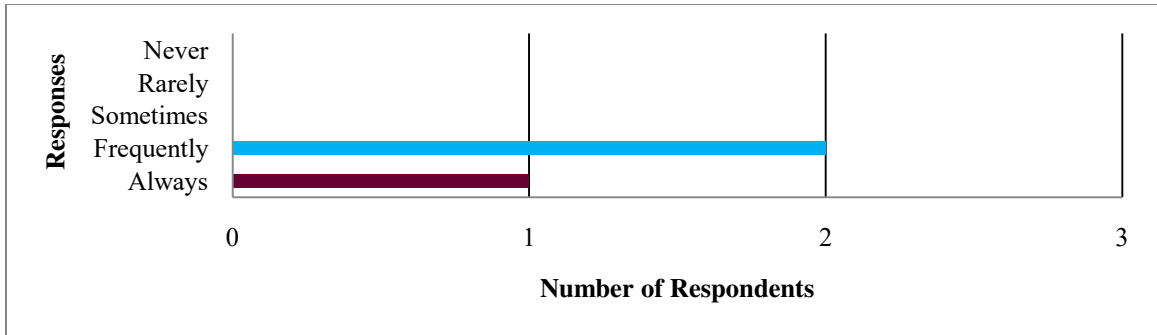


Figure 12: Planning Statement 1.5—Carnegie Master's Institution Responses

Carnegie Research institutions responses to statement 1.5 (Figure 13) show one respondent (25%) found it rarely problematic, one (25%) respondent found it sometimes problematic, and two respondents (50%) found it frequently problematic. A mean of 3.25 demonstrated that this planning statement was only sometimes problematic.

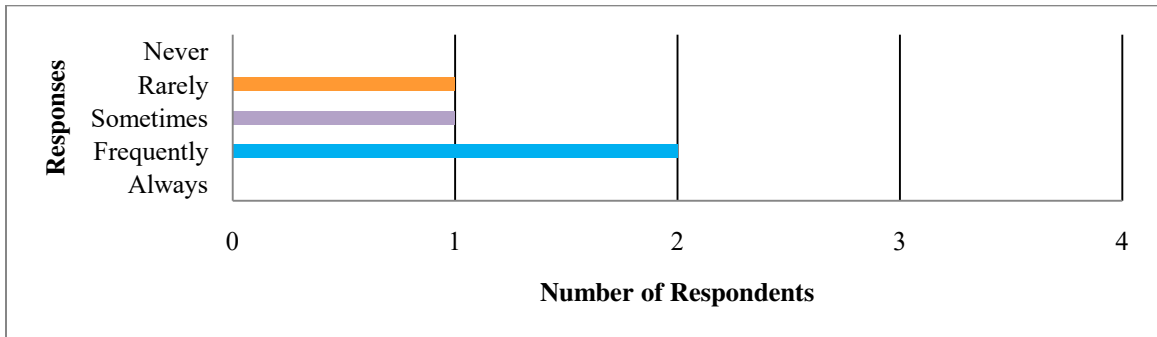


Figure 13: Planning Statement 1.5—Carnegie Research Institution Responses

Master’s institutions indicated this was frequently (4.33) problematic, while Research institutions stated it was sometimes (3.25) problematic. The respondent at the institution with the lowest enrollment stated it was always problematic, while the respondent at the institution with the largest enrollment found it sometimes problematic.

Statement 1.6

Planning statement 1.6 asked how problematic political (both internal and external) concerns were when planning for new educational technologies. Three respondents (43%) stated it was always problematic, two respondents (29%) stated it was sometimes problematic, and two respondents (29%) stated it was rarely problematic (Figure 14). The mean for this statement was 3.57 which meant it was sometimes problematic.

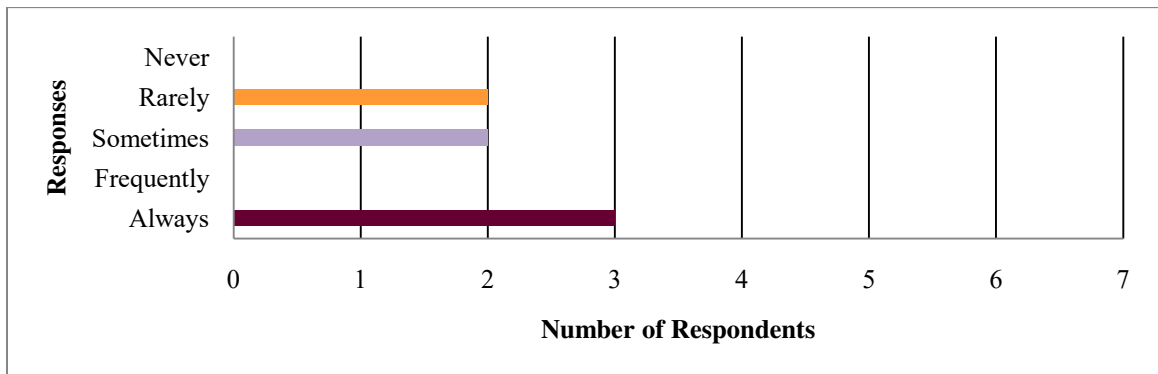


Figure 14: Planning Statement 1.6—Political, Internal/External Concerns

One respondent (34%) from a Carnegie Master's institution rated statement 1.6 sometimes problematic while two (66%) rated it rarely problematic (Figure 15). The mean of 4.33 demonstrated addressing political, internal/external environment concerns was frequently problematic.

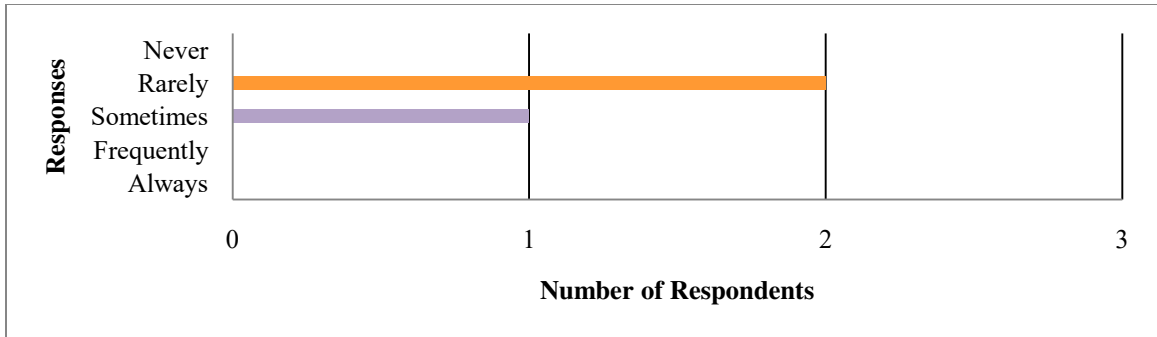


Figure 15: Planning Statement 1.6—Carnegie Master's Institution Responses

Two respondents (50%) from Carnegie Research institutions rated statement 1.6 rarely problematic, one (25%) rated it sometimes problematic, and one (25%) rated it always problematic (Figure 16). The mean score of 3.0 demonstrated this planning statement was sometimes problematic.

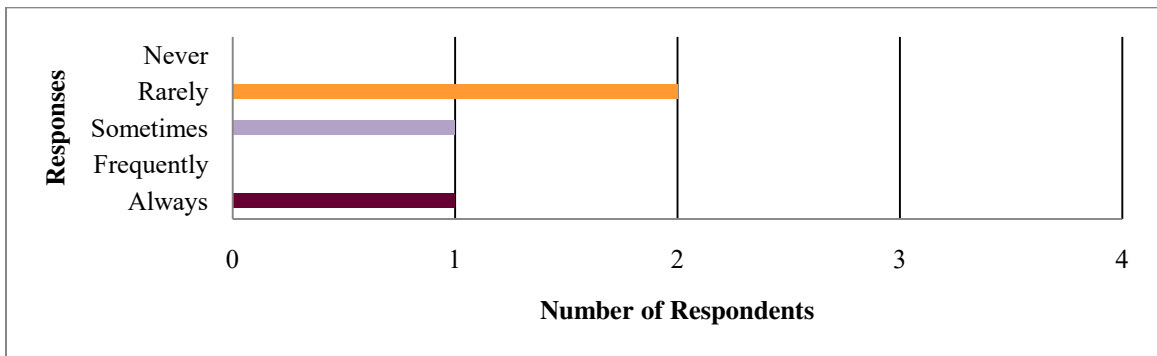


Figure 16: Planning Statement 1.6—Carnegie Research Institution Responses

Master's institutions indicated this was frequently (4.33) problematic, while Research institutions stated it was sometimes (3.0) problematic. The respondent at the

institution with the lowest enrollment stated it was sometimes problematic, while the respondent at the institution with the largest enrollment stated it was rarely problematic.

Statement 1.7

Planning statement 1.7 asked how problematic it was to coordinate time frames and schedules when planning new educational technologies into the respondent's overall IT concept. Two respondents (29%) stated it was rarely problematic, one respondent (14%) stated it was sometimes problematic; three respondents (43%) stated it was frequently problematic, and one (14%) stated it was always problematic (Figure 17). The mean response was 3.43 which meant overall it was sometimes problematic.

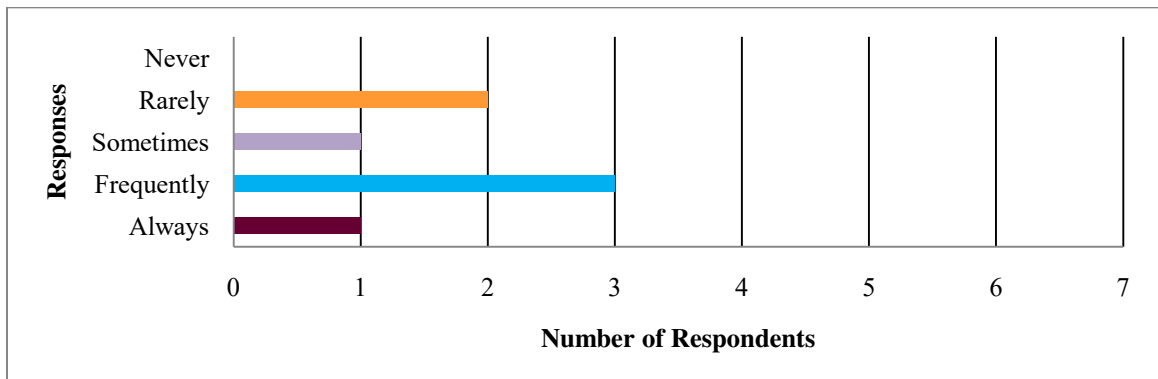


Figure 17: Planning Statement 1.7—Coordinating Timeframes & Scheduling

For respondents at a Carnegie Master's level institution, two (66%) considered statement 1.7 frequently problematic while one respondent (34%) rated it always problematic (Figure 18). The mean of 4.33 demonstrated that coordinating time frames and schedules when planning educational technologies was frequently problematic.

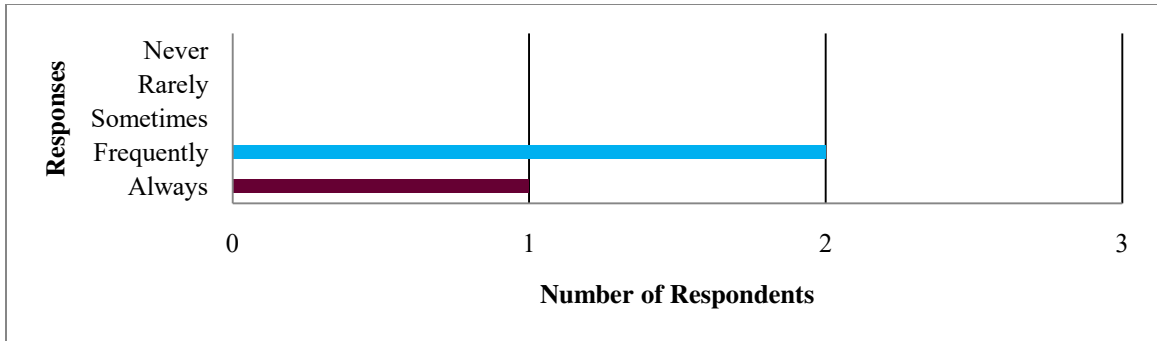


Figure 18: Planning Statement 1.7—Carnegie Master's Institution Responses

Two (50%) Carnegie Research institution respondents rated statement 1.7 rarely problematic, one (25%) found it sometimes problematic and one respondent (25%) found it was frequently problematic (Figure 19). The mean of 2.75 demonstrated that this planning statement was close to being sometimes problematic.

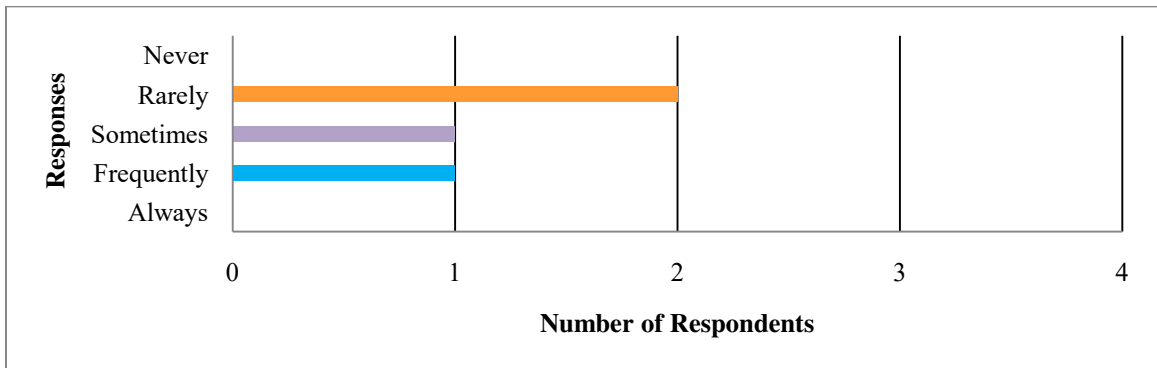


Figure 19: Planning Statement 1.7—Carnegie Research Institution Responses

Master's institutions indicated this was frequently (4.33) problematic, while Research institutions stated it was sometimes (2.75) problematic. The respondent at the institution with the lowest enrollment stated it was frequently problematic, while the

respondent at the institution with the largest enrollment indicated it was sometimes problematic.

Statement 1.8

Planning statement 1.8 asked respondents how problematic guidelines were when planning the usages for new educational technologies. One respondent (14%) stated it was never problematic; two (29%) more stated it was rarely problematic; two (29%) more stated it was sometimes problematic; and, two respondents (29%) stated it was frequently problematic (Figure 20). The mean for this statement was 2.71 which meant it was rarely problematic, but bordered on sometimes problematic.

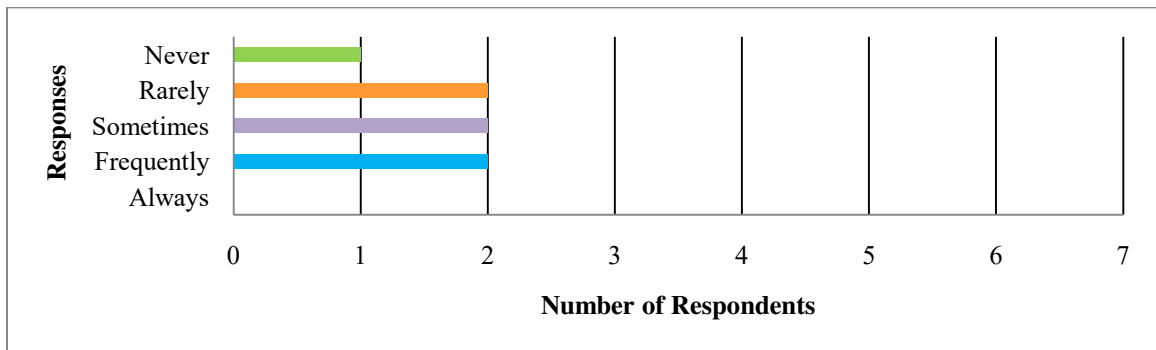


Figure 20: Planning Statement 1.8—Guidelines for Usage

For respondents at a Carnegie Master’s level institution, one (34%) considered statement 1.8 problematic sometimes, while two respondents (66%) rated it frequently problematic (Figure 21). The mean of 3.67 demonstrated the guidelines for planning usage of educational technologies were close to being frequently problematic.

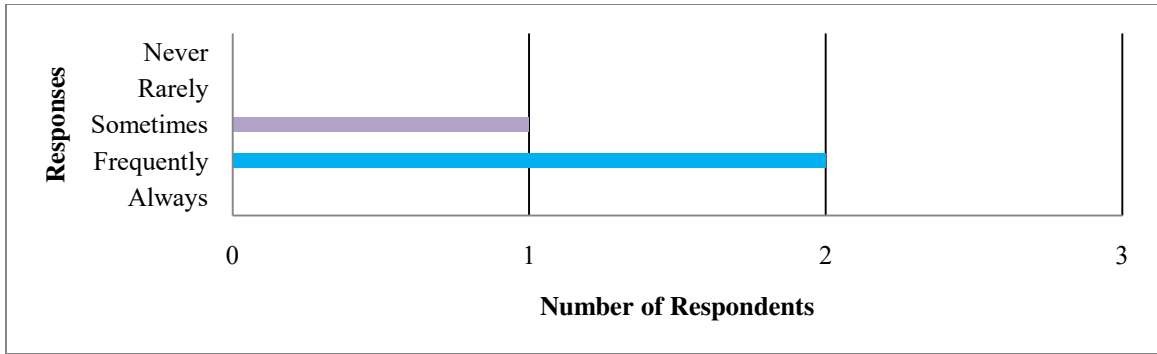


Figure 21: Planning Statement 1.8—Carnegie Master's Institution Responses

One Carnegie Research institution respondent (25%) found statement 1.8 frequently problematic, two (50%) found it rarely problematic, and one respondent (25%) found it was sometimes problematic (Figure 22). The mean of 2.0 demonstrated that this planning statement was rarely problematic.

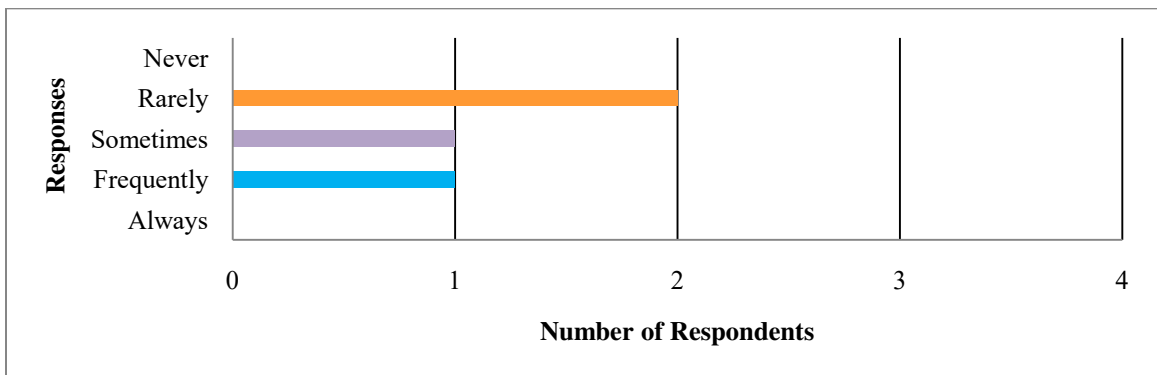


Figure 22: Planning Statement 1.8—Carnegie Research Institution Responses

Master’s institutions indicated this was frequently (3.67) problematic, while Research institutions stated it was rarely (2.0) problematic. The respondent at the

institution with the lowest enrollment stated it was frequently problematic, while the respondent at the institution with the largest enrollment stated it was never problematic.

Statement 1.9

Planning statement 1.9 asked how problematic it was in defining the organizational culture when planning for new educational technologies. One respondent (14%) stated it was rarely problematic, four (57%) stated it was sometimes problematic, and two respondents (29%) indicated it was frequently problematic (Figure 23). The mean for this statement was 3.14 indicating it was sometimes problematic.

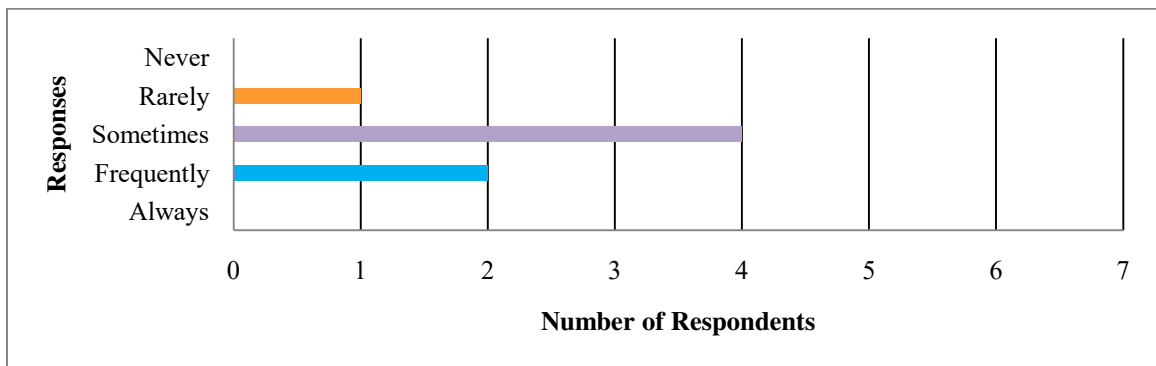


Figure 23: Planning Statement 1.9—Defining the Organizational Culture

For respondents at Carnegie Master’s level institutions, two (66%) considered statement 1.9 sometimes problematic, while one respondent (34%) rated it frequently problematic (Figure 24). The mean of 3.33 demonstrated the guidelines for defining the organization’s culture during planning for educational technologies was sometimes problematic.

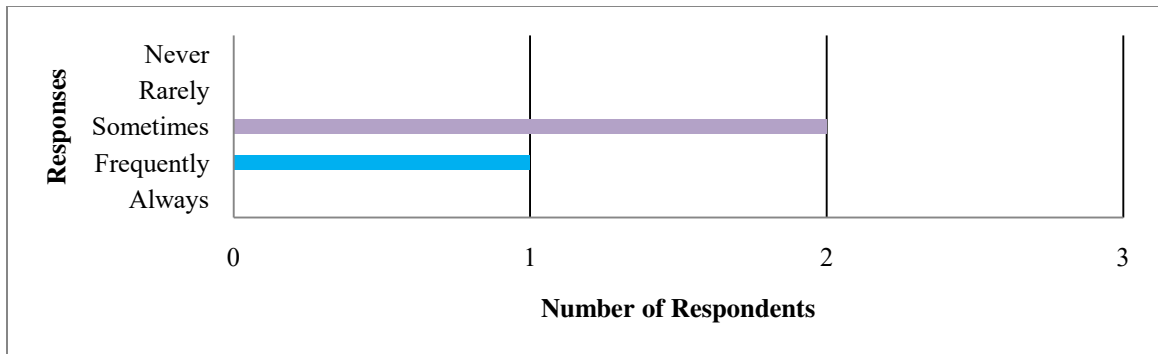


Figure 24: Planning Statement 1.9—Carnegie Master's Institution Responses

One (25%) Carnegie Research institution respondent found statement 1.9 rarely problematic, two (50%) found it sometimes problematic, and one respondent (25%) found it frequently problematic (Figure 25). The mean score of 3.0 demonstrated this planning statement was sometimes problematic.

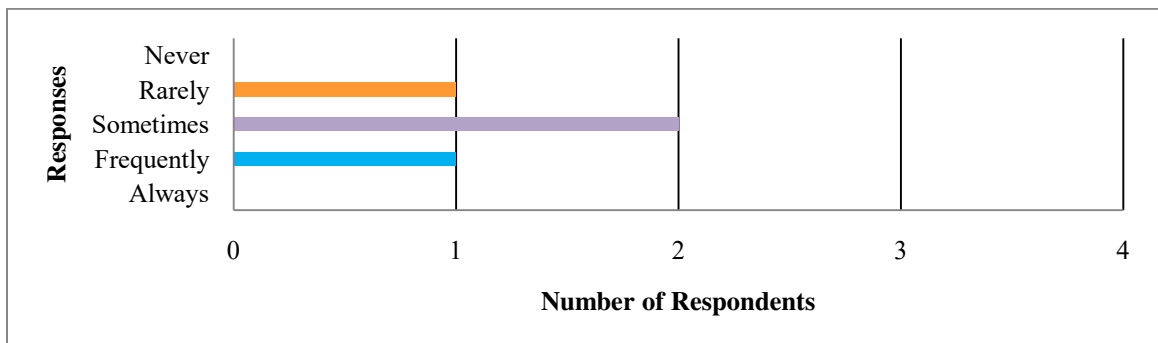


Figure 25: Planning Statement 1.9—Carnegie Research Institution Responses

Master's institutions respondents indicated the statement was sometimes (3.33) problematic, while Research institution respondents stated it was also sometimes (3.0) problematic. The respondent at the institution with the lowest enrollment stated it was frequently problematic, while the respondent at the institution with the largest enrollment stated it was sometimes problematic.

Planning Statement 1.10

Planning statement 1.10, an area where the respondent could write in specific problems when planning for educational technologies, was left blank by all seven respondents.

Planning Statements Summaries

Figures 26 through 33 graphically illustrate a total comparison of all the planning statements to include: response frequency for each planning statement, mean for each planning statement, Carnegie Master's and Research planning response frequencies, Carnegie Master's and Research planning response mean, Carnegie Master's and Research mean comparison, and smallest institution (by enrollment) and largest institution (by enrollment) response comparison.

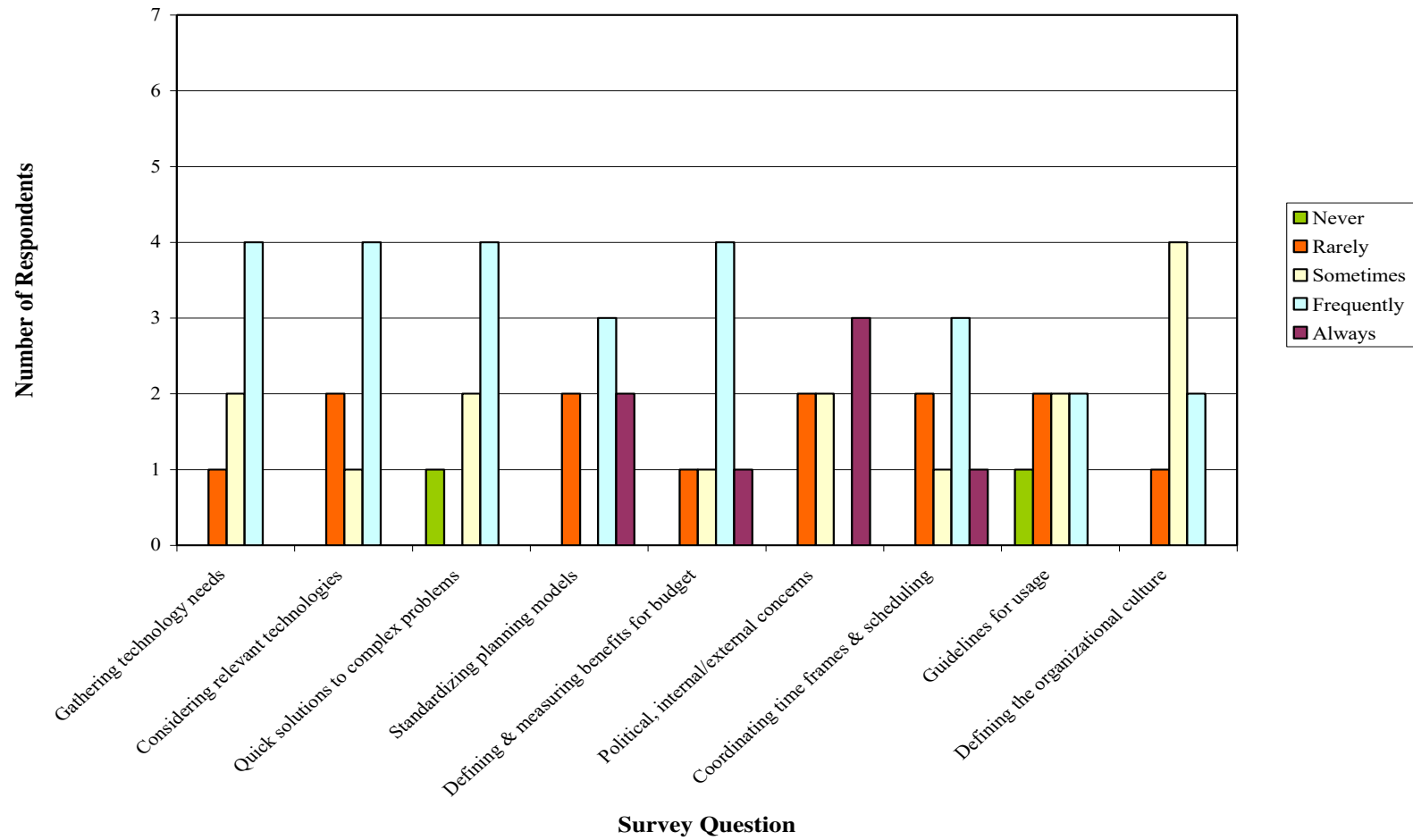


Figure 26: Planning Responses—Summary

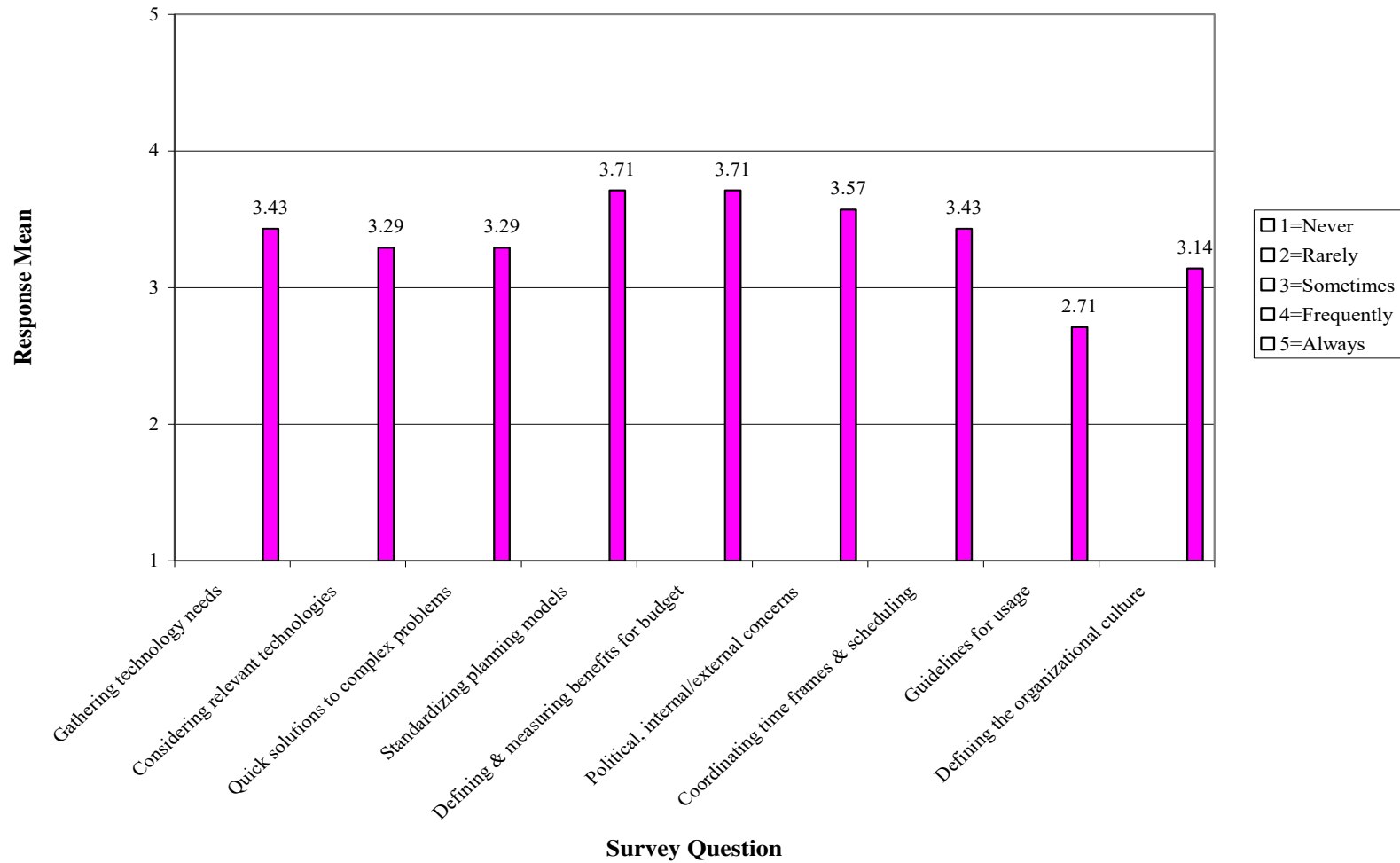


Figure 27: Planning Responses—Mean

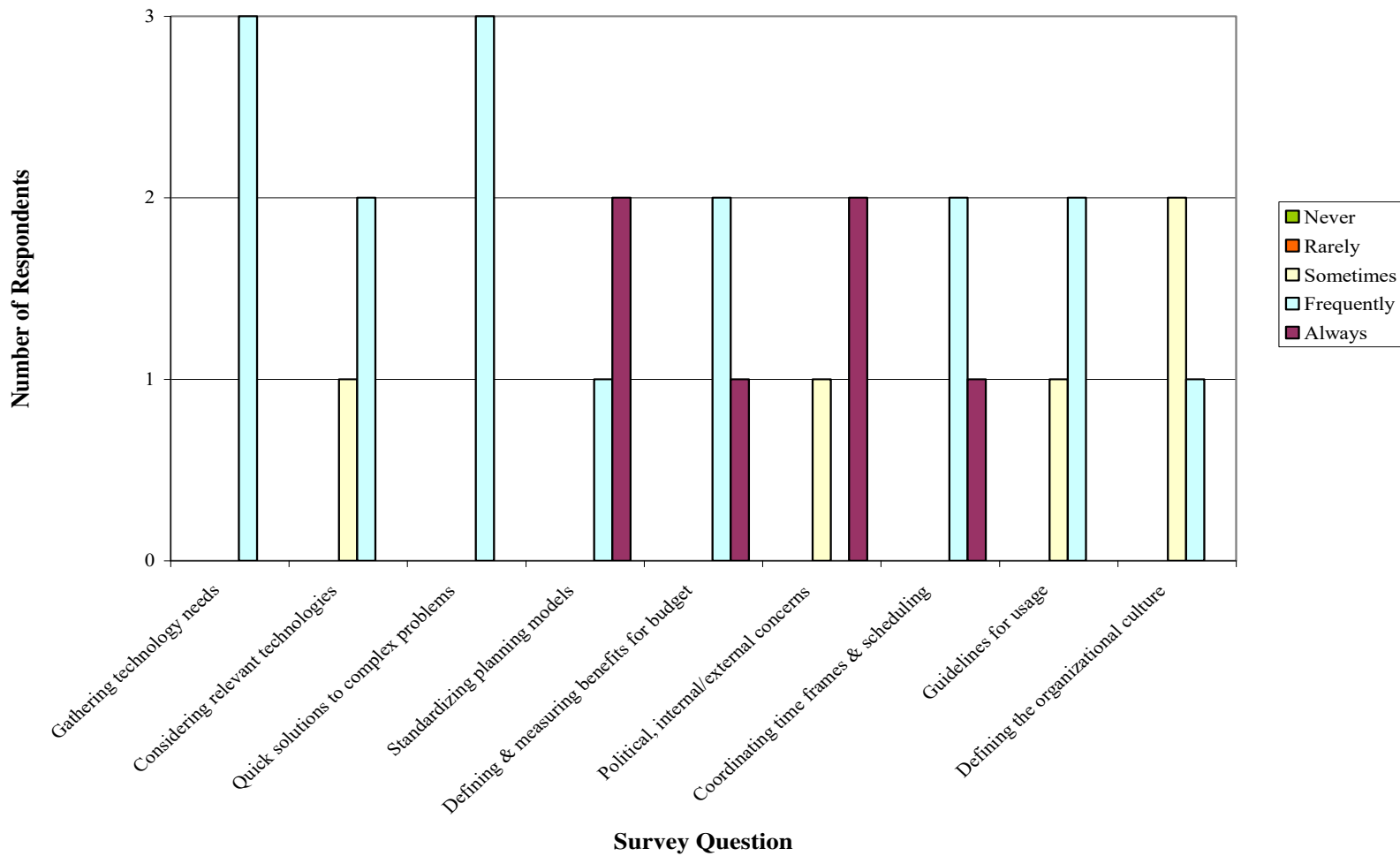


Figure 28: Planning Responses—Carnegie Master’s Institutions

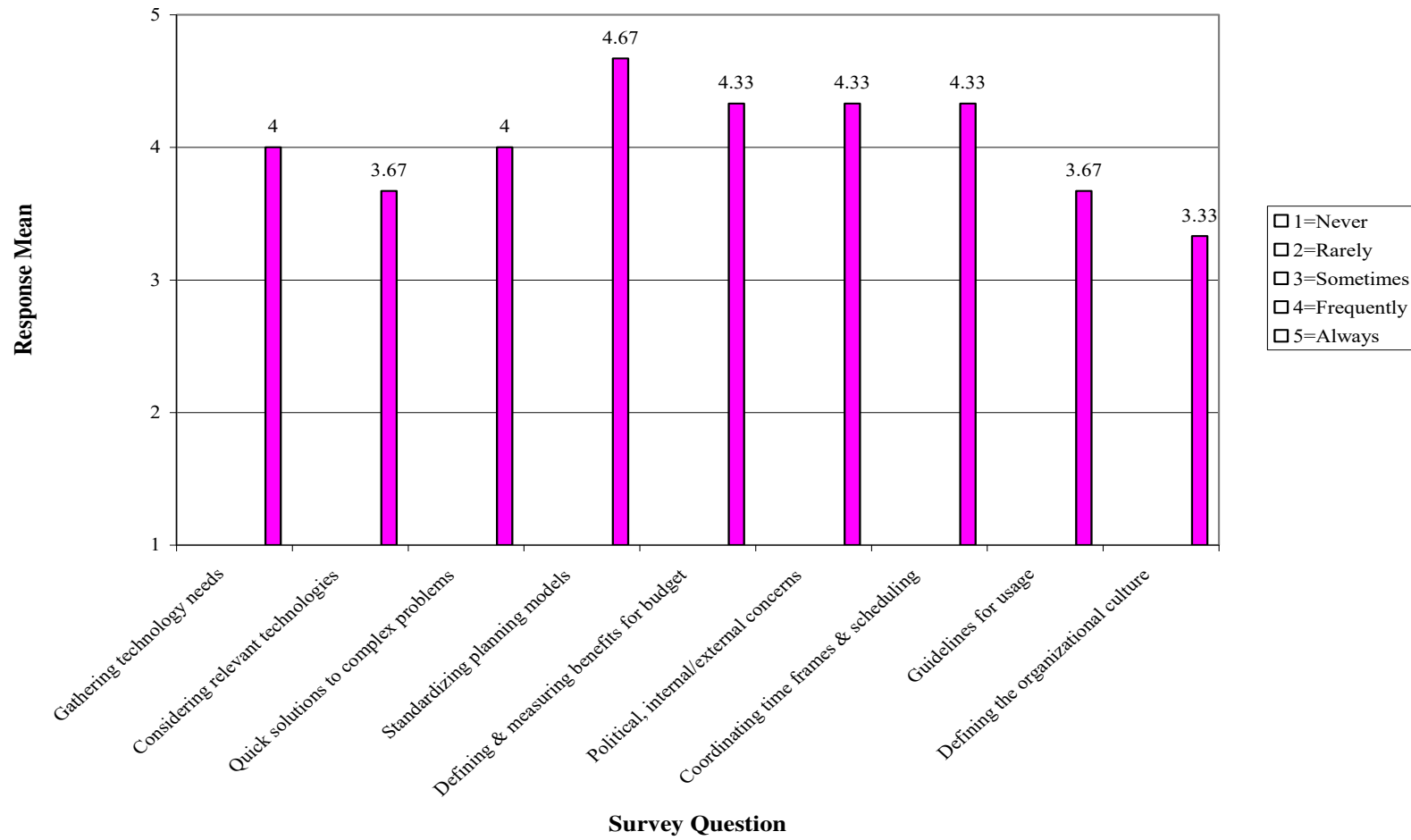


Figure 29: Planning Responses Mean—Carnegie Master’s Institutions

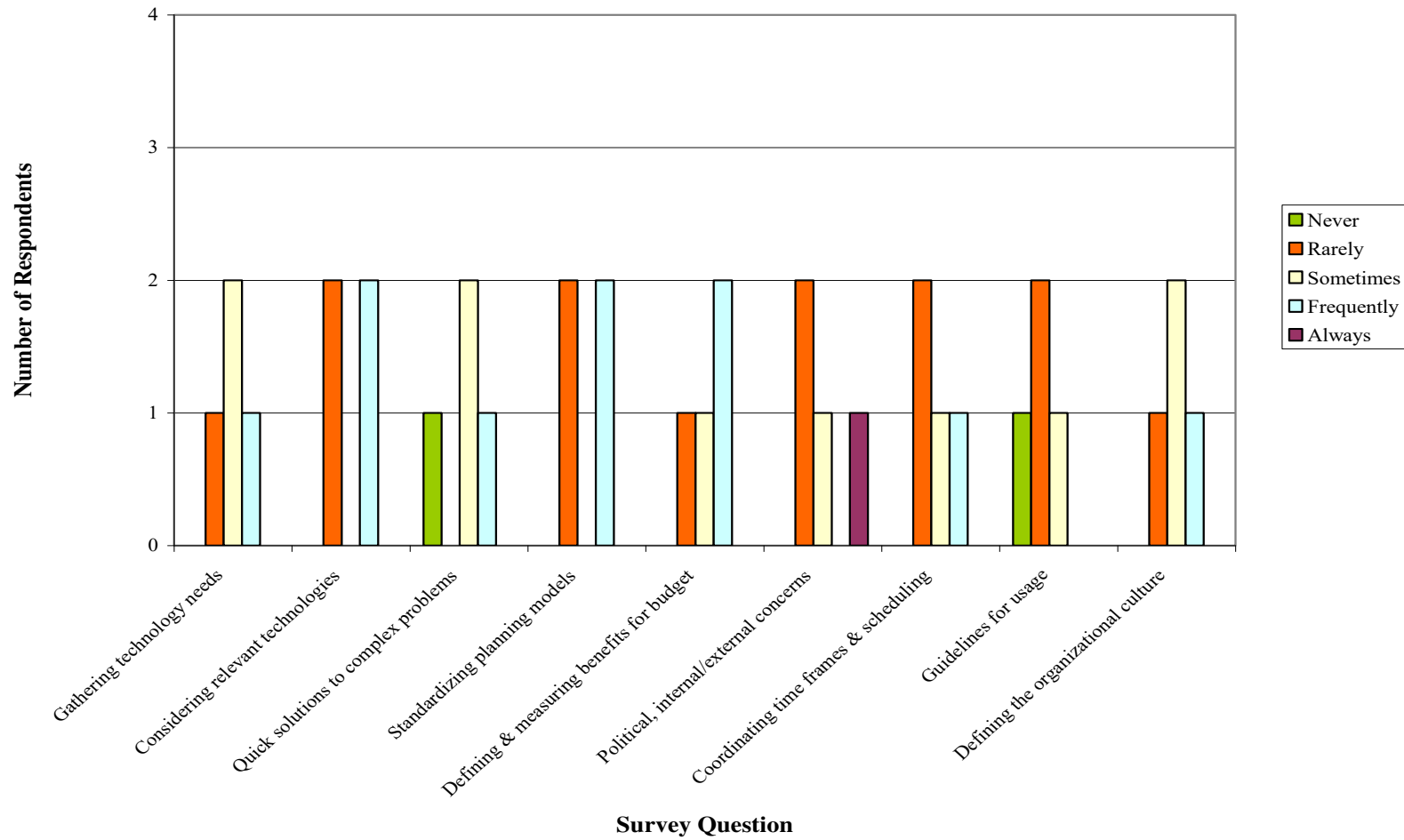


Figure 30: Planning Responses—Carnegie Research Institutions

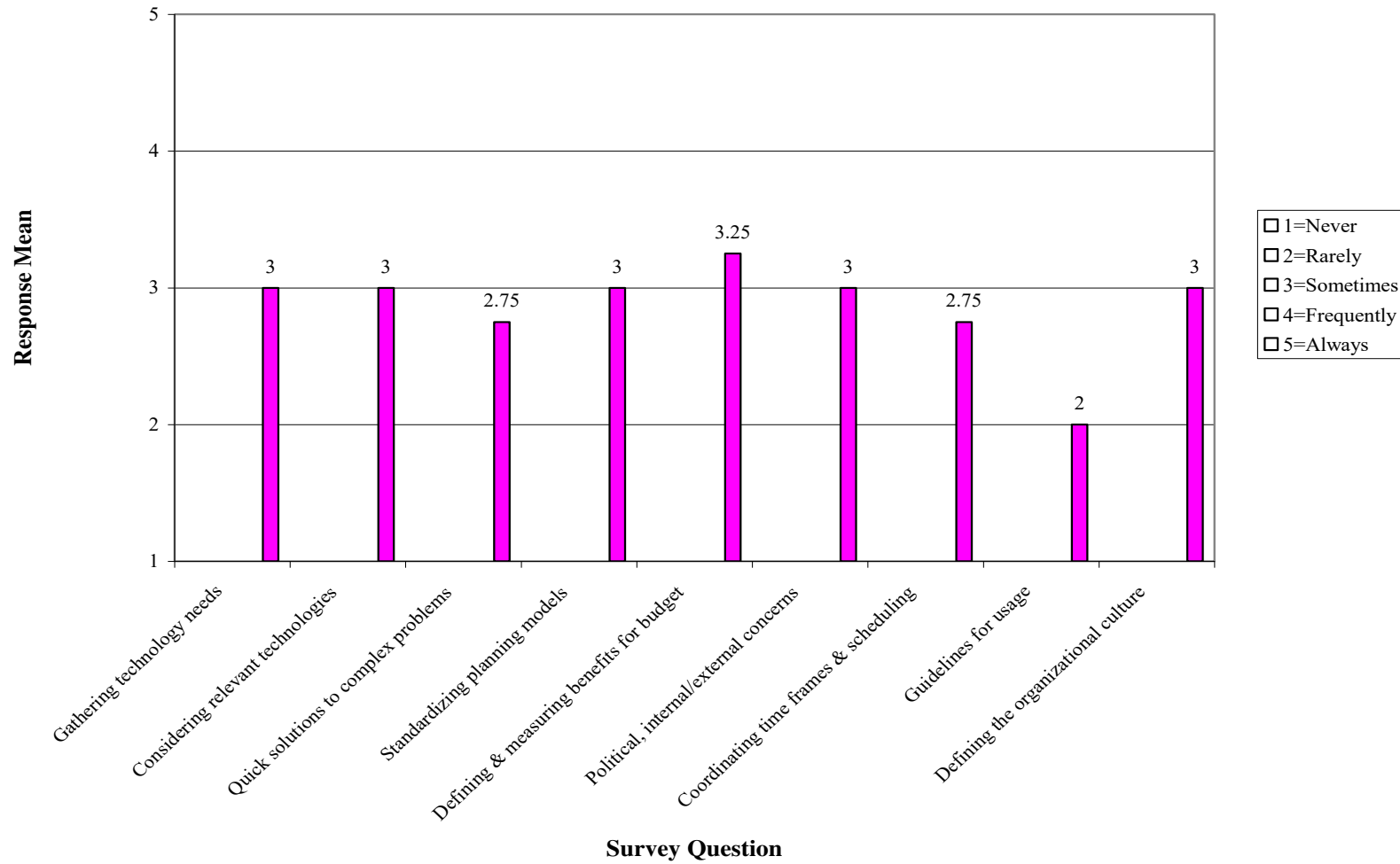


Figure 31: Planning Responses Mean—Carnegie Research Institutions

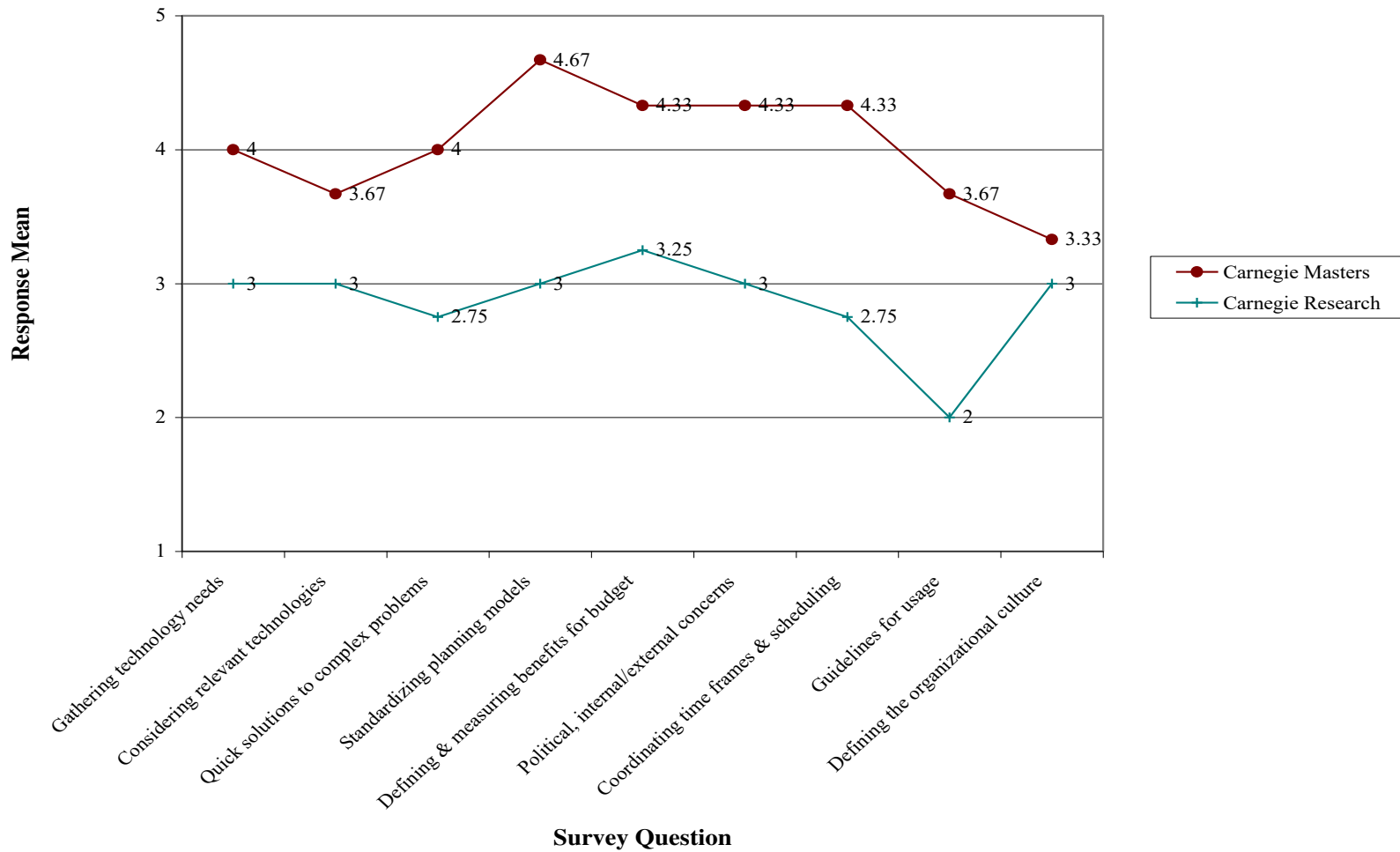


Figure 32: Planning Responses Mean Comparison—Carnegie Master’s and Research Institutions

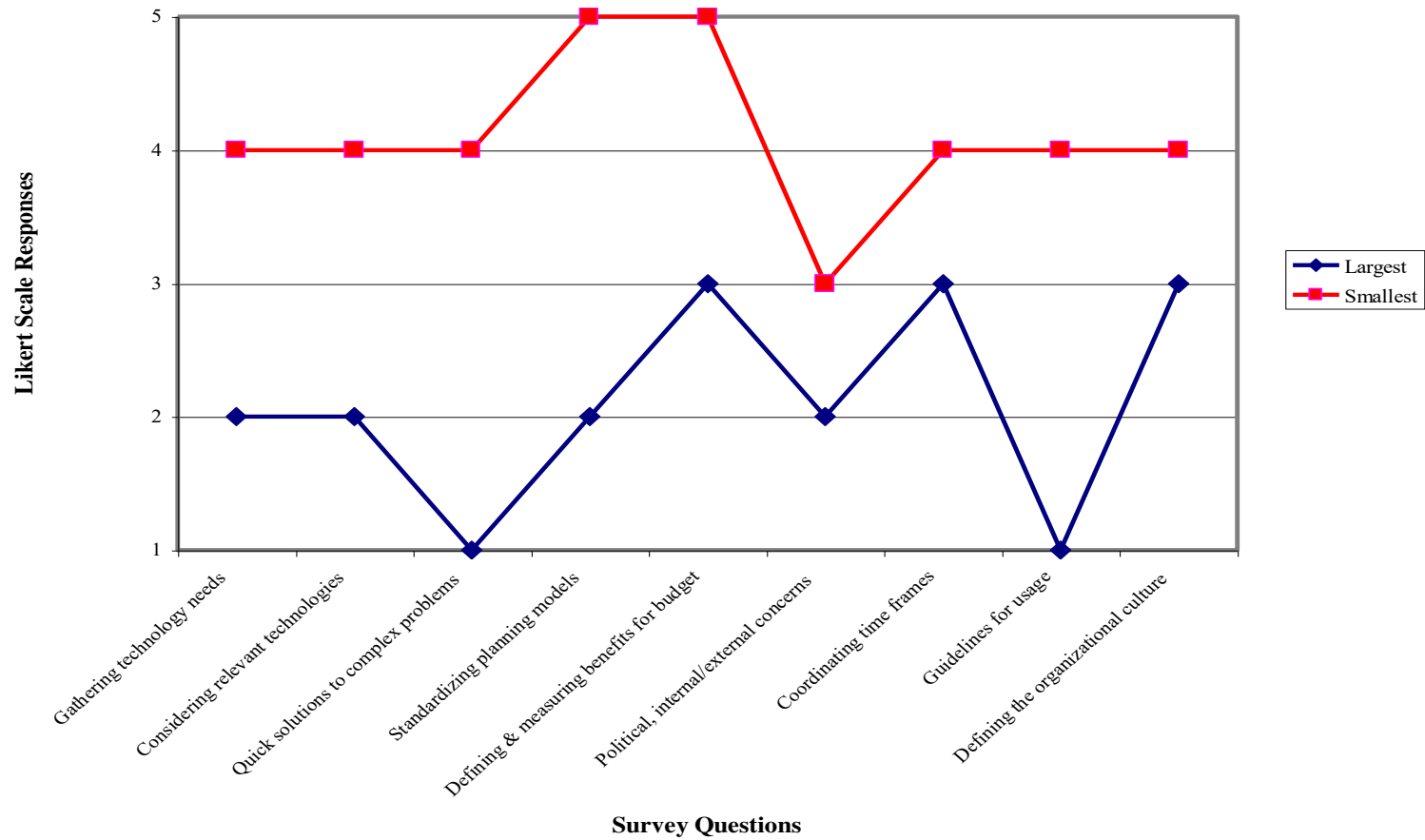


Figure 33: Planning Comparison—Largest Institution (by enrollment)/Smallest Institution (by enrollment)

Research Question 2

Data for Research Question 2, “What are the common descriptive patterns of implementation of innovative educational technologies by Florida’s SUS institutions?” were captured on the Survey by the respondents inputting Likert scaled responses to statements 2.1 through 2.12. In addition, question 4.2 was posed in the SOLUTIONS section of the Survey and the data collected was used as part of the analysis of Research Question 2. Statements 2.1 through 2.12 were areas of Research Question 2 which asked, “When IMPLEMENTING new educational technologies, how PROBLEMATIC is each of the following (areas)?”

Statement 2.1

Implementation statement 2.1 asked respondents to rate how problematic it was to manage systems with regards to rapidly changing technology. One respondent (14%) rated the statement as rarely problematic, five (71%) rated it sometimes problematic, and the final respondent (14%) rated the statement frequently problematic (Figure 34). The mean of 3.0 meant overall it was sometimes problematic.

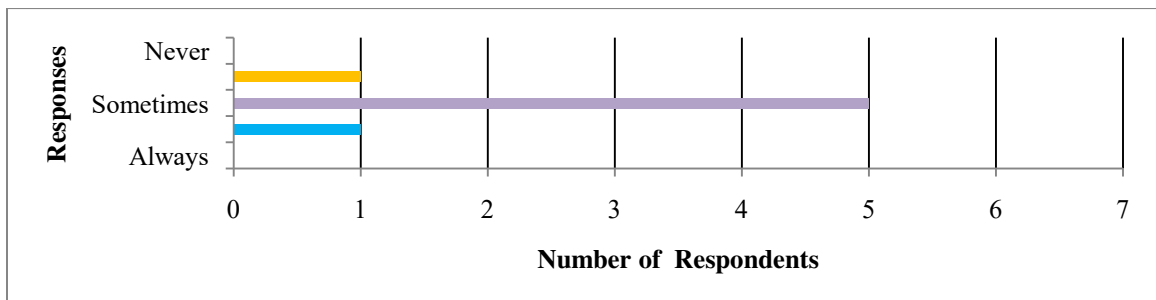


Figure 34: Implementation Statement 2.1—Managing Systems/Changing Technology

All three respondents (100%) from Carnegie Master’s institutions rated statement 2.1 sometimes problematic. The mean of 3.0 demonstrated when respondents from these institutions considered managing systems with regards to rapidly changing technology during implementation, it was sometimes problematic. One respondent (25%) from a Carnegie Research institution rated statement 2.1 rarely problematic, while two other respondents (50%) rated it sometimes problematic, and one (25%) indicated it was frequently problematic (Figure 35). The mean of 3.0 demonstrated this implementation statement was sometimes problematic.

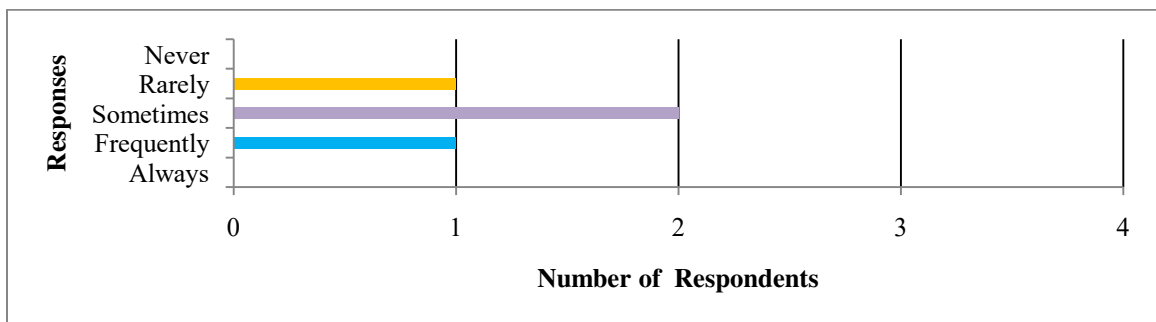


Figure 35: Implementation Statement 2.1—Carnegie Research Institution Responses

Master’s institutions indicated this was sometimes (3.0) problematic, while Research institutions concurred. The respondent at the institution with the lowest enrollment stated it was sometimes problematic, and the respondent at the institution with the largest enrollment concurred.

Statement 2.2

Implementation statement 2.2 asked how problematic individual competence and adaptation to new technologies was in a respondent’s respective institution. One (14%)

found it rarely problematic, four (57%) found it a sometimes problematic; one (14%) rated it frequently problematic, and one (14%) rated it always problematic (Figure 36). The mean of 3.29 meant overall that individual competence was sometimes problematic.

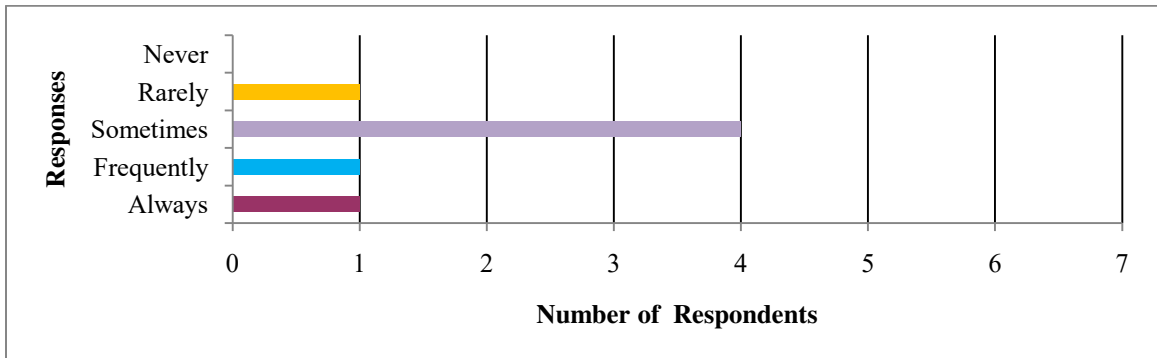


Figure 36: Implementation Statement 2.2—Individual Competence and New Technology

All three respondents (100%) from Carnegie Master’s institutions rated statement 2.2 as sometimes problematic. The mean of 3.0 demonstrated that when respondents from these institutions were to consider the individual competence and adaptation to new technologies, it was sometimes problematic. One respondent (25%) from a Carnegie Research institution rated statement 2.2 rarely problematic, one (25%) rated it sometimes problematic, one (25%) rated it frequently problematic, and one (25%) rated it always problematic (Figure 37). The mean of 3.5 demonstrated this implementation statement was sometimes problematic.

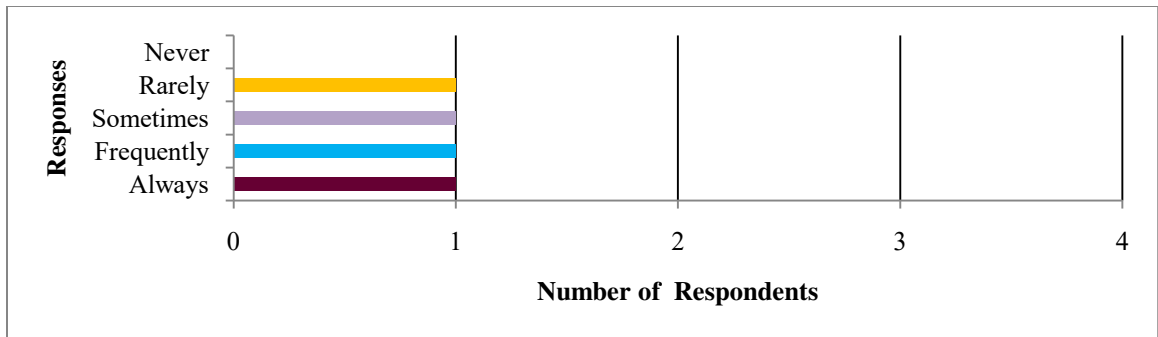


Figure 37: Implementation Statement 2.2—Carnegie Research Institution Responses

Master’s institutions indicated this was frequently (3.5) problematic, while Research institutions stated it was sometimes (3.0) problematic. The respondent at the institution with the lowest enrollment stated it was sometimes problematic, while the respondent at the institution with the largest enrollment stated it was frequently problematic.

Statement 2.3

Implementation statement 2.3 asked if adequate training for students and faculty was problematic. One respondent (14%) found it rarely problematic, four (57%) found it sometimes problematic, and two (29%) rated it frequently problematic (Figure 38). The mean of 3.14 meant that providing adequate training to students and faculty was sometimes problematic.

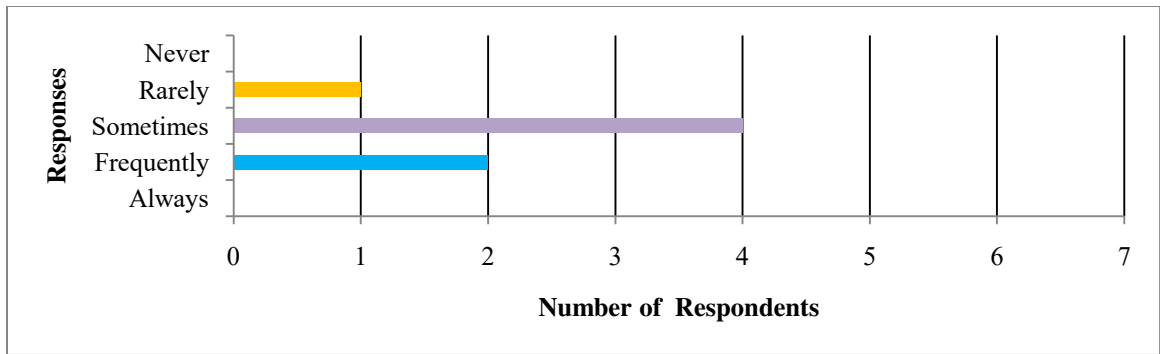


Figure 38: Implementation Statement 2.3—Adequate Training for Students and Faculty

The three respondents (100%) from Carnegie Master’s institutions rated statement 2.3 sometimes problematic. The mean of 3.0 demonstrated that when respondents from these institutions considered the adequacy of training for students and faculty, it was sometimes problematic. One respondent (25%) from a Carnegie Research institution rated statement 2.3 rarely problematic, one respondent (25%) rated it sometimes problematic, and two (50%) rated statement 2.3 frequently problematic (Figure 39). The mean of 3.25 demonstrated this implementation statement was sometimes problematic.

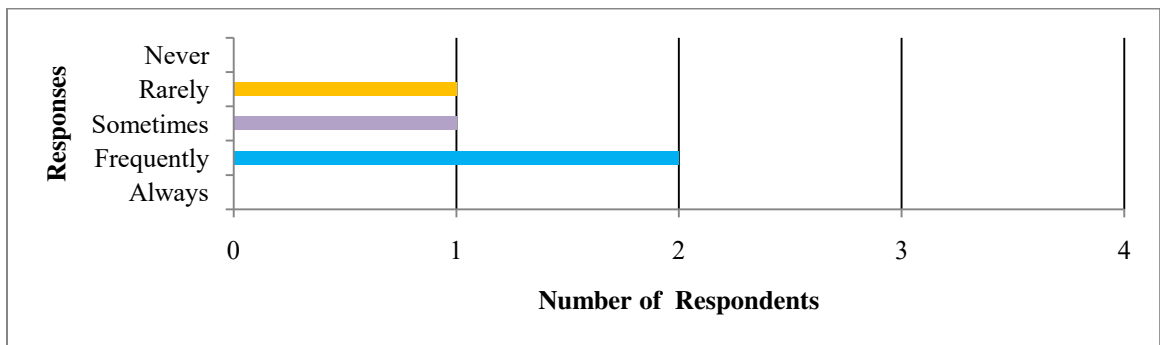


Figure 39: Implementation Statement—Carnegie Research Institution Responses

Master’s institutions indicated this was sometimes (3.0) problematic, while Research institutions agreed (3.25). The respondent at the institution with the lowest enrollment stated it was sometimes problematic, while the respondent at the institution with the largest enrollment states it was frequently problematic.

Statement 2.4

Implementation statement 2.4 asked how problematic resistance to change was with an unfamiliar technology. One (14%) found it rarely problematic, two (29%) found it sometimes problematic, three (43%) rated it frequently problematic, and one (14%) rated it always problematic (Figure 40). The mean of 3.57 meant resistance to change was sometimes problematic.

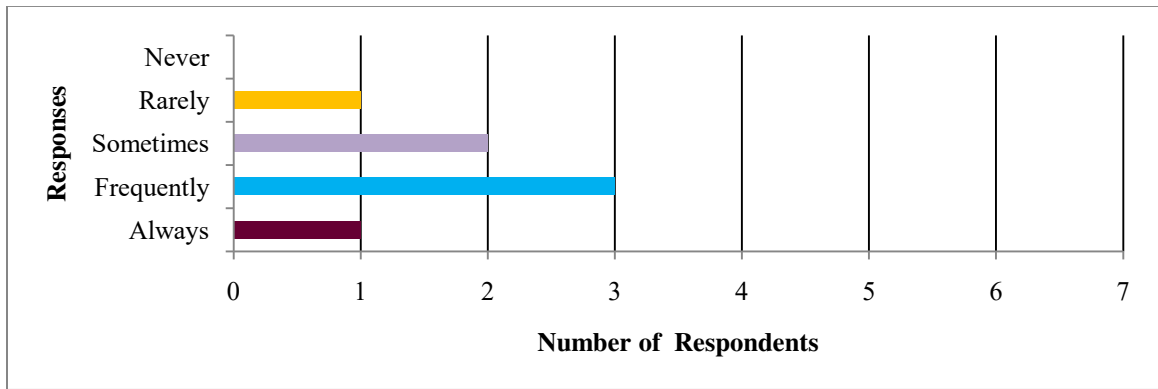


Figure 40: Implementation Statement 2.4—Resistance to Change

Two respondents (66%) from a Carnegie Master’s institution rated statement 2.4 sometimes problematic, and one (34%) rated it frequently problematic (Figure 41). The mean of 3.33 demonstrated that when respondents from these institutions were to

consider the problem of resistance to change due to fear of the unfamiliar, it was sometimes problematic.

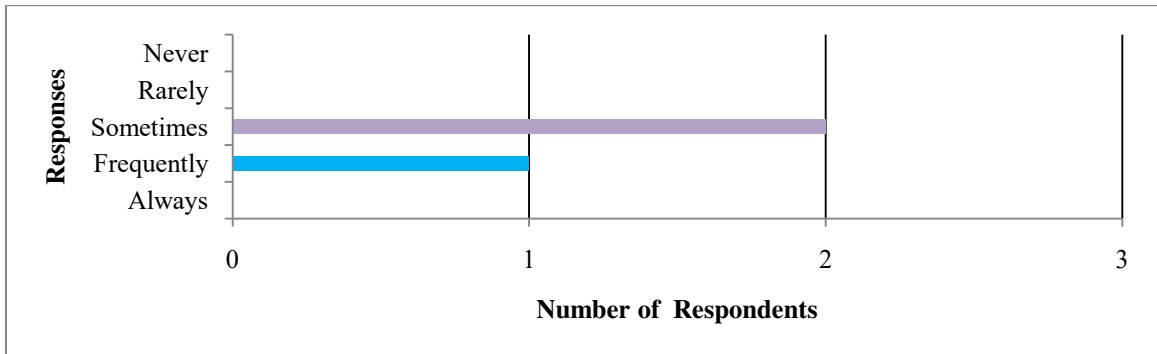


Figure 41: Implementation Statement 2.4—Carnegie Master's Institution Responses

One respondent (25%) from a Carnegie Research institution rated statement 2.4 rarely problematic, two (50%) rated it frequently problematic, and one (25%) rated it always problematic (Figure 42). The mean of 3.75 demonstrated this implementation statement was sometimes problematic, but it bordered on becoming a frequent problem.

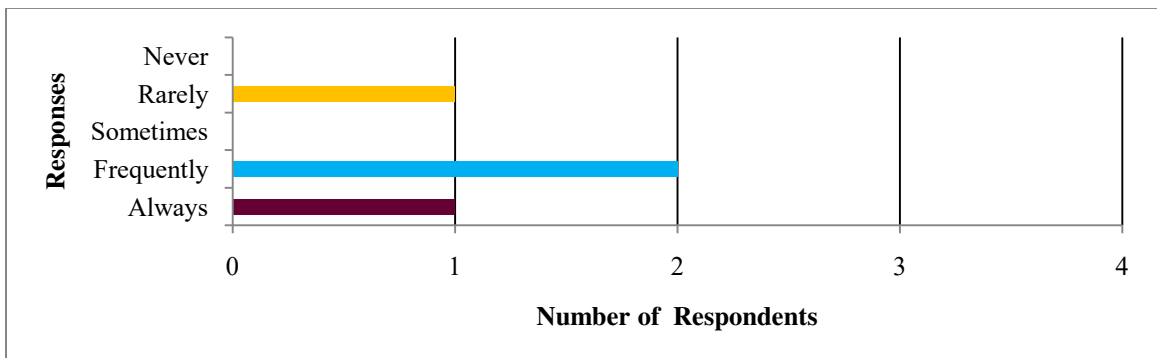


Figure 42: Implementation Statement 2.4—Carnegie Research Institution Responses

Master's institutions indicated this was sometimes (3.33) problematic, while Research institutions stated it was frequently (3.75) problematic. The respondent at the

institution with the lowest enrollment stated it was sometimes problematic, while the respondent at the institution with the largest enrollment stated it was frequently problematic.

Statement 2.5

Implementation statement 2.5 asked how problematic it was for the respondent's institution to focus resources during implementation to enhance technological ability. Two (29%) found it rarely problematic, three (43%) rated it sometimes problematic, and two (29%) found it frequently problematic (Figure 43). The mean for this statement was 3.0 which meant it was sometimes problematic.

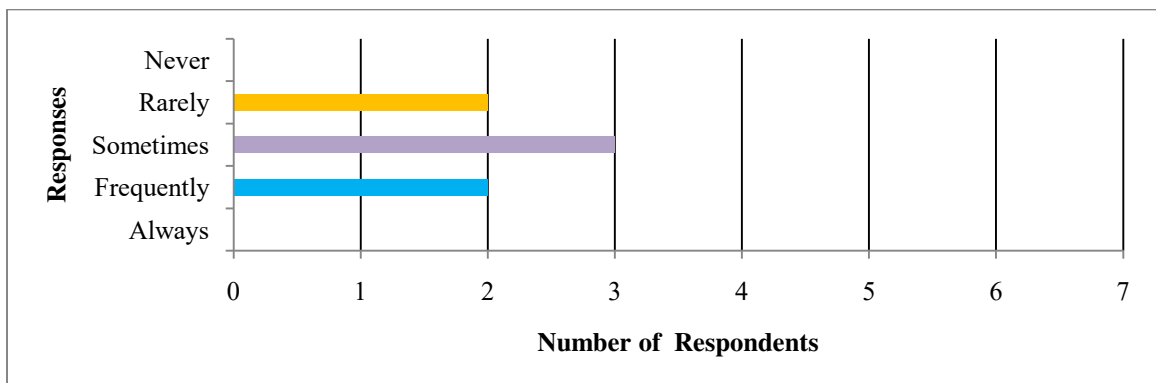


Figure 43: Implementation Statement 2.5—Focused Institutional Resources

One respondent (34%) from a Carnegie Master's institution rated statement 2.5 sometimes problematic and two (66%) rated it frequently problematic (Figure 44). The mean of 3.67 demonstrated that when respondents from these institutions considered the problem of focusing resources during implementation to enhance technological abilities, it bordered on being frequently problematic.

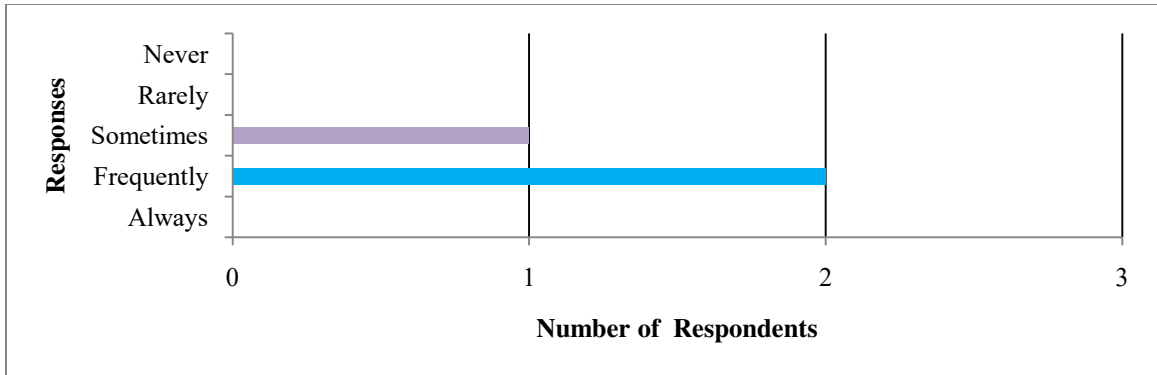


Figure 44: Implementation Statement 2.5—Carnegie Master’s Institution Responses

Two respondents (50%) from Carnegie Research institutions rated statement 2.5 rarely problematic and two respondents (50%) rated it sometimes problematic (Figure 45). The mean of 2.5 demonstrated this implementation statement was rarely problematic.

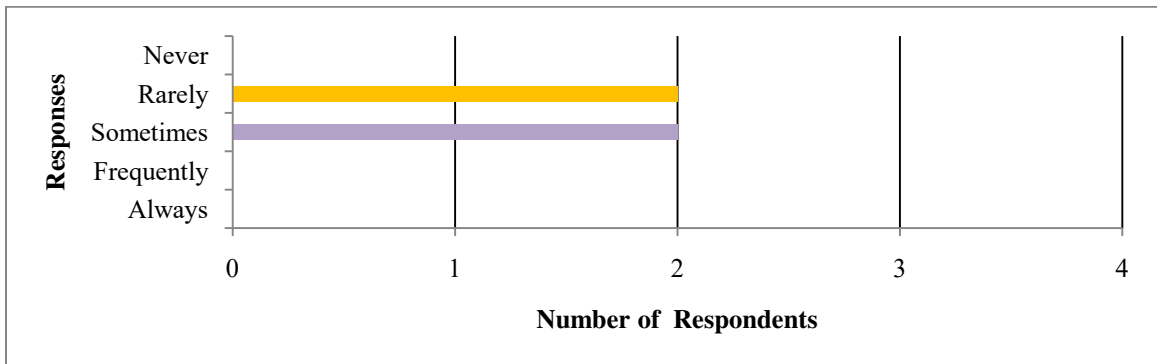


Figure 45: Implementation Statement 2.5—Carnegie Research Institution Responses

Master’s institutions indicated this was frequently (3.67) problematic, while Research institutions stated it was sometimes (2.5) problematic. The respondent at the institution with the lowest enrollment stated it was frequently problematic, while the respondent at the institution with the largest enrollment stated it was rarely problematic.

Statement 2.6

Statement 2.6 asked if the compatibility of systems and software was addressed early in the implementation phase. One respondent (14%) rated it rarely problematic, three (43%) rated it sometimes problematic and three (43%) rated it frequently problematic (Figure 46). The mean of 3.29 meant that it was sometimes problematic.

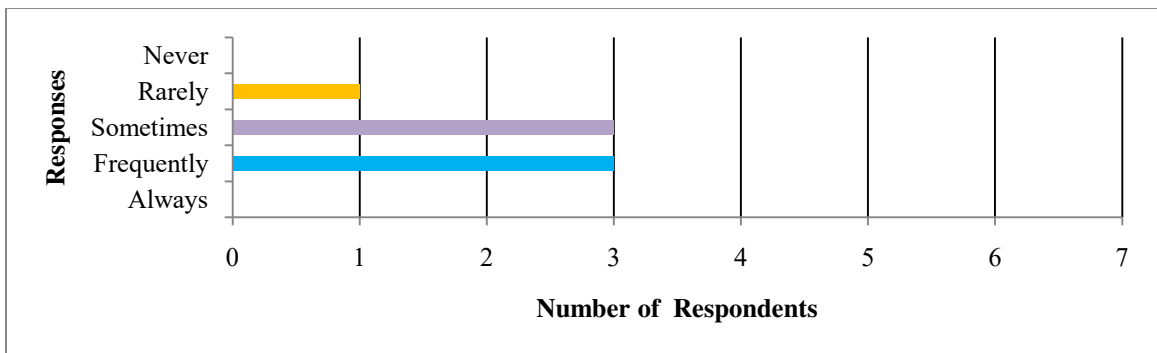


Figure 46: Implementation Statement 2.6—Compatibility of Systems and Software

One respondent (34%) from a Carnegie Master’s institution rated statement 2.6 sometimes problematic and two (66%) rated it frequently problematic (Figure 47). The mean of 3.67 demonstrated that when respondents from these institutions considered if the compatibility of systems and software was addressed early in the implementation phase, it bordered on being frequently problematic.

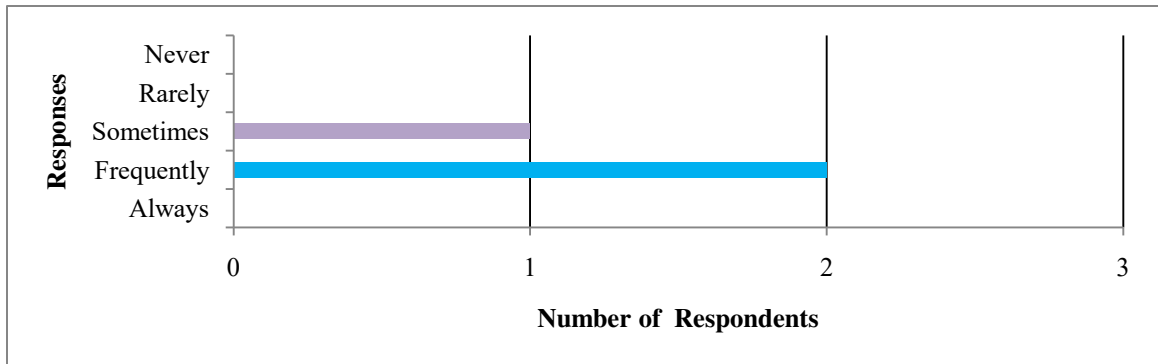


Figure 47: Implementation Statement 2.6—Carnegie Master's Institution Responses

One respondent (25%) from a Carnegie Research institution rated statement 2.6 rarely problematic, two respondents (50%) rated it sometimes problematic, and one respondent (25%) rated it frequently problematic (Figure 48). The mean of 3.0 demonstrated that this implementation statement was sometimes problematic.

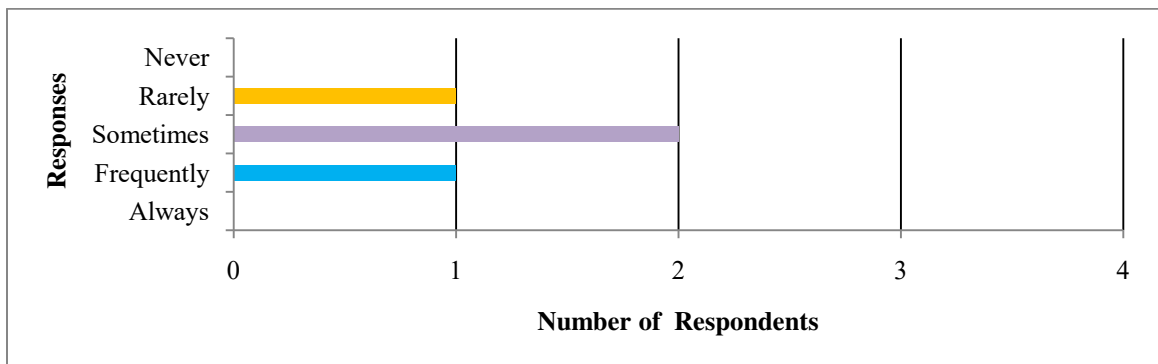


Figure 48: Implementation Statement 2.6—Carnegie Research Institution Responses

Master's institutions indicated this was frequently (3.67) problematic, while Research institutions stated it was sometimes (3.0) problematic. The respondent at the institution with the lowest enrollment stated it was frequently problematic, while the

respondent at the institution with the largest enrollment stated it was sometimes problematic.

Statement 2.7

Implementation statement 2.7 asked if the number of qualified support staff was adequate enough to implement a new educational technology. Two respondents (29%) rated it rarely problematic, two (29%) rated it sometimes problematic, two (29%) rated it frequently problematic and one (14%) rated it always problematic (Figure 49). The mean of 3.29 meant it was sometimes problematic.

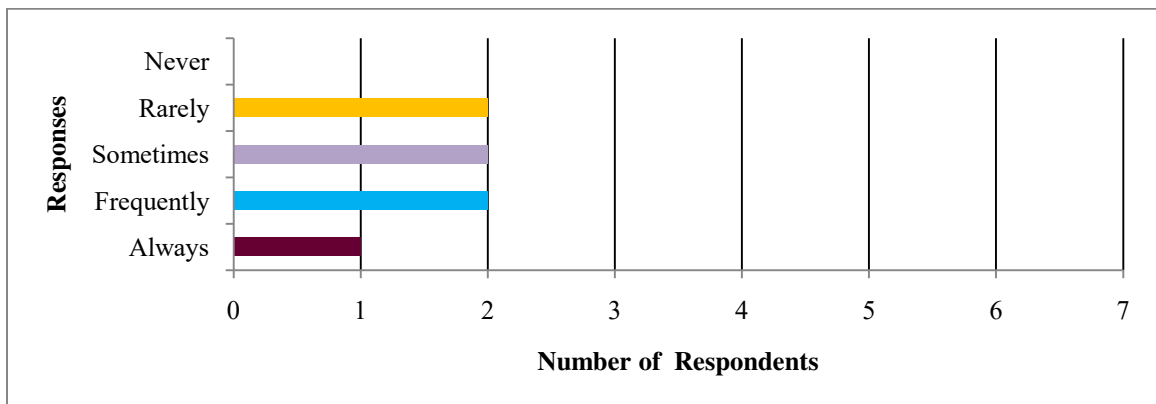


Figure 49: Implementation Statement 2.7—Adequate Qualified Support Staff

One respondent (34%) from a Carnegie Master's institution rated statement 2.7 sometimes problematic, one (34%) rated it frequently problematic, and one (34%) rated it always problematic (Figure 50). The mean of 4.0 demonstrated that when respondents from these institutions considered the adequacy of qualified support staff during implementation, it was frequently problematic.

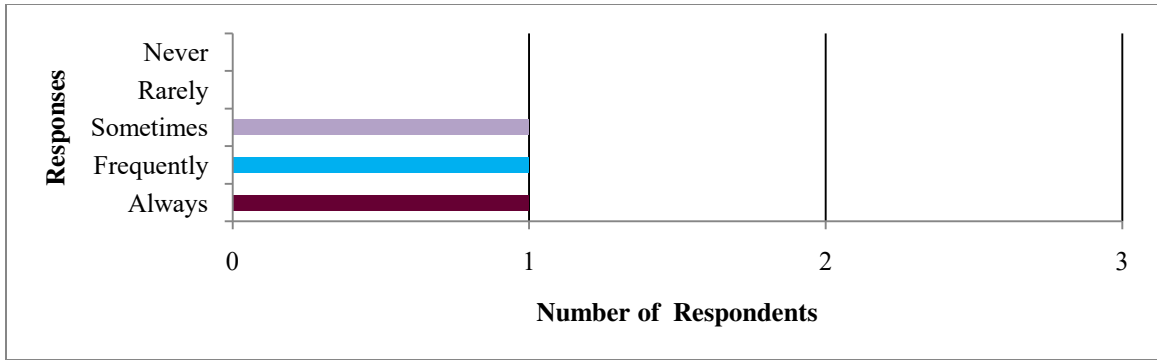


Figure 50: Implementation Statement 2.7—Carnegie Master's Institution Responses

Two respondents (50%) from Carnegie Research institutions rated statement 2.7 rarely problematic, one (25%) rated it sometimes problematic, and one (25%) rated it frequently problematic (Figure 51). The mean of 2.75 demonstrated this implementation statement was rarely problematic, but could be sometimes problematic.

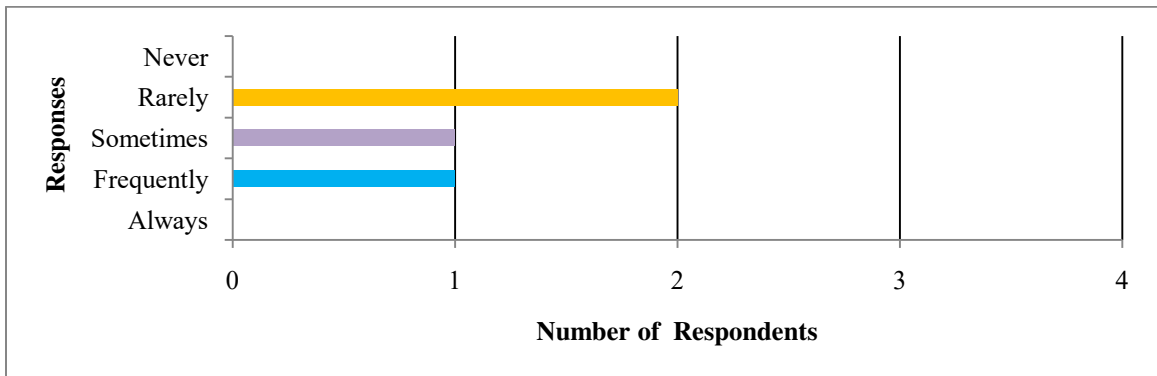


Figure 51: Implementation Statement 2.7—Carnegie Research Institution Responses

Master's institutions indicated this was frequently (4.0) problematic, while Research institutions stated it was sometimes (2.75) problematic. The respondent at the institution with the lowest enrollment stated it was frequently problematic and the respondent at the institution with the largest enrollment agreed.

Statement 2.8

Implementation statement 2.8 asked if coordinating the implementation of an educational technology across departments was a problem. One respondent (14%) rated it rarely problematic, three (43%) rated it sometimes problematic and three (43%) rated it frequently problematic (Figure 52). The mean of 3.29 meant coordination across departments was sometimes problematic.

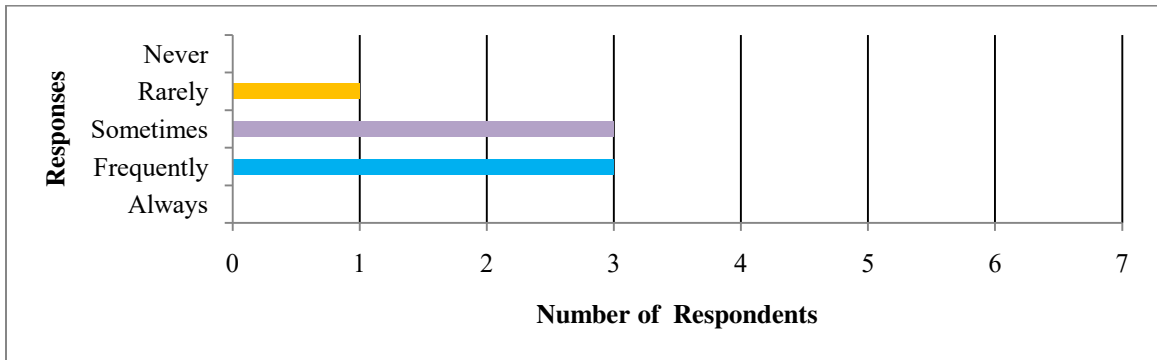


Figure 52: Implementation Statement—Coordinating Across Departments

All three respondents (100%) from Carnegie Master’s institutions rated statement 2.8 never problematic. The mean of 4.0 demonstrated that when respondents from these institutions considered the problem of coordinating the implementation of an educational technology across departments, it was frequently problematic. One respondent (25%) from a Carnegie Research institution rated statement 2.8 rarely problematic, while three (75%) rated it sometimes problematic (Figure 53). The mean of 2.75 demonstrated this implementation statement was rarely problematic, but might be interpreted as sometimes problematic.

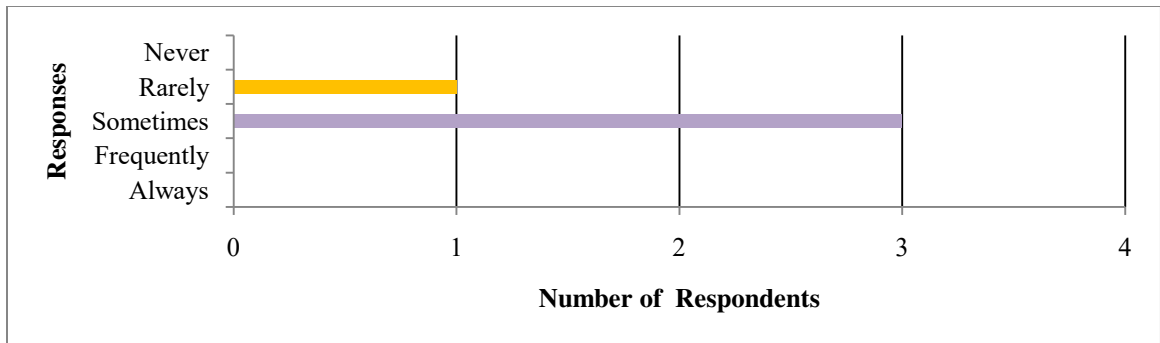


Figure 53: Implementation Statement 2.8—Carnegie Research Institution Responses

Master’s institutions indicated this was frequently (4.0) problematic, while Research institutions stated it was sometimes (2.75) problematic. The respondent at the institution with the lowest enrollment stated it was frequently problematic, while the respondent at the institution with the largest enrollment stated it was sometimes problematic.

Statement 2.9

Implementation statement 2.9 asked if developing general procedures to implement educational technology was problematic. Two respondents (29%) rated it rarely problematic, four (57%) rated it sometimes problematic, and one (14%) rated it frequently problematic (Figure 54). The mean of 2.86 demonstrated it was rarely problematic, but bordered on sometimes problematic.

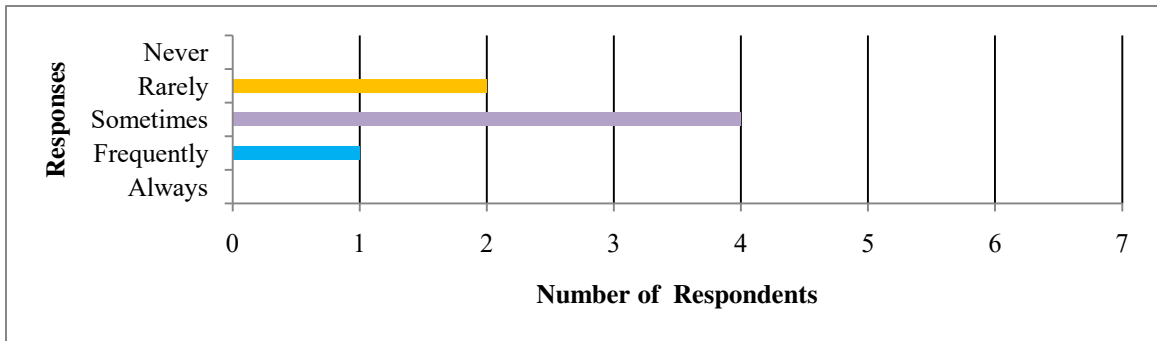


Figure 54: Implementation Statement 2.9—Developing General Procedures

Two respondents (66%) from Carnegie Master’s institutions rated statement 2.9 sometimes problematic and one (34%) respondent rated it frequently problematic (Figure 55). The mean of 3.33 demonstrated that when respondents from these institutions considered the problem of developing general procedures to implement educational technology, it was sometimes problematic.

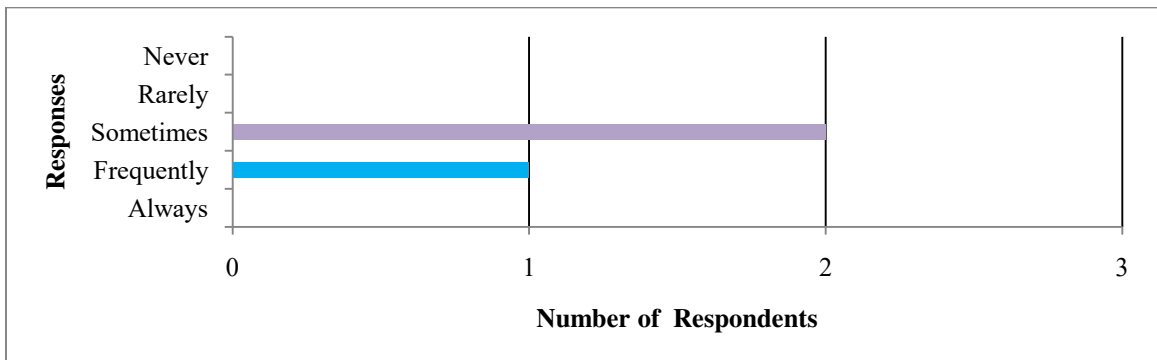


Figure 55: Implementation Statement 2.9—Carnegie Master's Institution Responses

Two respondents (50%) from Carnegie Research institutions rated statement 2.9 rarely problematic, and two (50%) rated it sometimes problematic (Figure 56). The mean of 2.5 demonstrated this implementation statement was rarely problematic.



Figure 56: Implementation Statement 2.9—Carnegie Research Institution Responses

Master’s institutions indicated this was sometimes (3.33) problematic, while Research institutions stated it was between rarely and sometimes (2.5) problematic. The respondent at the institution with the lowest enrollment stated it was frequently problematic, while the respondent at the institution with the largest enrollment stated it was rarely problematic.

Statement 2.10

Implementation statement 2.10 questioned how problematic was the development of effective timeframes and schedules for implementation of new educational technologies. Three respondents (43%) rated it rarely problematic, three (43%) rated it sometimes problematic, and one (14%) rated it frequently problematic (Figure 57). The mean of 2.71 demonstrated that effective timeframes and schedules were rarely problematic, but could be interpreted as sometimes problematic.

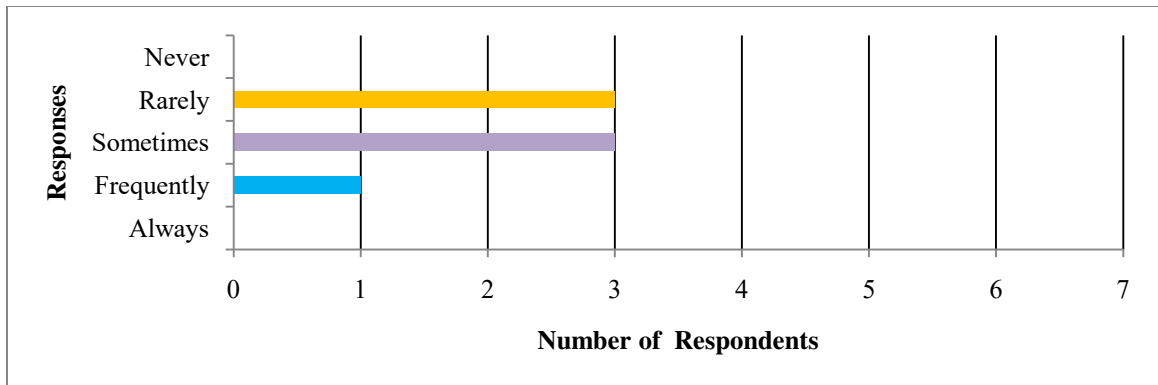


Figure 57: Implementation Statement 2.10—Developing Timeframes and Schedules

Two respondents (66%) from Carnegie Master’s institutions rated statement 2.10 sometimes problematic and one respondent (34%) rated it frequently problematic (Figure 58). The mean of 3.33 demonstrated that when respondents from these institutions considered the problem of developing general procedures to implement educational technology, it was sometimes problematic.

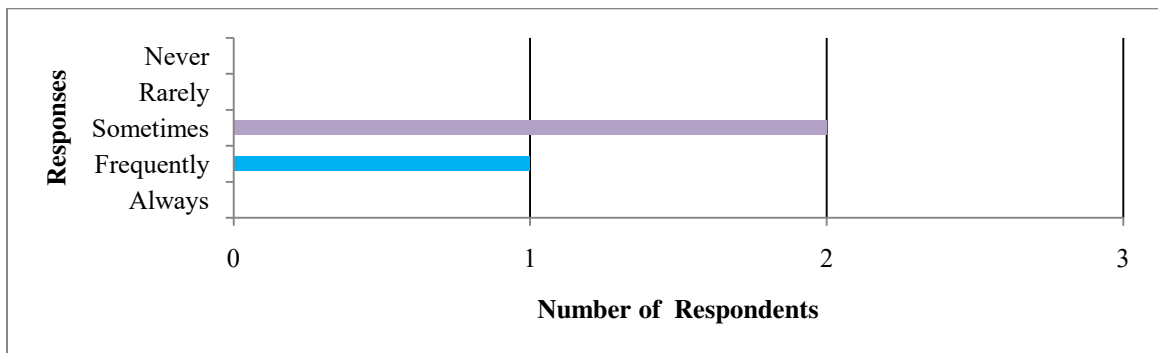


Figure 58: Implementation Statement 2.10—Carnegie Master's Institution Responses

Three respondents (75%) from Carnegie Research institutions rated statement 2.10 rarely problematic, while one (25%) rated it sometimes problematic (Figure 59). The mean of 2.25 demonstrated this implementation statement was rarely problematic.

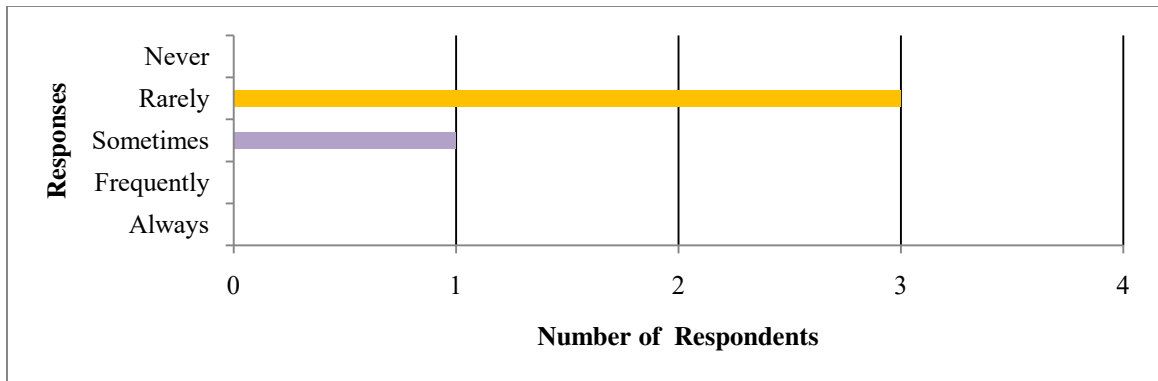


Figure 59: Implementation Statement 2.10—Carnegie Research Institution Responses

Master’s institutions indicated this was sometimes (3.33) problematic, while Research institutions stated it was sometimes (2.25) problematic. The respondent at the institution with the lowest enrollment stated it was frequently problematic, while the respondent at the institution with the largest enrollment stated it was rarely problematic.

Statement 2.11

Implementation statement 2.11 asked if it was a problem to set consistency and efficiency standards when implementing new educational technologies. Two respondents (29%) rated it rarely problematic, four (57%) rated it sometimes problematic, and one (14%) rated it frequently problematic (Figure 60). The mean of 2.86 meant that setting standard was rarely problematic, but it bordered on sometimes problematic.

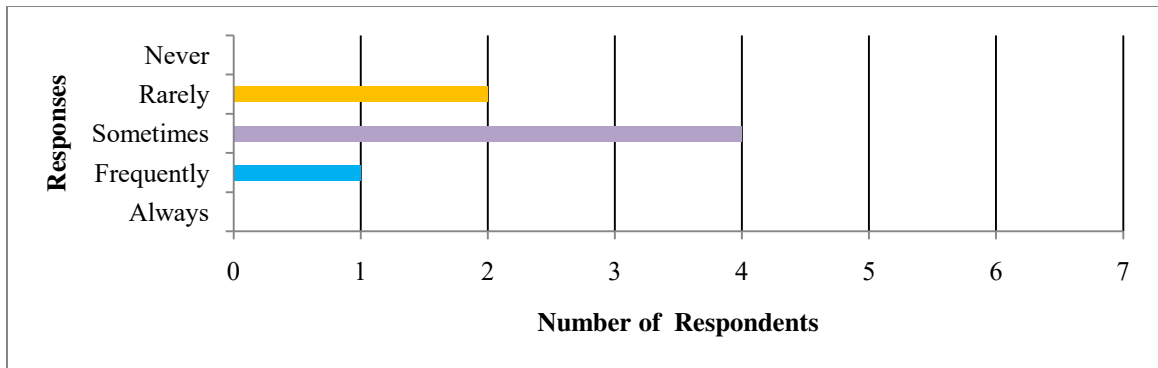


Figure 60: Implementation Statement 2.11—Setting Consistency/Efficiency Standards

Two respondents (66%) from Carnegie Master’s institutions rated statement 2.11 sometimes problematic and one (34%) respondent rated it frequently problematic (Figure 61). The mean of 3.33 demonstrated that when respondents from these institutions considered the problem of developing general procedures to implement educational technologies, it was sometimes problematic.

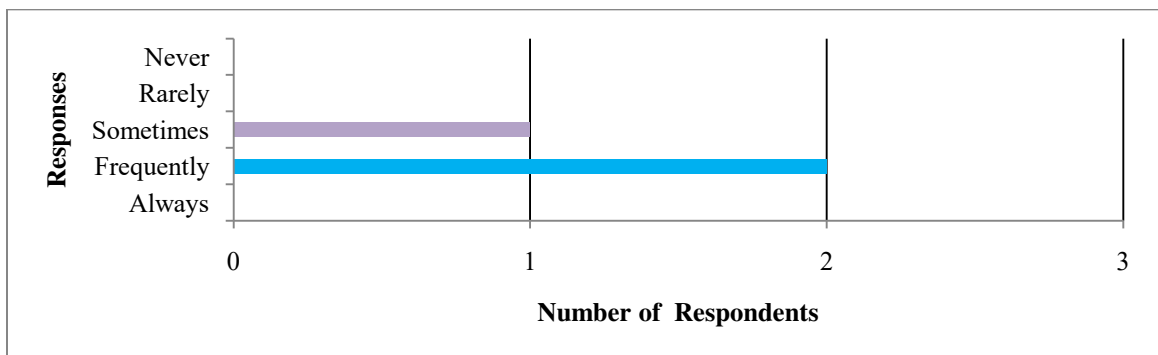


Figure 61: Implementation Statement 2.11—Carnegie Master's Institution Responses

Two respondents (50%) from Carnegie Research institutions rated statement 2.11 rarely problematic, and two (50%) rated it sometimes problematic (Figure 62). The mean of 2.5 demonstrated this implementation statement was rarely problematic.

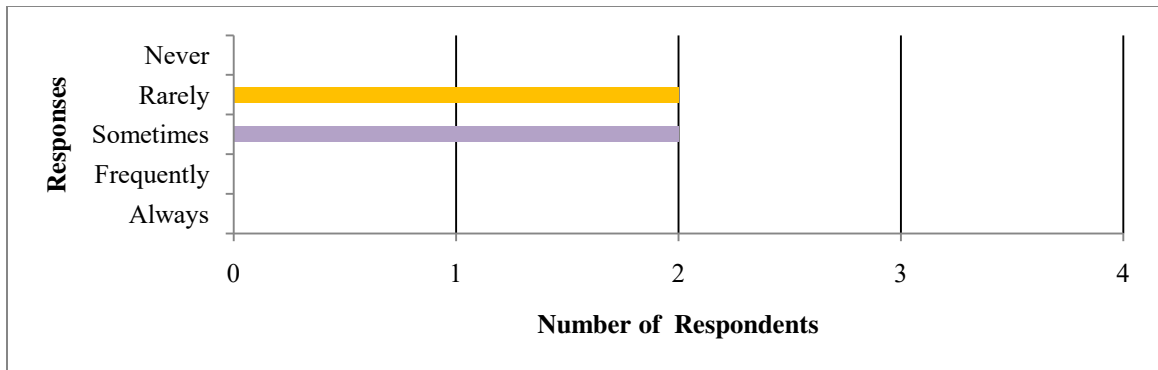


Figure 62: Implementation Statement 2.11—Carnegie Research Institution Responses

Master’s institutions indicated this was sometimes (3.33) problematic, while Research institutions stated it was sometimes (2.5) problematic. The respondent at the institution with the lowest enrollment stated it was frequently problematic, while the respondent at the institution with the largest enrollment stated it was rarely problematic.

Statement 2.12

Planning statement 2.12, an area where the respondent could write in specific problems when planning for educational technologies, was left blank by all seven respondents.

Implementation Statement Summaries

Figures 63 through 70 graphically illustrate a total comparison of all the implementation statements to include: response frequency for each implementation statement, mean for each implementation statement, Carnegie Master’s and Research implementation response frequencies, Carnegie Master’s and Research implementation response mean, Carnegie Master’s and Research mean comparison, and smallest

institution (by enrollment) and largest institution (by enrollment) implementation response comparison.

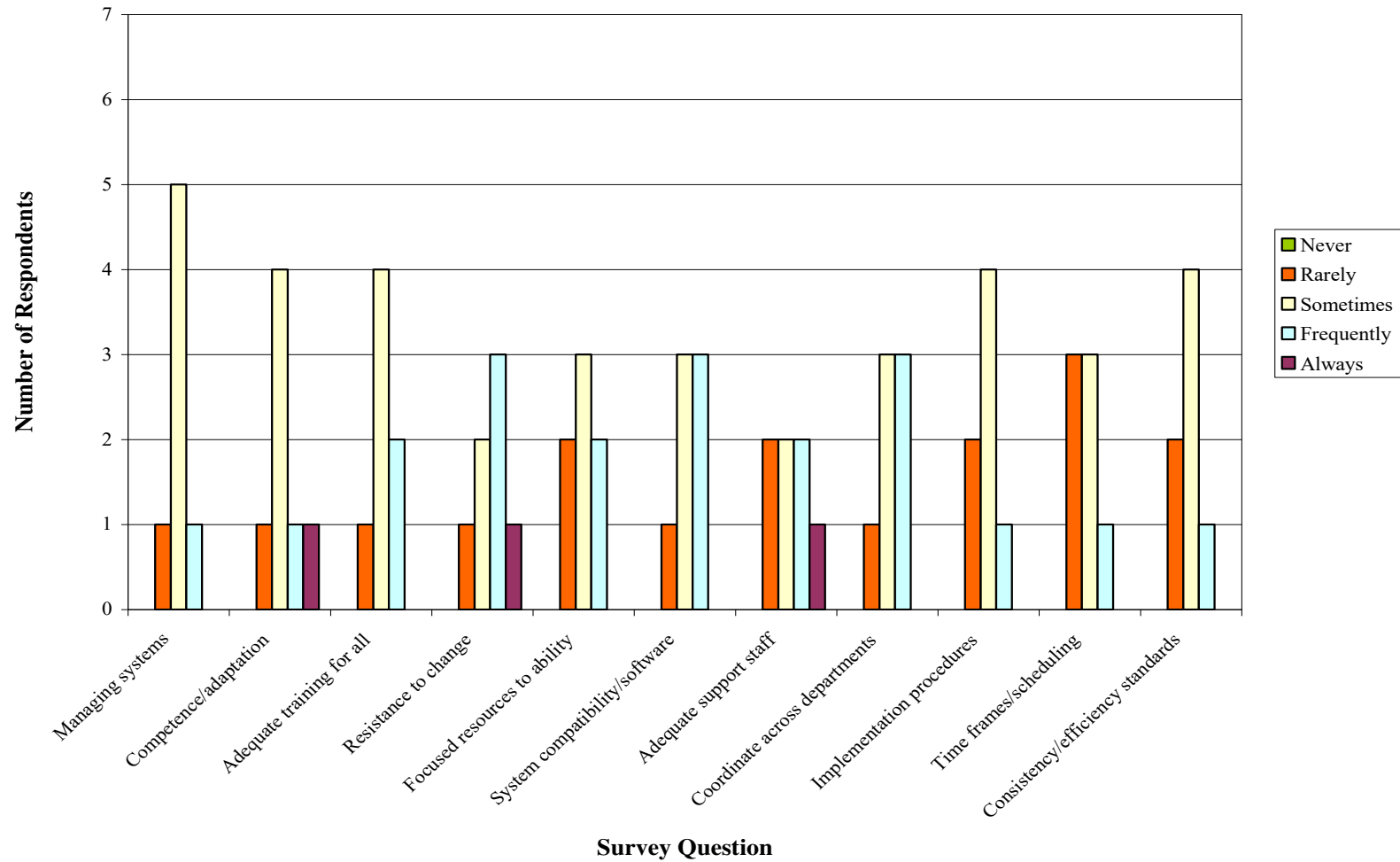


Figure 63: Implementation Responses—Summary

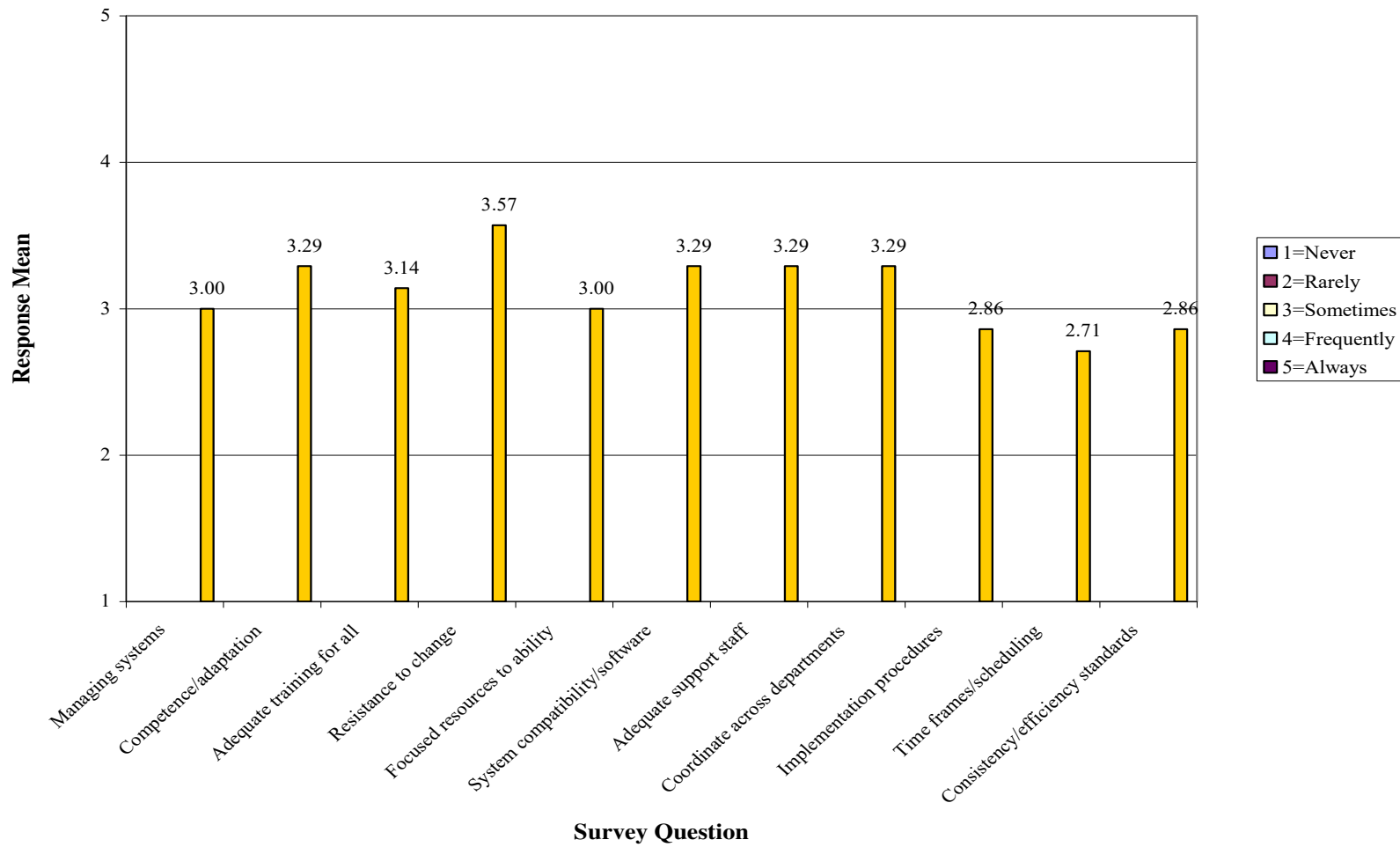


Figure 64: Implementation Responses—Mean

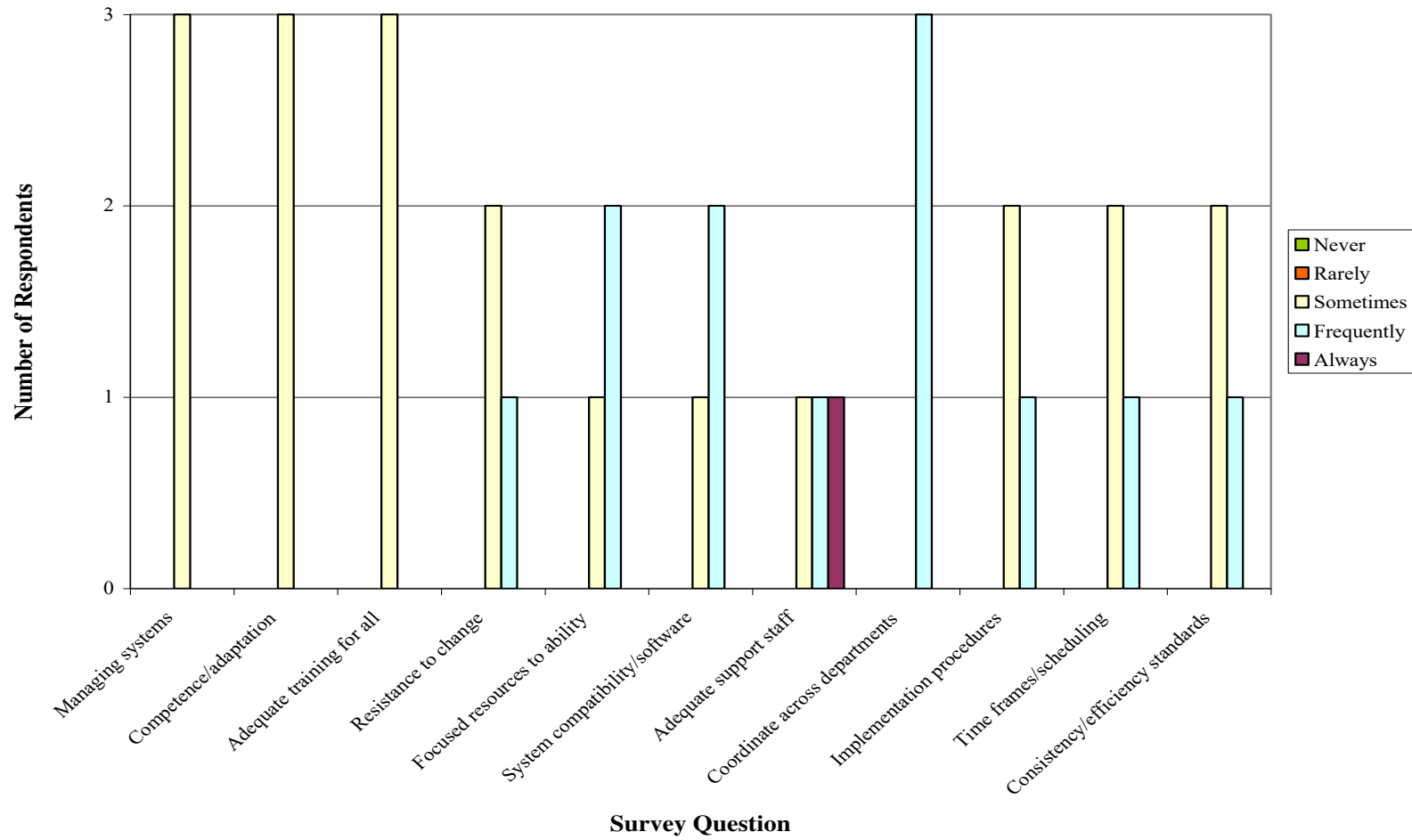


Figure 65: Implementation Responses—Carnegie Master’s Institutions

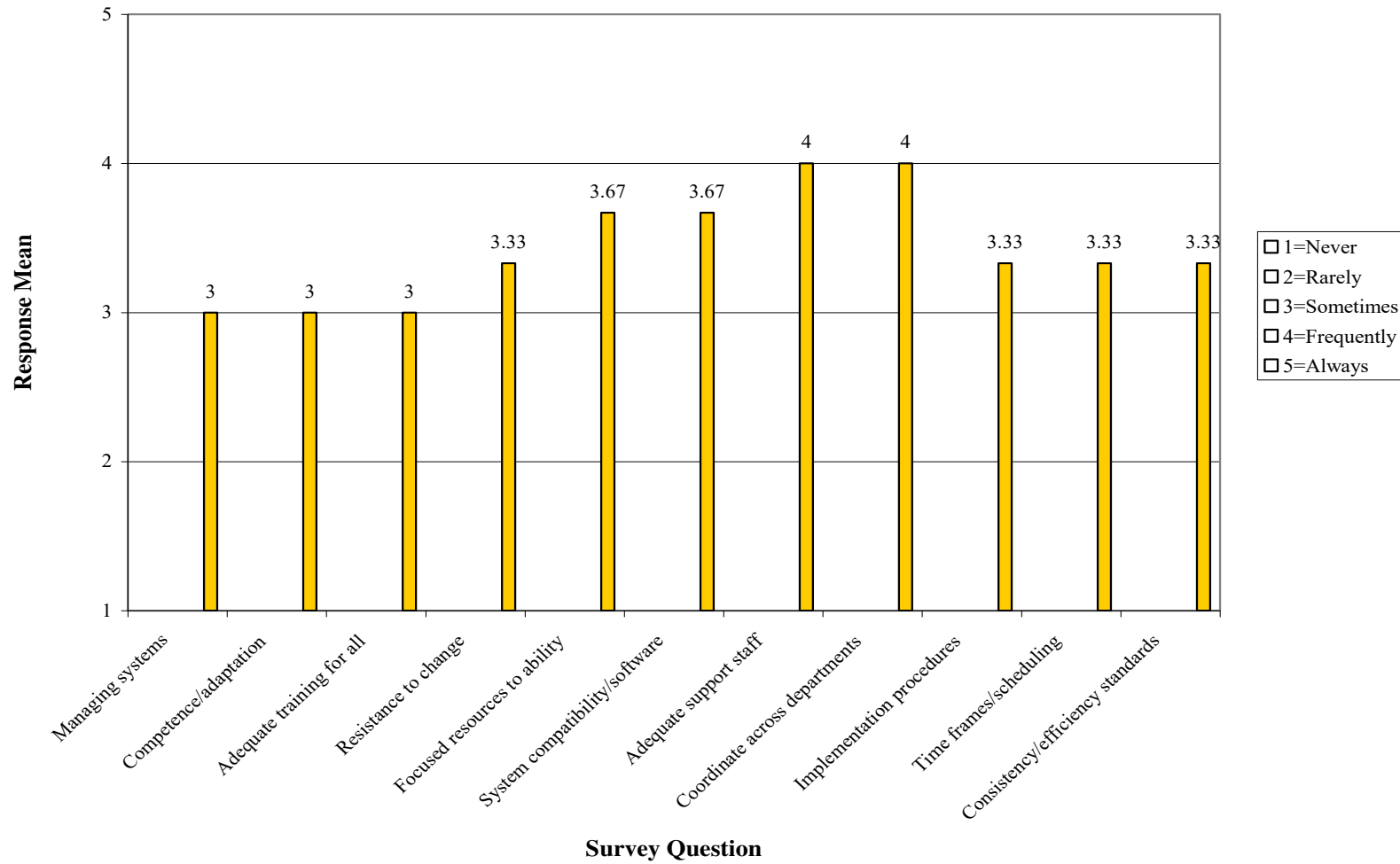


Figure 66: Implementation Responses Mean—Carnegie Master’s Institutions

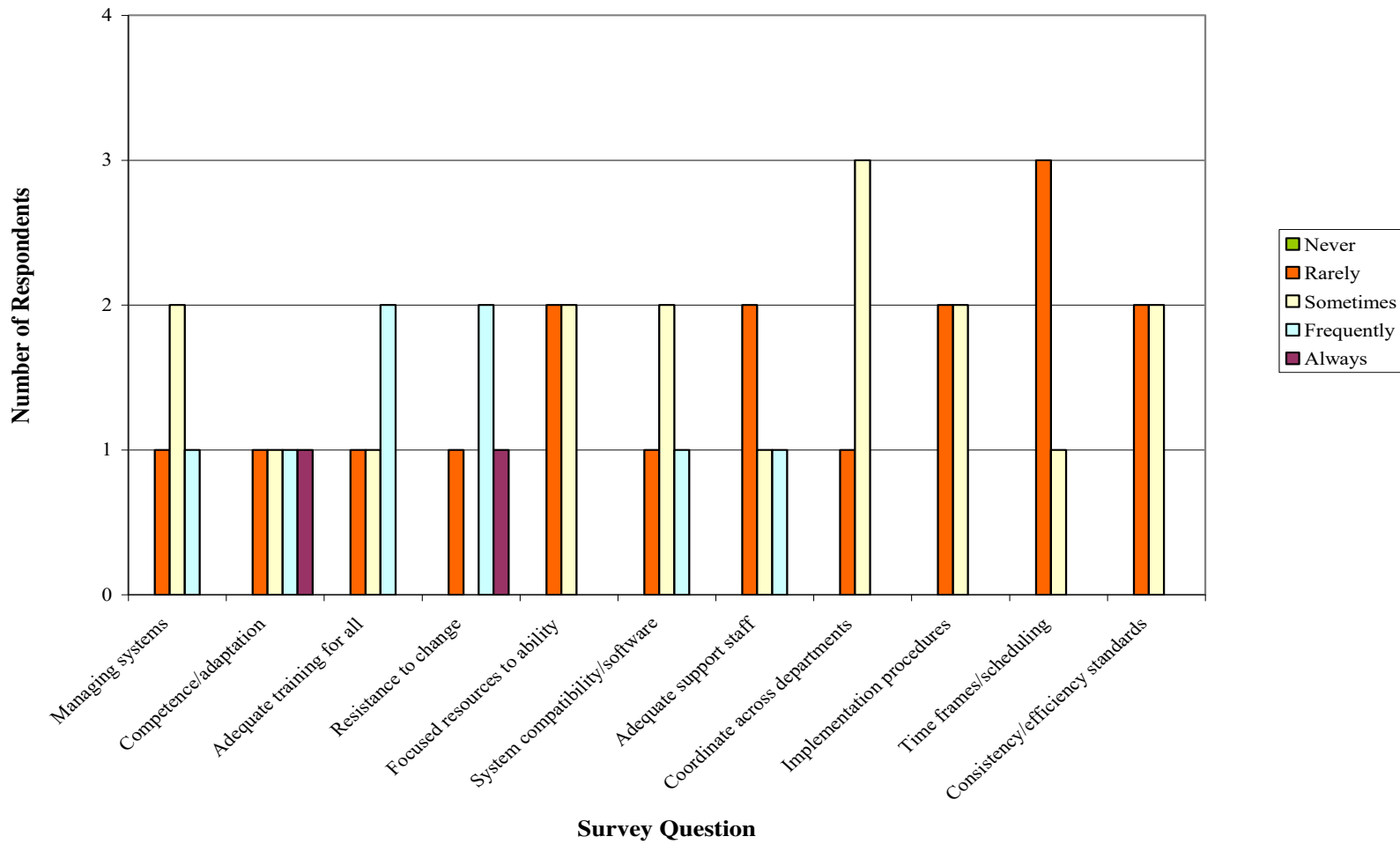


Figure 67: Implementation Responses—Carnegie Research Institutions

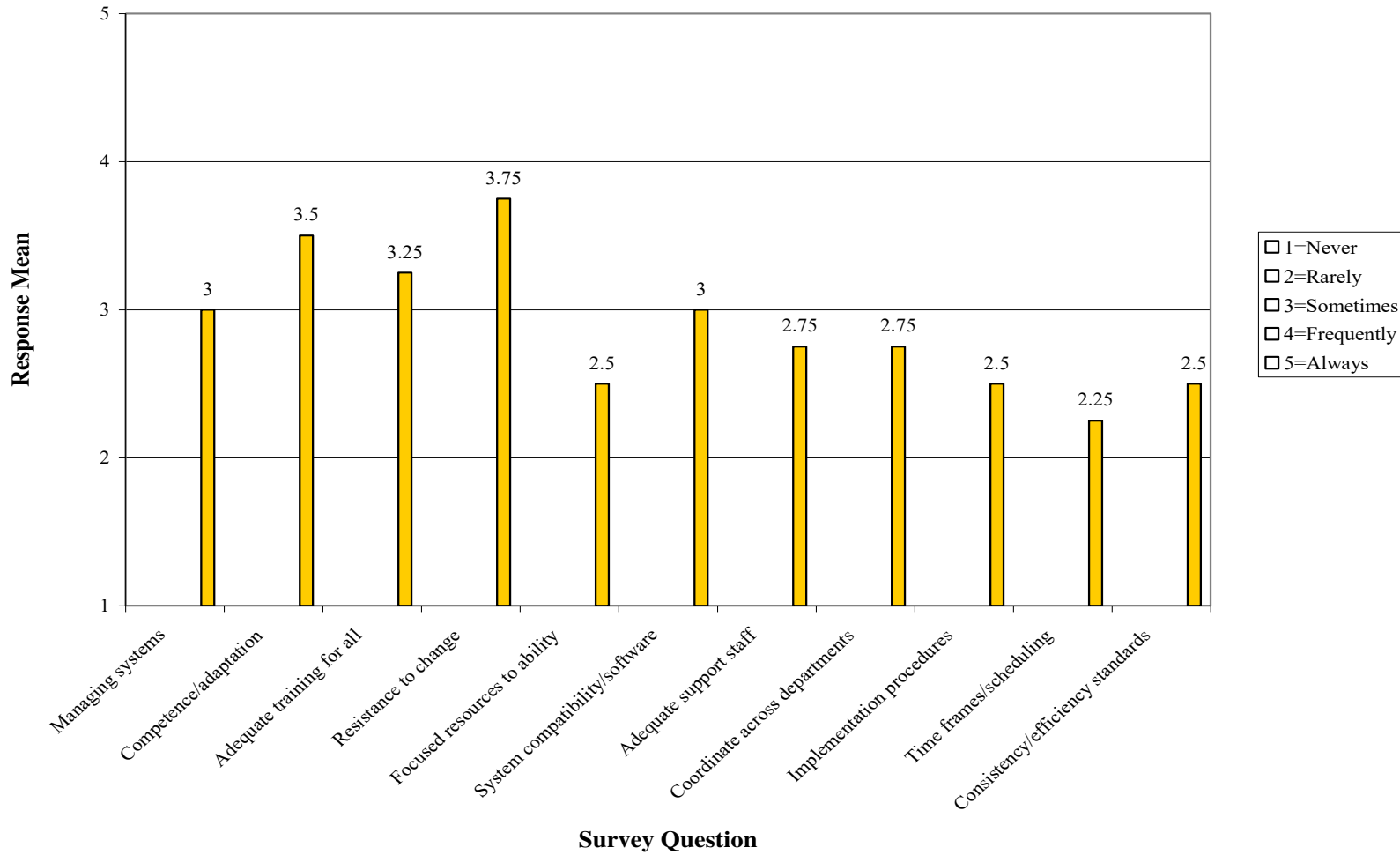


Figure 68: Implementation Responses Mean—Carnegie Research Institutions

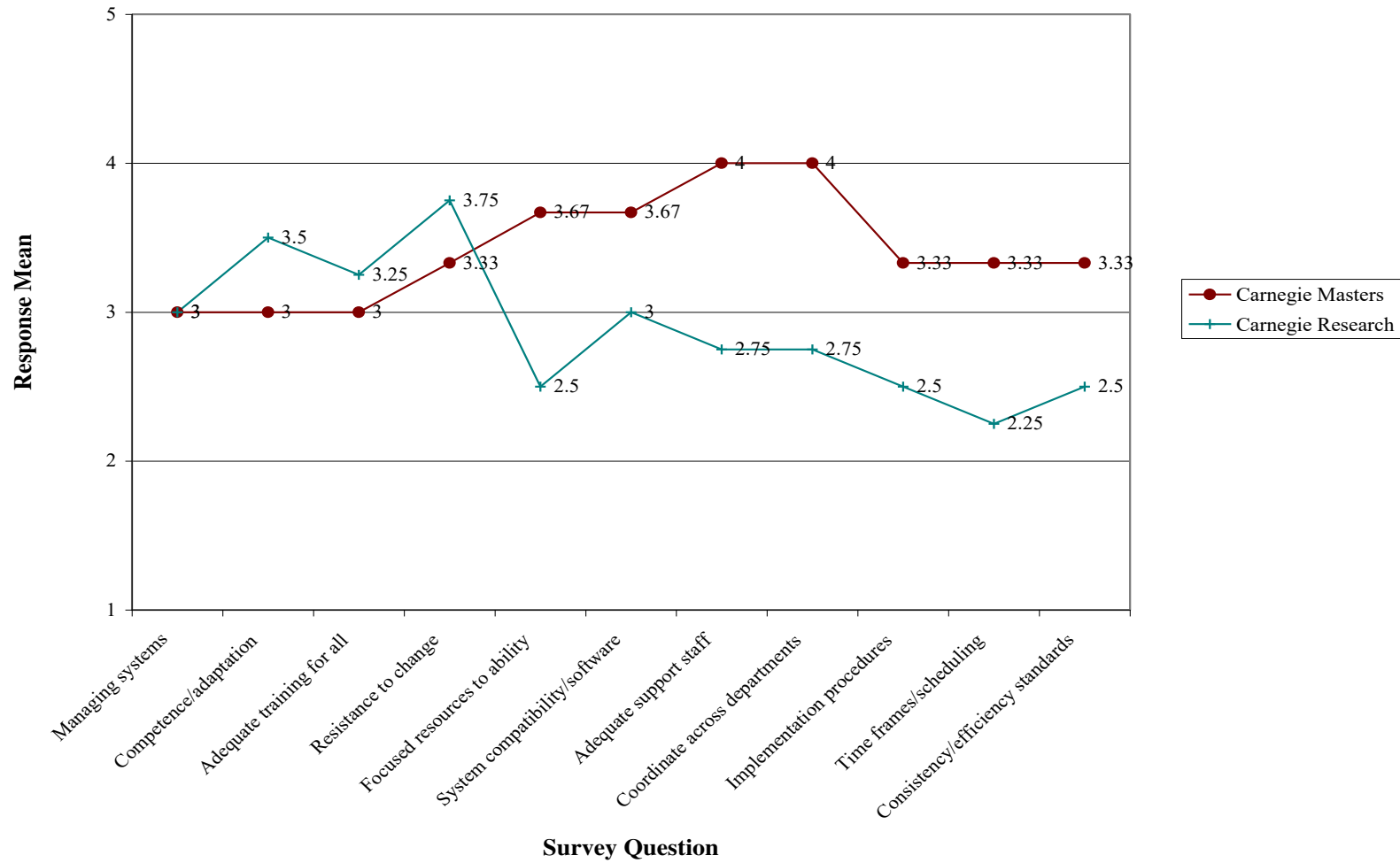


Figure 69: Implementation Responses Mean Comparison—Carnegie Master’s and Research Institutions

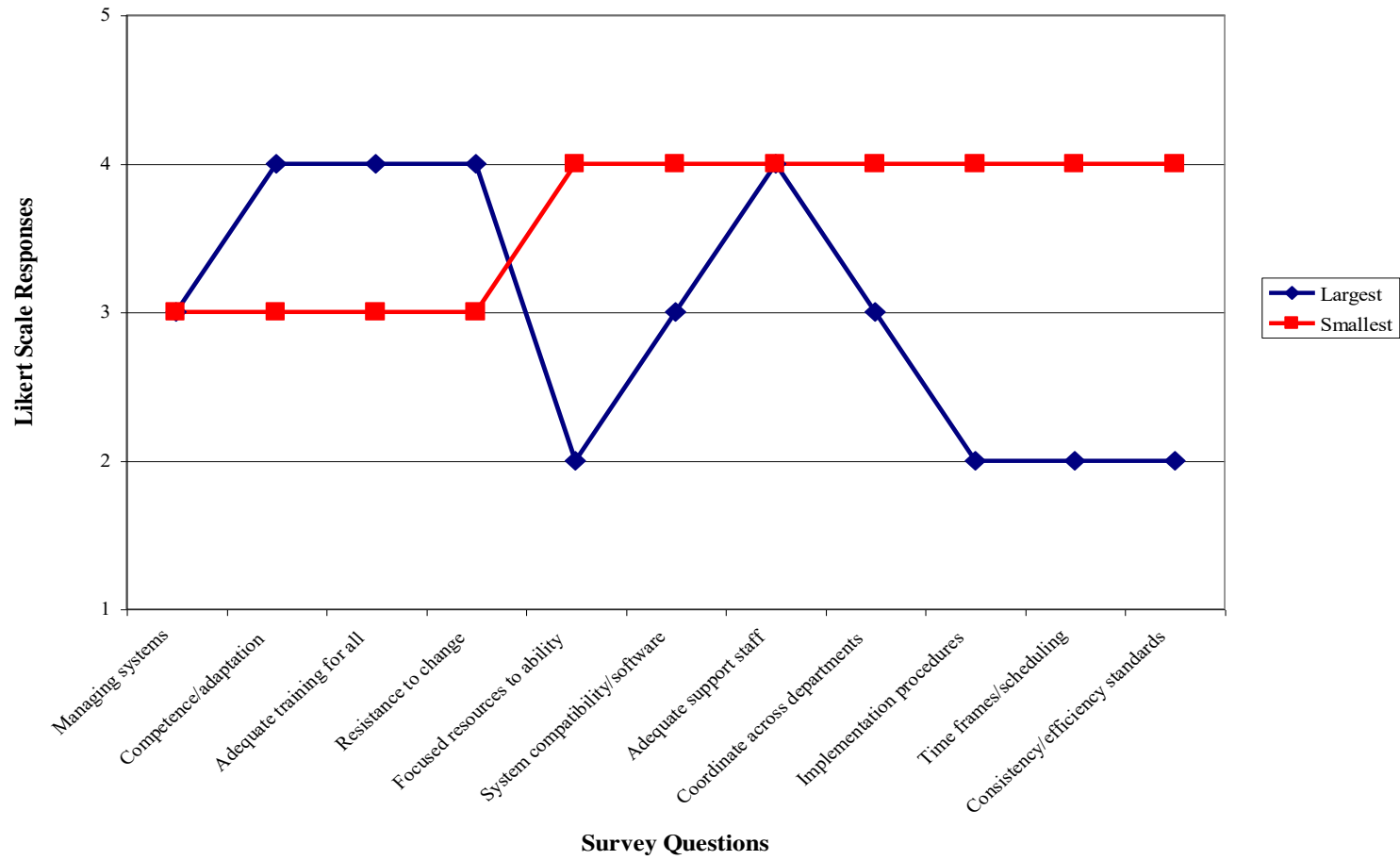


Figure 70: Implementation Comparison—Largest Institution (by enrollment)/Smallest Institution (by enrollment)

Research Question 3

Data for Research Question 3, “What are the challenges and opportunities associated with the diffusion of innovative educational technologies by Florida’s SUS institutions?” were captured on the Survey by the respondents inputting Likert scaled responses to statements 3.1 through 3.11. In addition, question 4.3 was posed in the SOLUTIONS section of the Survey and the data collected here was used as part of the analysis of Research Question 3. Statements 3.1 through 3.11 were areas of Research Question 3 which asked, “When considering DIFFUSION of new educational technologies, how PROBLEMATIC is each of the following (areas)?”

Statement 3.1

Diffusion statement 3.1 asked if there were problems in perceiving benefits (e.g., ease of use/usefulness) when adopting educational technology solutions. Two respondents (29%) rated it rarely problematic, four (57%) rated it sometimes problematic, and one (14%) rated it frequently problematic (Figure 71). The mean of 2.86 meant it was rarely problematic, but it bordered on sometimes problematic.

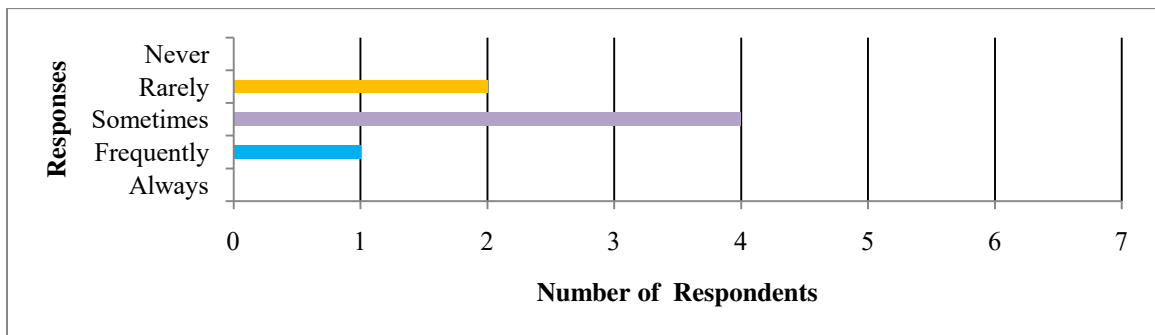


Figure 71: Diffusion Statement 3.1—Perceived Benefits

Three respondents (100%) from Carnegie Master’s institutions rated statement 3.1 sometimes problematic. The mean of 3.0 demonstrated when respondents considered the perception of benefits, it was sometimes problematic. Two respondents (50%) from Carnegie Research institutions rated statement 3.1 rarely problematic, one (25%) rated it sometimes problematic, and one (25%) rated it frequently problematic (Figure 72). The mean 2.75 demonstrated this diffusion statement was rarely problematic, but bordered on sometimes problematic.

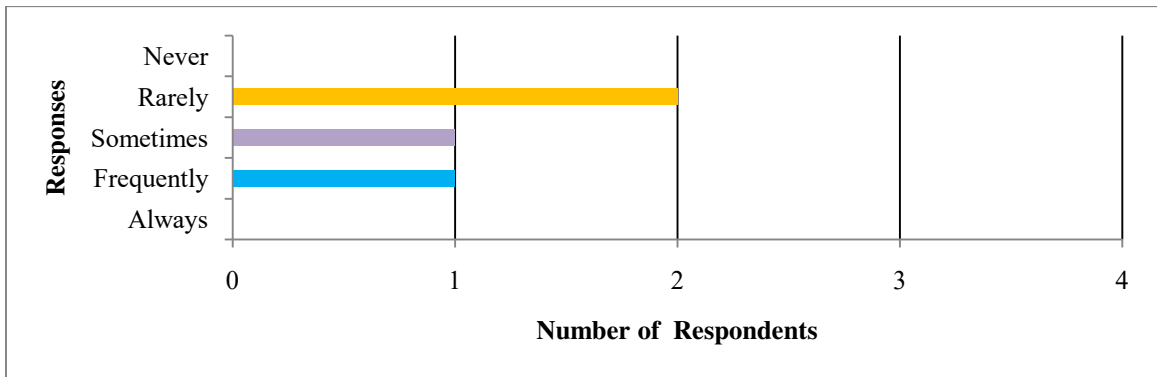


Figure 72: Diffusion Statement 3.1—Carnegie Research Institution Responses

Master’s institutions indicated this was sometimes (3.0) problematic, and Research institutions stated it was also sometimes (2.75) problematic. The respondent at the institution with the lowest enrollment stated it was sometimes problematic, while the respondent at the institution with the largest enrollment found it rarely problematic.

Statement 3.2

Statement 3.2 asked how problematic the levels of the interactions of other processes were when adopting educational technology solutions for diffusion in the

institution. One respondent (14%) rated it rarely problematic, four (57%) rated it sometimes problematic, and two (29%) rated it frequently problematic (Figure 73). The mean of 3.14 for all respondents, meant interactions of processes was sometimes problematic.

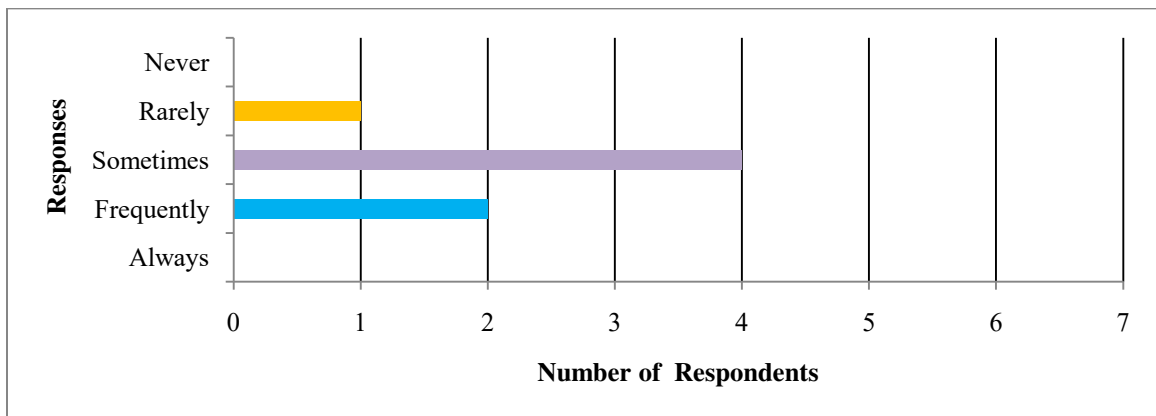


Figure 73: Diffusion Statement 3.2—Interactions with Other Processes

Two respondents (66%) from Carnegie Master’s institutions rated statement 3.2 sometimes problematic and one (34%) respondent rated it frequently problematic (Figure 74). The mean of 3.33 demonstrated that when respondents from these institutions considered levels of interactions of other processes when adopting educational technologies during diffusion, it was sometimes problematic.

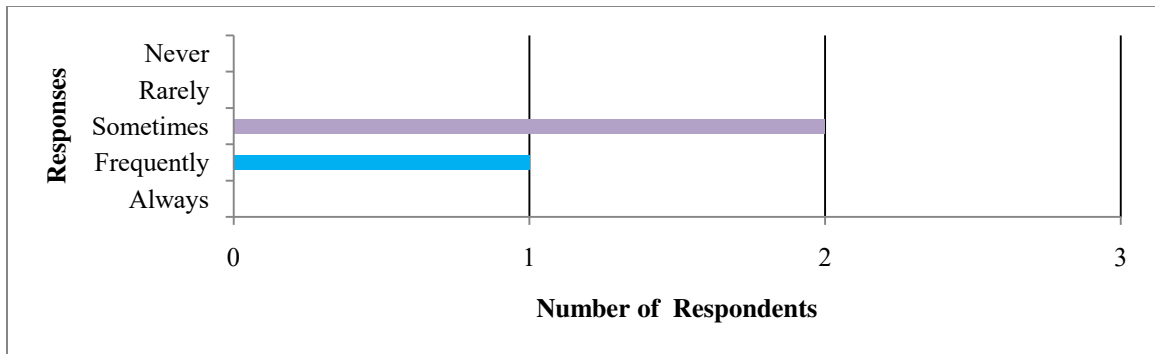


Figure 74: Diffusion Statement 3.2—Carnegie Master's Institution Responses

One respondent (25%) from a Carnegie Research institutions rated statement 3.2 rarely problematic, two (50%) rated it sometimes problematic, and one (25%) rated it frequently problematic (Figure 75). The mean of 3.0 demonstrated this diffusion statement was sometimes problematic.

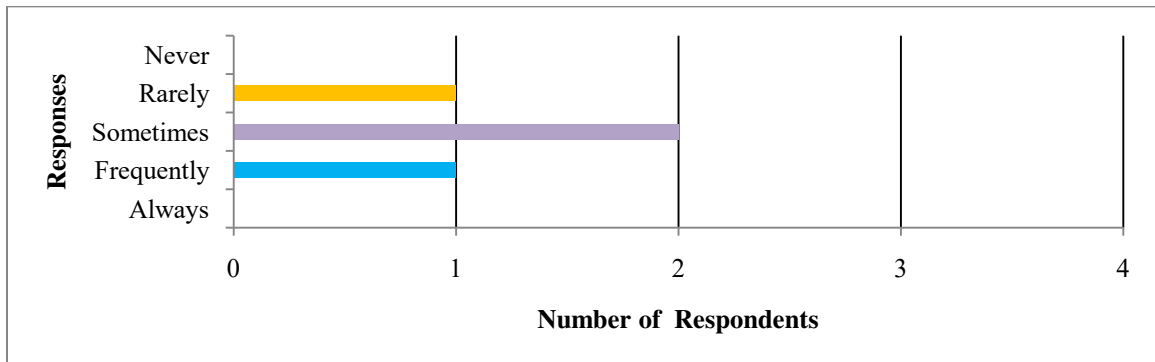


Figure 75: Diffusion Statement 3.2—Carnegie Research Institution Responses

Master’s institutions indicated this was sometimes (3.33) a problem, while Research institutions stated it was sometimes (3.0) problematic. The respondent at the institution with the lowest enrollment stated it was sometimes problematic, while the respondent at the institution with the largest enrollment found it frequently problematic.

Statement 3.3

Diffusion statement 3.3 asked to what degree the time consumed to adopt and diffuse educational technology solutions in the respondent's institution was problematic. Four respondents (57%) rated it sometimes problematic, and three (43%) rated it frequently problematic (Figure 76). The mean of 3.43 for all respondents meant this diffusion statement was sometimes problematic.

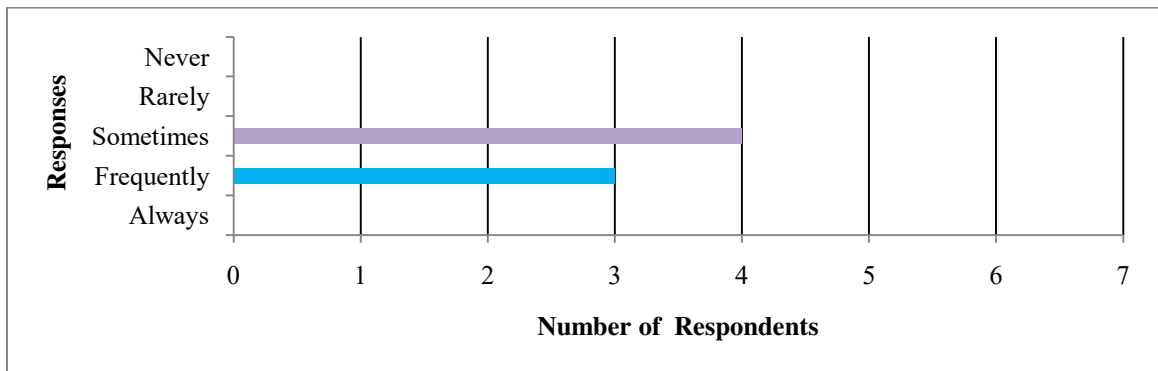


Figure 76: Diffusion Statement 3.3—Time Necessary to Adopt a Technology

Two respondents (66%) from Carnegie Master's institutions rated statement 3.3 sometimes problematic and one respondent (34%) rated it frequently problematic (Figure 77). The mean of 3.33 demonstrated that when respondents from these institutions considered the problem of the time consumed to adopt and diffuse educational technology solutions, it was sometimes problematic.

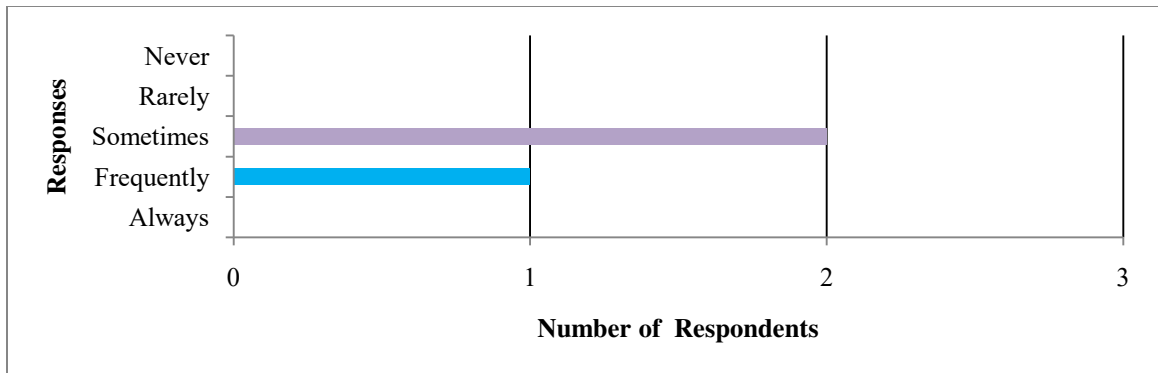


Figure 77: Diffusion Statement 3.3—Carnegie Master's Institution Responses

Two respondents (50%) from Carnegie Research institutions rated statement 3.3 sometimes problematic, and two (50%) rated it frequently problematic (Figure 78). The mean of 3.5 demonstrated this diffusion statement was sometimes problematic.

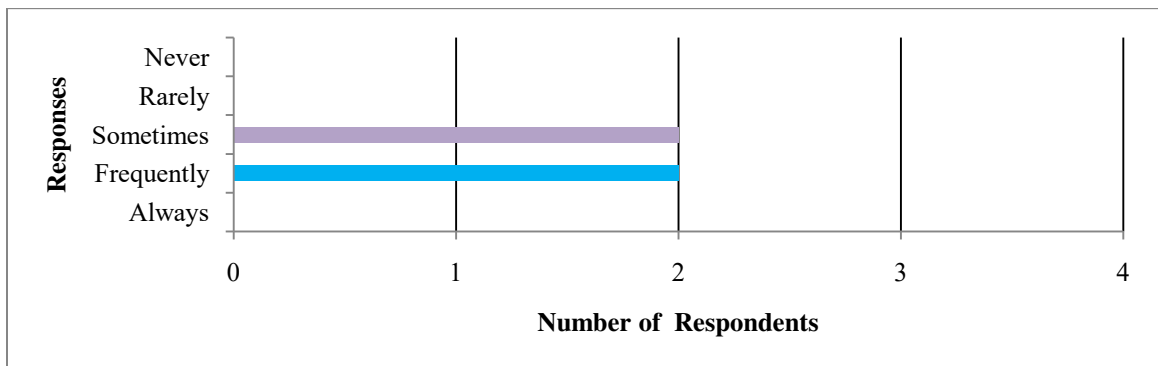


Figure 78: Diffusion Statement 3.3—Carnegie Research Institution Responses

Master's institutions indicated this was sometimes (3.33) problematic, while Research institutions stated it was frequently (3.5) problematic. The respondent at the institution with the lowest enrollment stated it was frequently problematic, as did the respondent at the institution with the largest enrollment.

Statement 3.4

Statement 3.4 asked if security problems associated with diffusing educational technologies solutions were problematic. Two respondents (29%) rated it rarely problematic, four (57%) rated it sometimes problematic, and one (14%) rated it frequently problematic (Figure 56). The mean of 2.86 indicated that it was rarely problematic, but bordered on sometimes problematic.

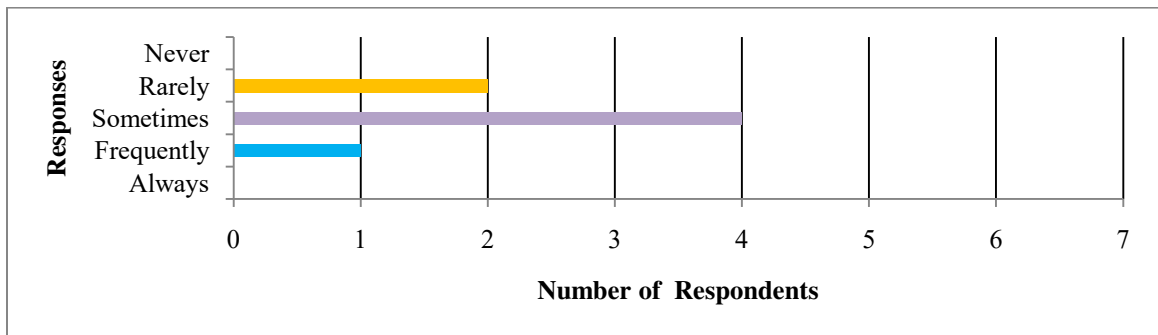


Figure 79: Diffusion Statement 3.4—Security Problems

Three respondents (100%) from Carnegie Master’s institutions rated statement 3.4 sometimes problematic. The mean of 3.0 demonstrated that when respondents from these institutions considered security issues associated with diffusing educational technology solutions, they were sometimes problematic. Two respondents (50%) from Carnegie Research institutions rated statement 3.4 rarely problematic, one (25%) rated it sometimes problematic, and one (25%) rated it frequently problematic (Figure 80). The mean of 2.75 demonstrated that this diffusion statement was rarely problematic, but bordered on sometimes problematic.

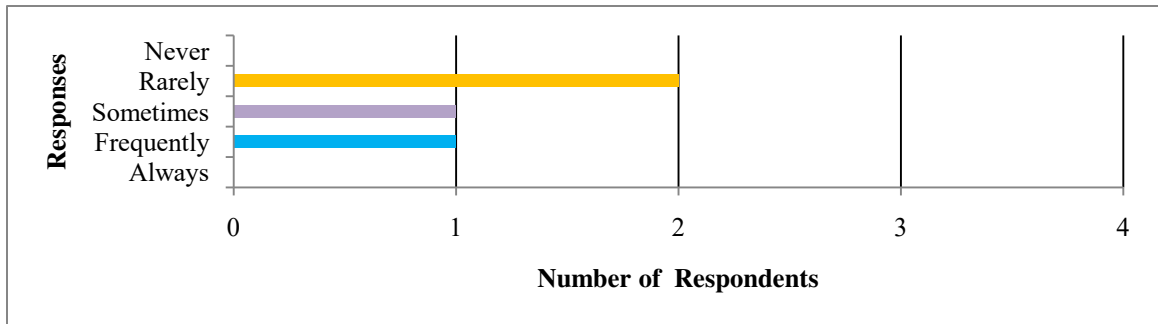


Figure 80: Diffusion Statement 3.4—Carnegie Research Institution Responses

Master’s institutions indicated this was sometimes (3.0) problematic, as did Research institutions (2.75). The respondent at the institution with the lowest enrollment stated it was sometimes problematic and the respondent at the institution with the largest enrollment indicated it was frequently problematic.

Statement 3.5

Diffusion statement 3.5 asked if it was problematic for management to participate in adopting educational technology solution. Three respondents (43%) rated it rarely problematic and four (57%) rated it as sometimes problematic (Figure 81). The mean of 2.57 meant management participation was rarely problematic.

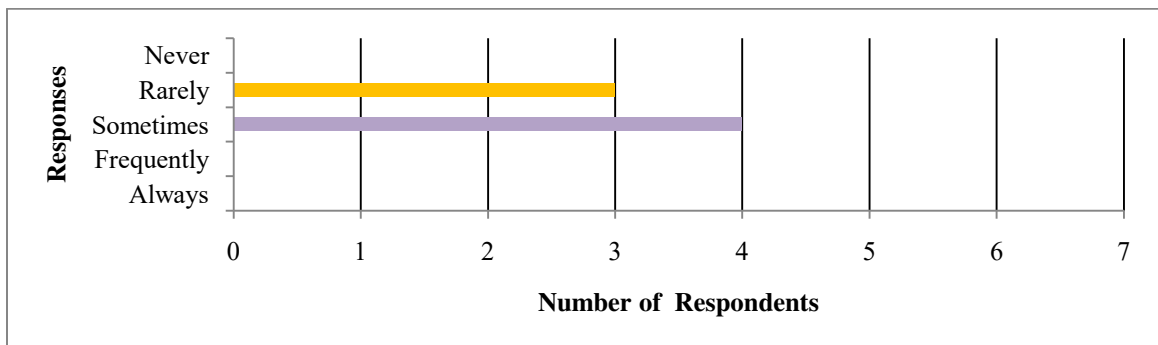


Figure 81: Diffusion Statement 3.5—Management Involvement

Three respondents (100%) from Carnegie Master’s institutions rated statement 3.5 sometimes problematic. The mean of 3.0 demonstrated that when respondents from these institutions considered the problem of management’s participation in adopting the diffusion portion of educational technology solutions, it was sometimes problematic. Three respondents (75%) from Carnegie Research institutions rated statement 3.5 rarely problematic and one (25%) rated it sometimes problematic (Figure 82). The mean of 2.25 demonstrated that this diffusion statement was rarely problematic.

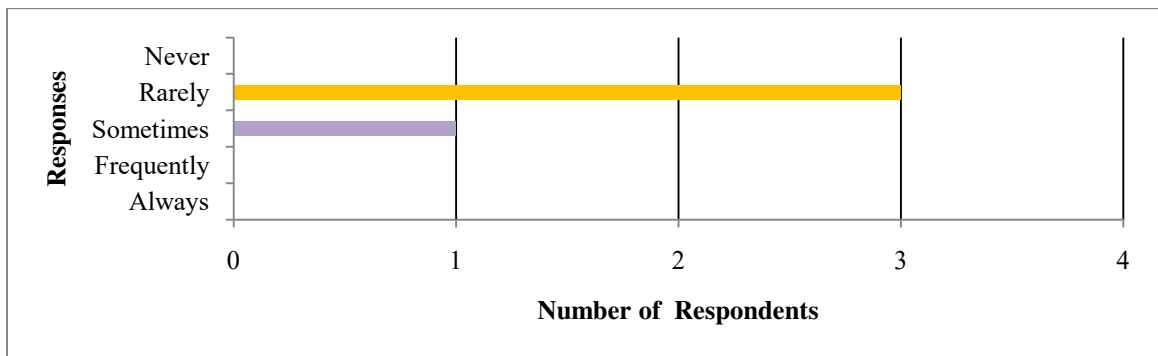


Figure 82: Diffusion Statement 3.5—Carnegie Research Institution Responses

Master’s institutions indicated this was sometimes (3.0) problematic, while Research institutions stated it was rarely (2.25) problematic. The respondent at the institution with the lowest enrollment stated it was sometimes problematic, and the respondent at the institution with the largest enrollment indicated it was rarely problematic.

Statement 3.6

Diffusion statement 3.6 asked if the attitude of end users, when asked to change the way their work was to be completed, was problematic. One respondent (14%) rated it rarely problematic, one (14%) rated it sometimes problematic, and five (71%) rated it frequently problematic (Figure 83). The mean of 3.57 for all respondents meant the attitude of end users was sometimes problematic.

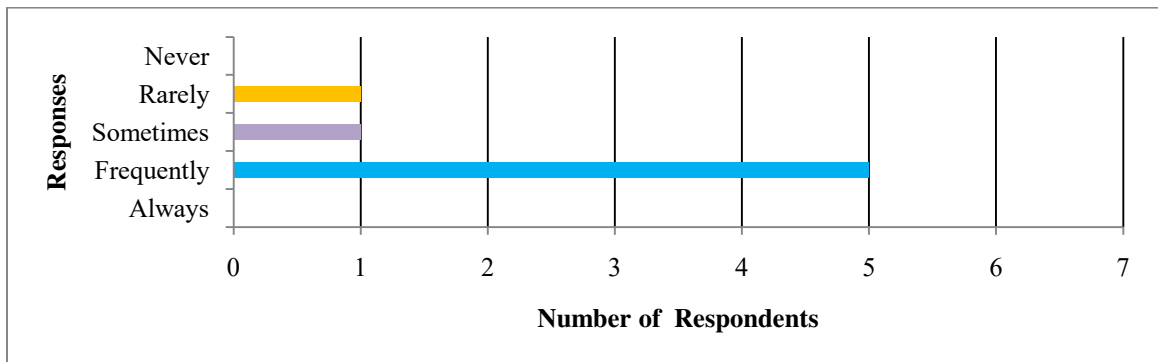


Figure 83: Diffusion Statement 3.6—Attitude of End Users

One respondent (34%) from a Carnegie Master's institution rated statement 3.6 sometimes problematic and two respondents (66%) rated it frequently problematic (Figure 84). The mean of 3.67 demonstrated that when respondents from these institutions considered the attitudes of end users asked to change their work was to be completed, it was sometimes problematic, but bordered on frequently problematic.

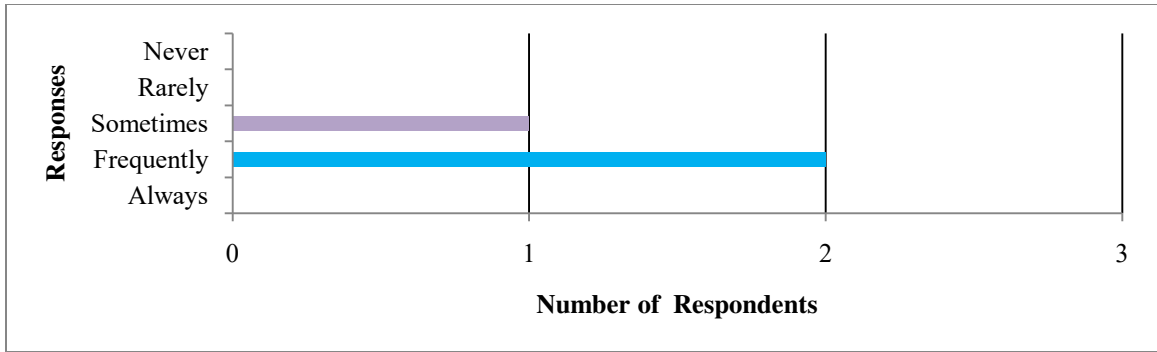


Figure 84: Diffusion Statement 3.6—Carnegie Master's Institution Responses

One respondent (25%) from a Carnegie Research institution rated statement 3.6 rarely problematic and three (75%) rated it frequently problematic (Figure 85). The mean of 3.5 demonstrated this diffusion statement was sometimes problematic.

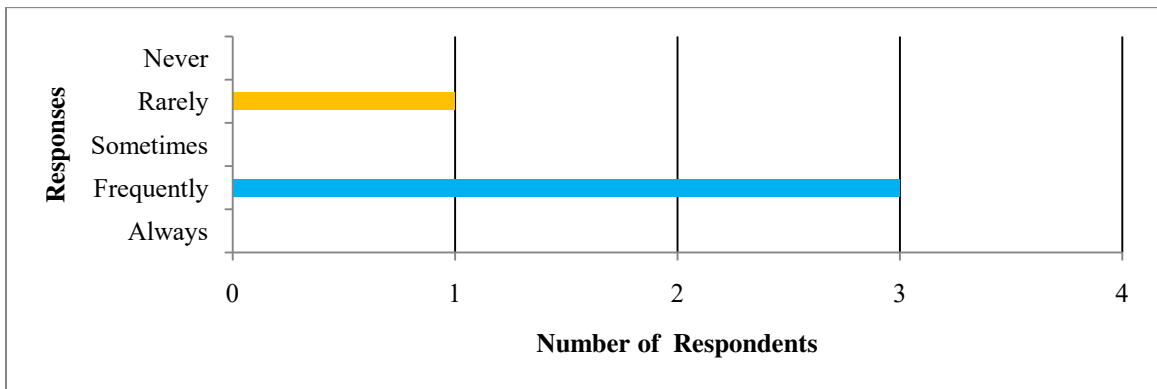


Figure 85: Diffusion Statement 3.6—Carnegie Research Institution Responses

Master's institutions indicated this was frequently (3.67) problematic, while Research institutions stated it was frequently (3.5) problematic. The respondent at the institution with the lowest enrollment stated it was sometimes problematic, and the respondent at the institution with the largest enrollment indicated it was frequently problematic.

Statement 3.7

Statement 3.7 asked if there were problems regarding the effort it took to master the tasks required to use educational technology solutions during the diffusion stage. One respondent (14%) rated it rarely problematic, three (43%) rated it sometimes problematic, and three (43%) rated it frequently problematic (Figure 86). The mean response for this statement was 3.29 which meant the effort it took to master tasks was sometimes problematic.

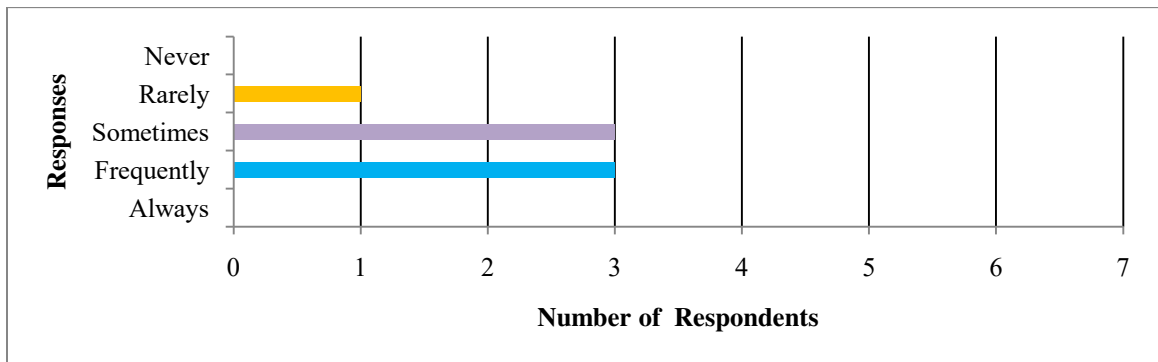


Figure 86: Diffusion Statement 3.7—Mastery of Tasks by Users

Two respondents (66%) from Carnegie Master’s institutions rated statement 3.7 sometimes problematic and one respondent (34%) rated it frequently problematic (Figure 87). The mean of 3.33 demonstrated that when respondents from these institutions considered the problem of efforts to master the task required to use educational technologies during the diffusion stage, it was sometimes problematic.

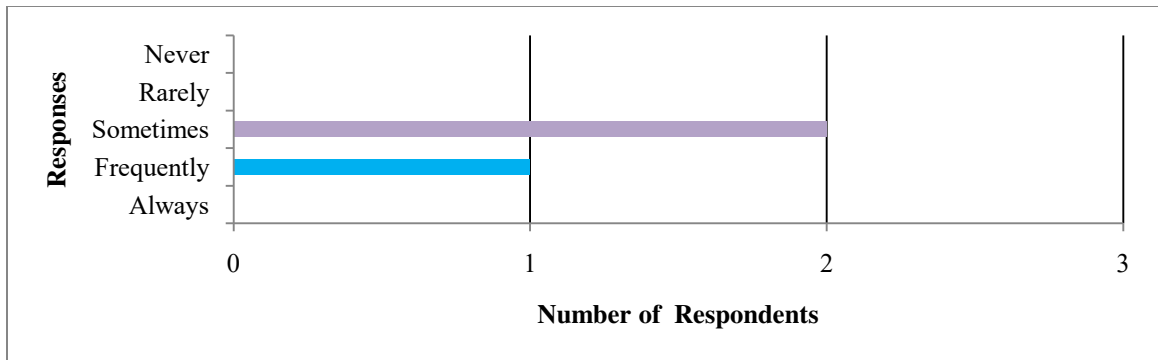


Figure 87: Diffusion Statement 3.7—Carnegie Master's Institution Responses

One respondent (25%) from a Carnegie Research institution rated statement 3.7 rarely problematic, one (25%) rated it sometimes problematic, and two (50%) rated it frequently problematic (Figure 88). The mean of 3.25 demonstrated this diffusion statement was sometimes problematic.

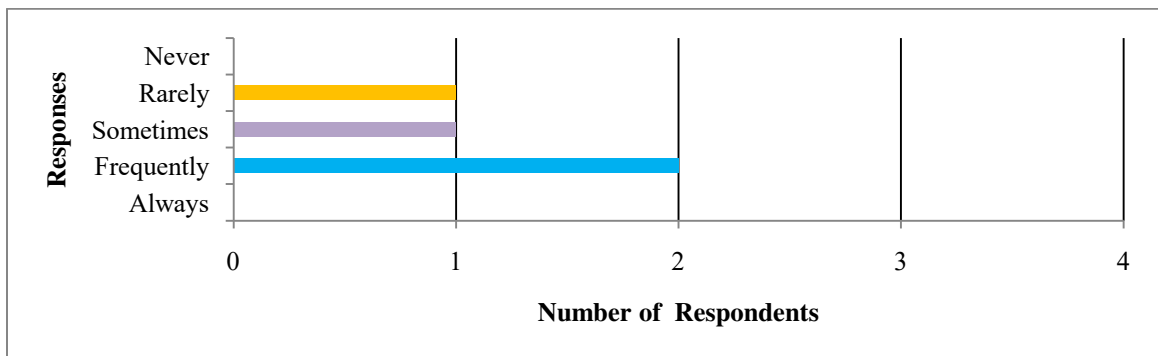


Figure 88: Diffusion Statement 3.7—Carnegie Research Institution Responses

Master's institutions indicated this was sometimes (3.33) problematic, and Research institutions stated it was sometimes (3.25) a problem. The respondent at the institution with the lowest enrollment stated it was sometimes problematic, and the

respondent at the institution with the largest enrollment indicated it was frequently problematic.

Statement 3.8

Diffusion statement 3.8 asked if there were problems in the successful diffusion of a previous educational technology that was adopted by the respondent's institution. Two respondents (29%) rated it rarely problematic, four (57%) rated it sometimes problematic, and one (14%) rated it frequently problematic (Figure 89). The mean of 2.86 meant overall the success of a previous technology adoption was rarely problematic.

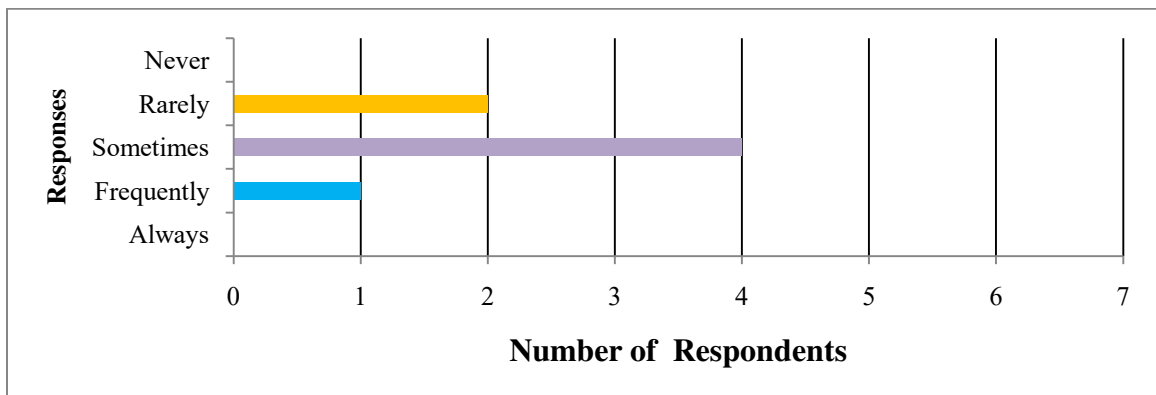


Figure 89: Diffusion Statement 3.8—Diffusion of Previous Technology

All three respondents (100%) from Carnegie Master's institutions rated diffusion statement 3.8 sometimes problematic. The mean of 3.0 demonstrated that when respondents from these institutions considered the problem of diffusing a previous educational technology, it was sometimes problematic. Two respondents (50%) from Carnegie Research institutions rated statement 3.8 rarely problematic, one (25%) rated it

sometimes problematic, and one (25%) rated it frequently problematic (Figure 90). The mean of 2.75 demonstrated this diffusion statement was rarely problematic, but bordered on sometimes problematic.

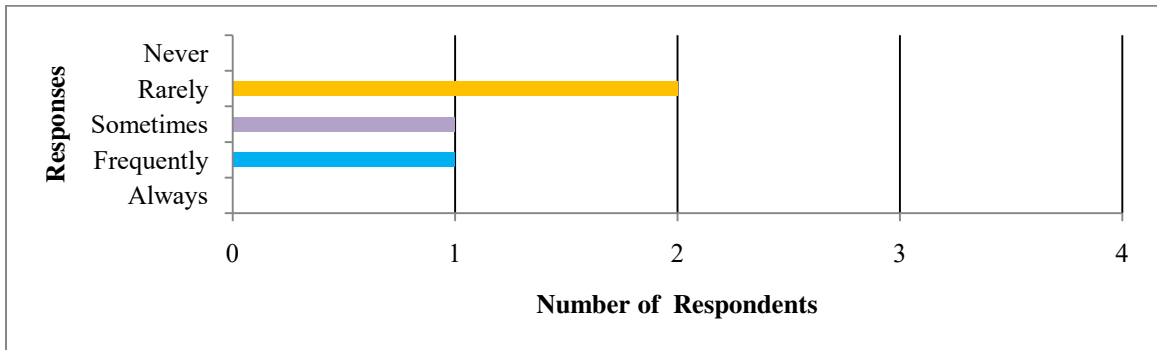


Figure 90: Diffusion Statement 3.8—Carnegie Research Institution Responses

Master’s institutions indicated this was sometimes (3.0) problematic, and Research institutions stated it was sometimes (2.75) problematic. The respondent at the institution with the lowest enrollment stated it was sometimes problematic, and the respondent at the institution with the largest enrollment indicated it was rarely problematic.

Statement 3.9

Diffusion statement 3.9 asked if the respondent’s institution’s willingness to accept high risk from untried educational technologies was problematic. One respondent (14%) rated it rarely problematic, two (29%) rated it sometimes problematic, three (43%)

rated it frequently problematic, and one (14%) rated it always problematic (Figure 91).

The mean of 3.57 meant this diffusion statement was sometimes problematic.

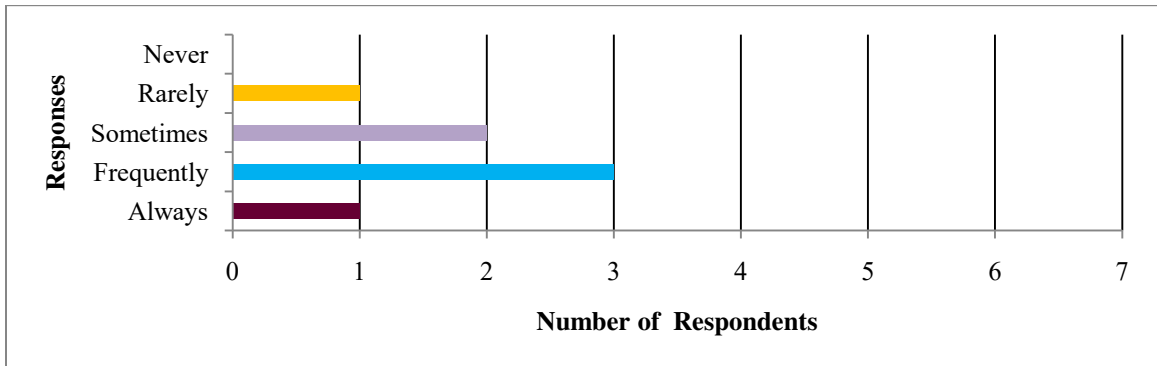


Figure 91: Diffusion Statement 3.9—Willingness to Accept Risk

One respondent (34%) from a Carnegie Master’s institutions rated statement 3.9 sometimes problematic and two respondents (66%) rated it frequently being problematic (Figure 92). The mean of 3.67 demonstrated that when respondents from these institutions considered the problem of the willingness to accept high risks from untried educational technologies, it was rated sometimes problematic, but bordered on frequently problematic.

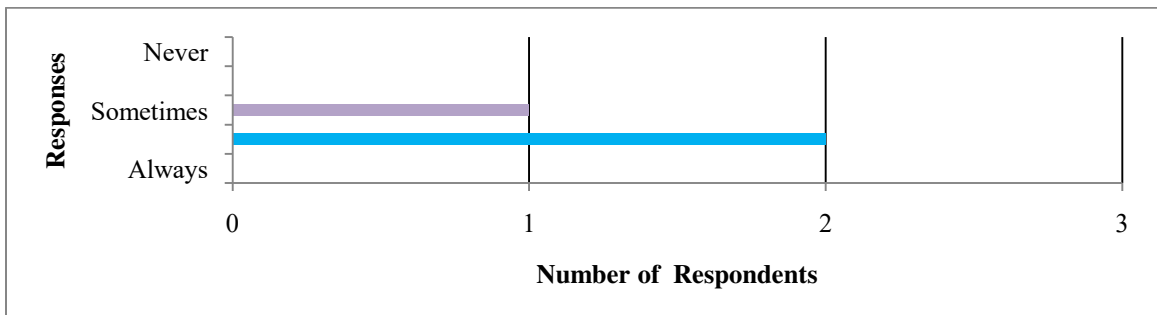


Figure 92: Diffusion Statement 3.9—Carnegie Master's Institution Responses

One respondent (25%) from Carnegie Research institutions rated statement 3.9 rarely problematic, one (25%) rated it sometimes problematic, one (25%) rated it frequently problematic, and one (25%) rated it always problematic (Figure 93). The mean of 3.5 demonstrated this diffusion statement was sometimes problematic.

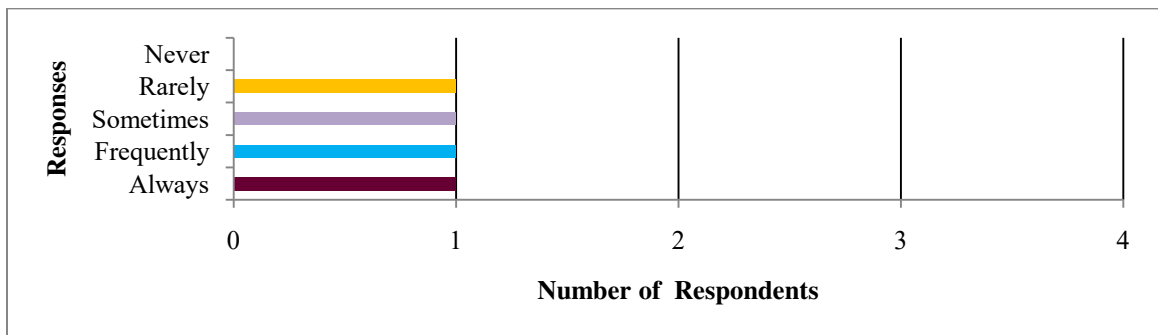


Figure 93: Diffusion Statement 3.9—Carnegie Research Institution Responses

Master’s institutions indicated this was frequently (3.67) problematic, while Research institutions stated it was also frequently (3.5) problematic. The respondent at the institution with the lowest enrollment stated it was frequently problematic, and the respondent at the institution with the largest enrollment indicated it was sometimes problematic.

Statement 3.10

Diffusion statement 3.10 asked if it was problematic to involve the faculty to the extent that they were aware of requirements and obstacles associated with educational technology solutions. Two respondents (29%) rated it rarely problematic, three (43%)

rated it sometimes problematic, and two (29%) rated it frequently problematic (Figure 94). The mean of 3.0 meant overall this diffusion concept was sometimes problematic.

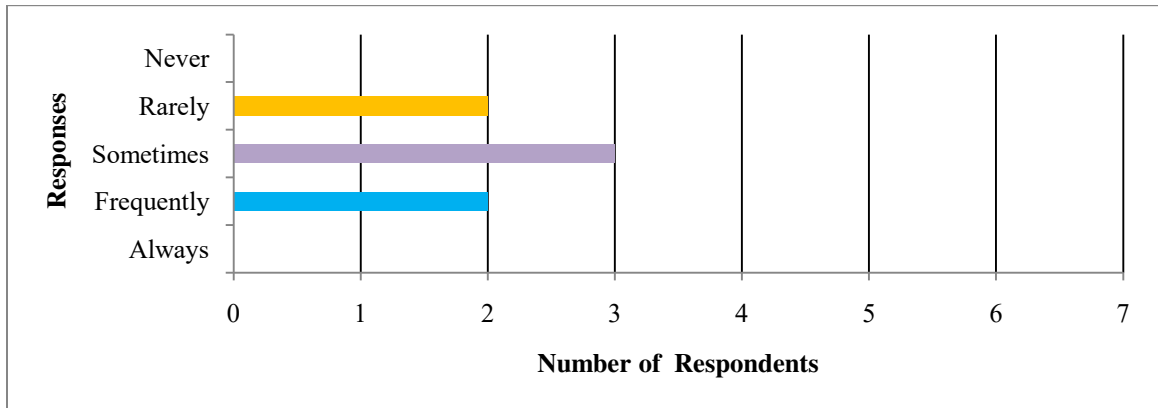


Figure 94: Diffusion Statement 3.10—Faculty Knowledge of Requirements/Obstacles

Two respondents (66%) from Carnegie Master’s institutions rated statement 3.10 sometimes problematic and one respondent (34%) rated it frequently problematic (Figure 95). The mean of 3.33 demonstrated that when respondents from these institutions considered the problem of faculty awareness, it was sometimes problematic.

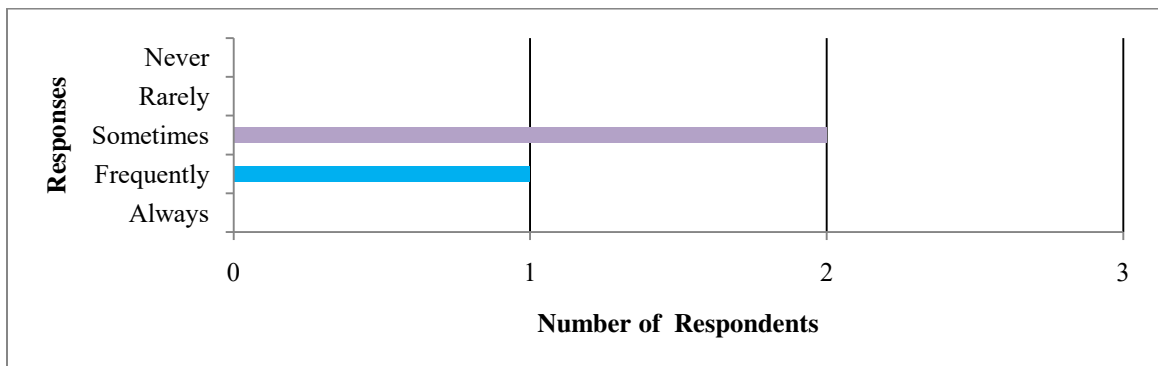


Figure 95: Diffusion Statement 3.10—Carnegie Master's Institution Responses

Two respondents (50%) from Carnegie Research institutions rated statement 3.10 rarely problematic, one (25%) rated it sometimes problematic, and one (25%) rated it frequently problematic (Figure 96). The mean of 2.75 demonstrated this diffusion statement concept was rarely problematic, but bordered on sometimes problematic.

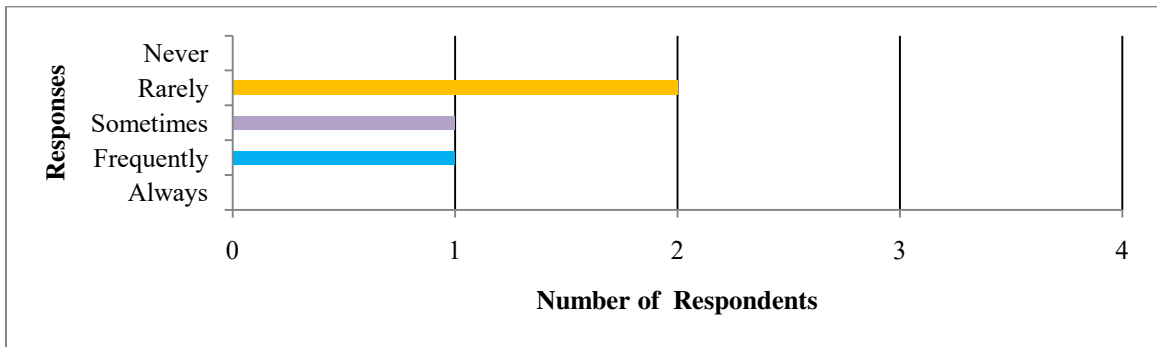


Figure 96: Diffusion Statement 3.10—Carnegie Research Institution Responses

Master’s institutions indicated this was sometimes (3.33) problematic, and Research institutions also stated it was sometimes (2.75) problematic. The respondent at the institution with the lowest enrollment stated it was sometimes problematic, while the respondent at the institution with the largest enrollment indicated it was rarely problematic.

Statement 3.11

Diffusion statement 3.11, an area where the respondent could write in specific problems when planning for educational technologies, was left blank by all seven respondents.

Diffusion Statement Summaries

Figures 97 through 104 graphically illustrate a total comparison of all the diffusion statements to include: response frequency for each diffusion statement, mean for each diffusion statement, Carnegie Master's and Research diffusion response frequencies, Carnegie Master's and Research diffusion response mean, Carnegie Master's and Research mean comparison, and smallest institution (by enrollment) and largest institution (by enrollment) diffusion response comparison.

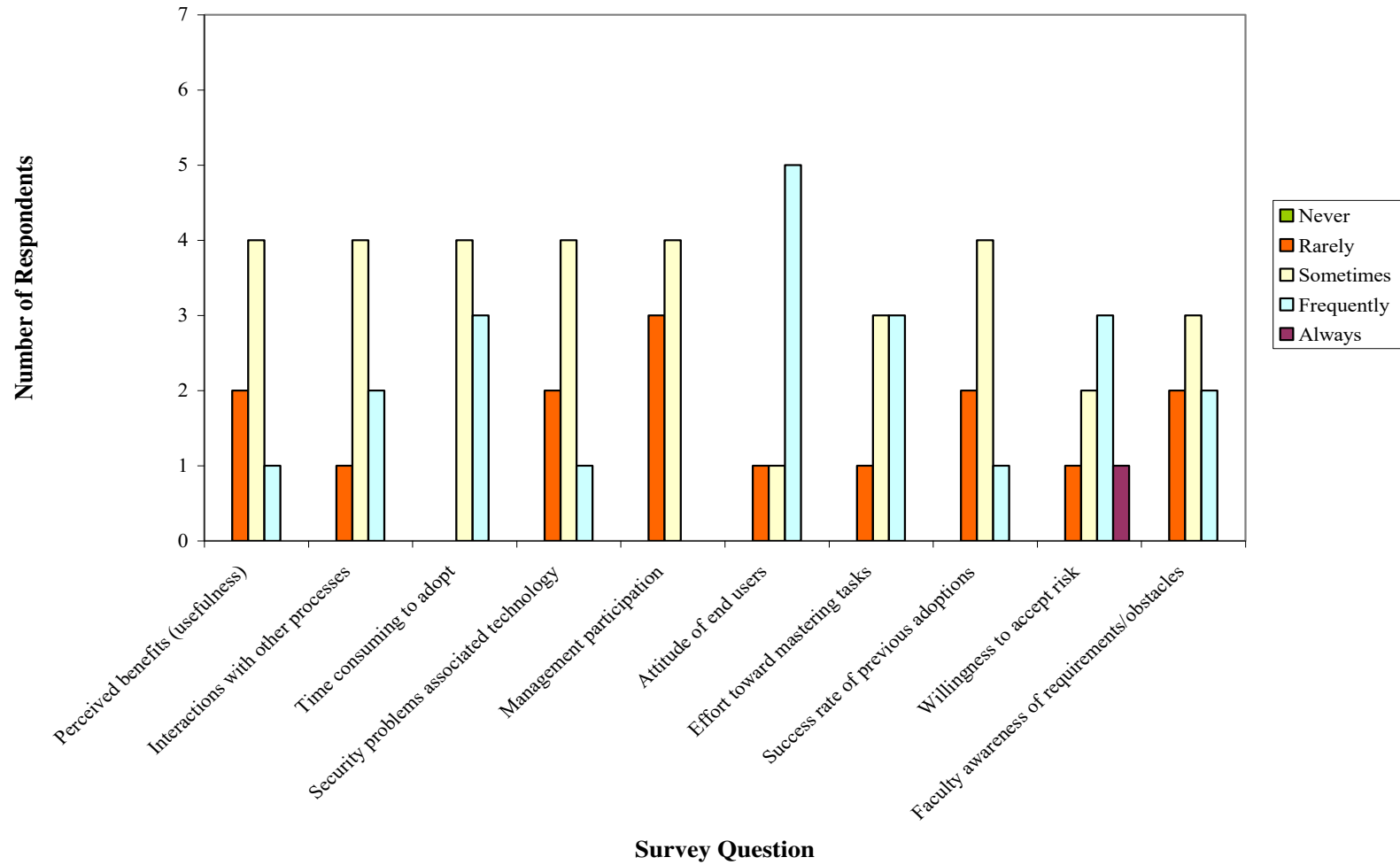


Figure 97: Diffusion Responses—Summary

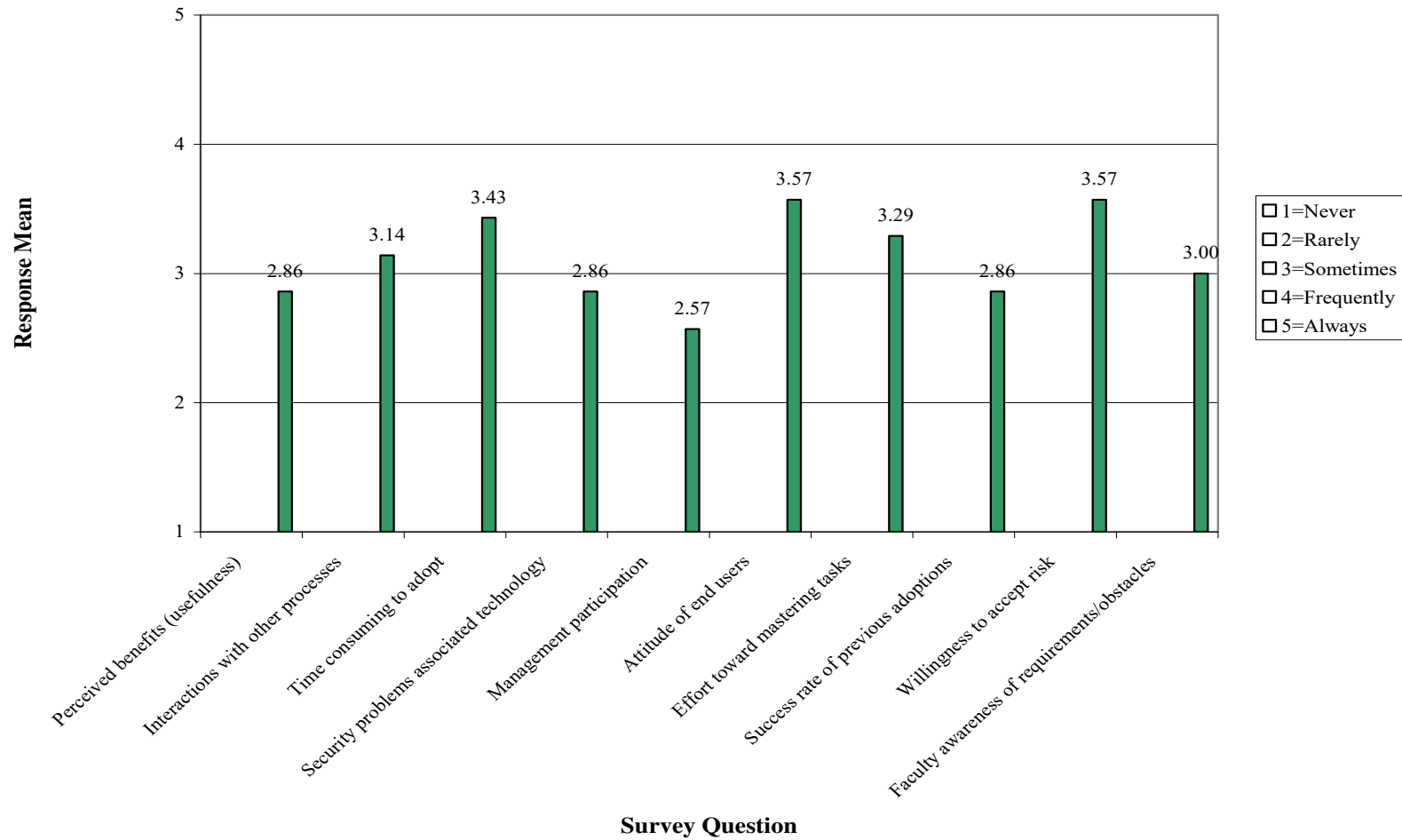


Figure 98: Diffusion Responses—Mean

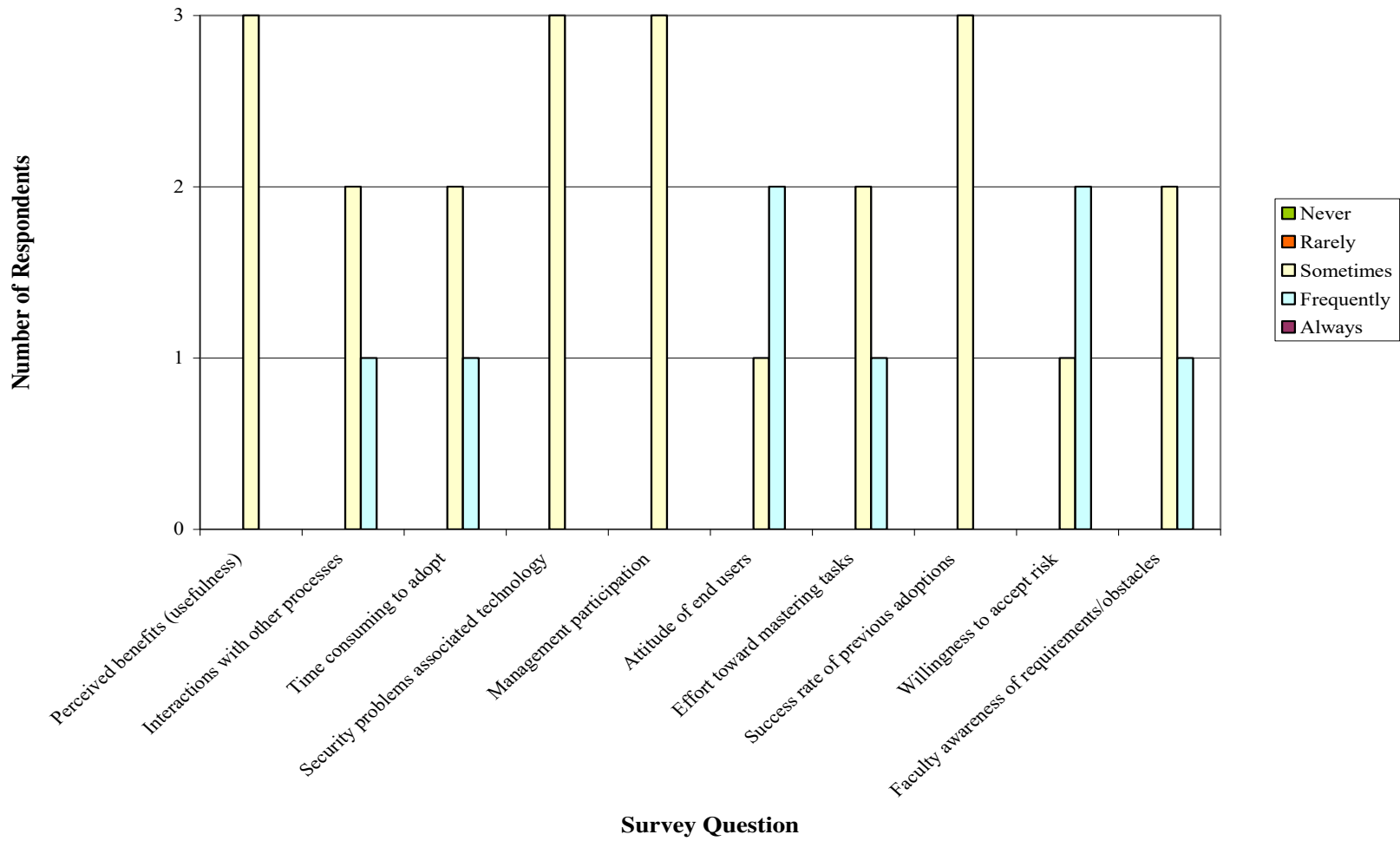


Figure 99: Diffusion Responses—Carnegie Master’s Institutions

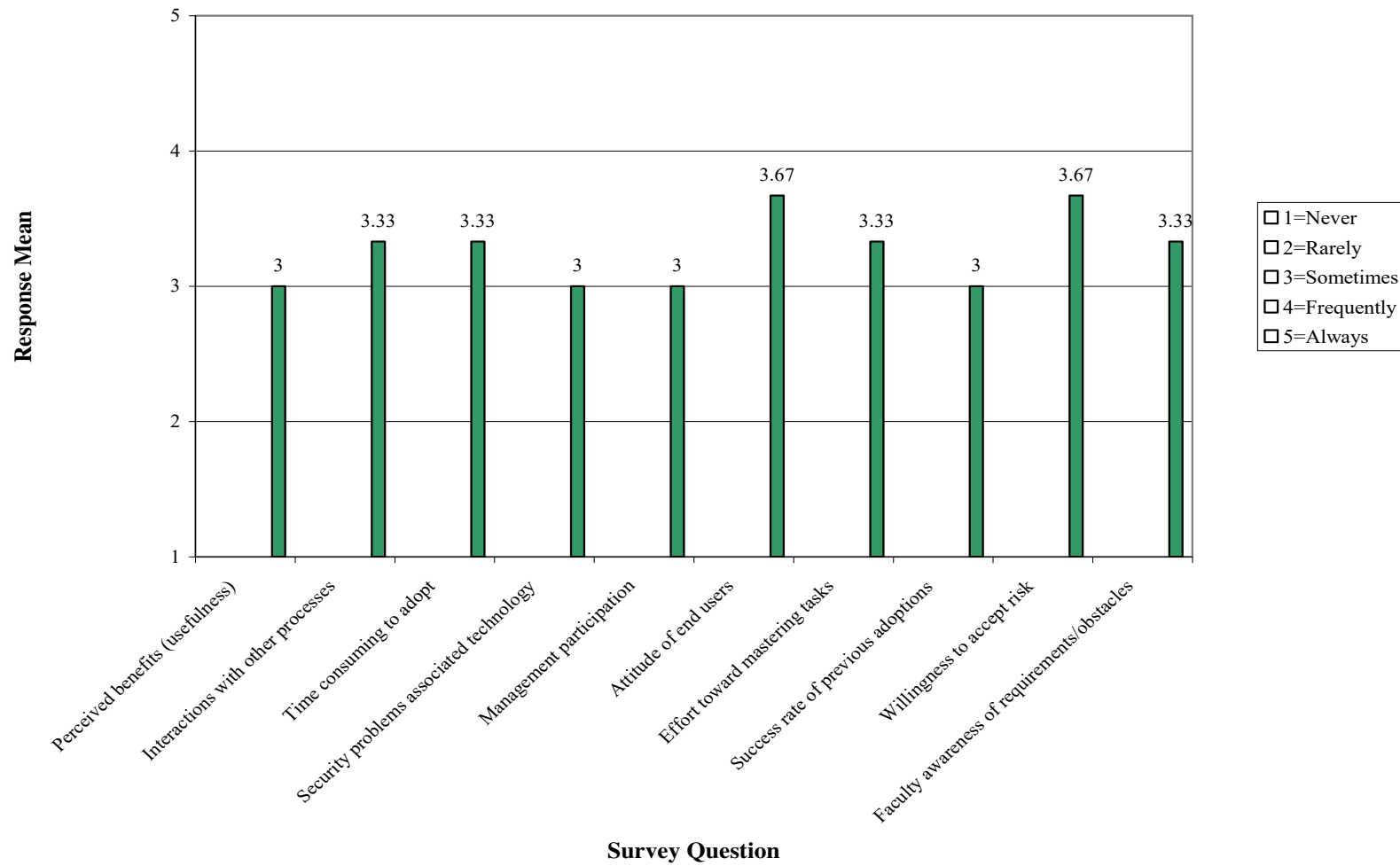


Figure 100: Diffusion Responses Mean—Carnegie Master’s Institutions

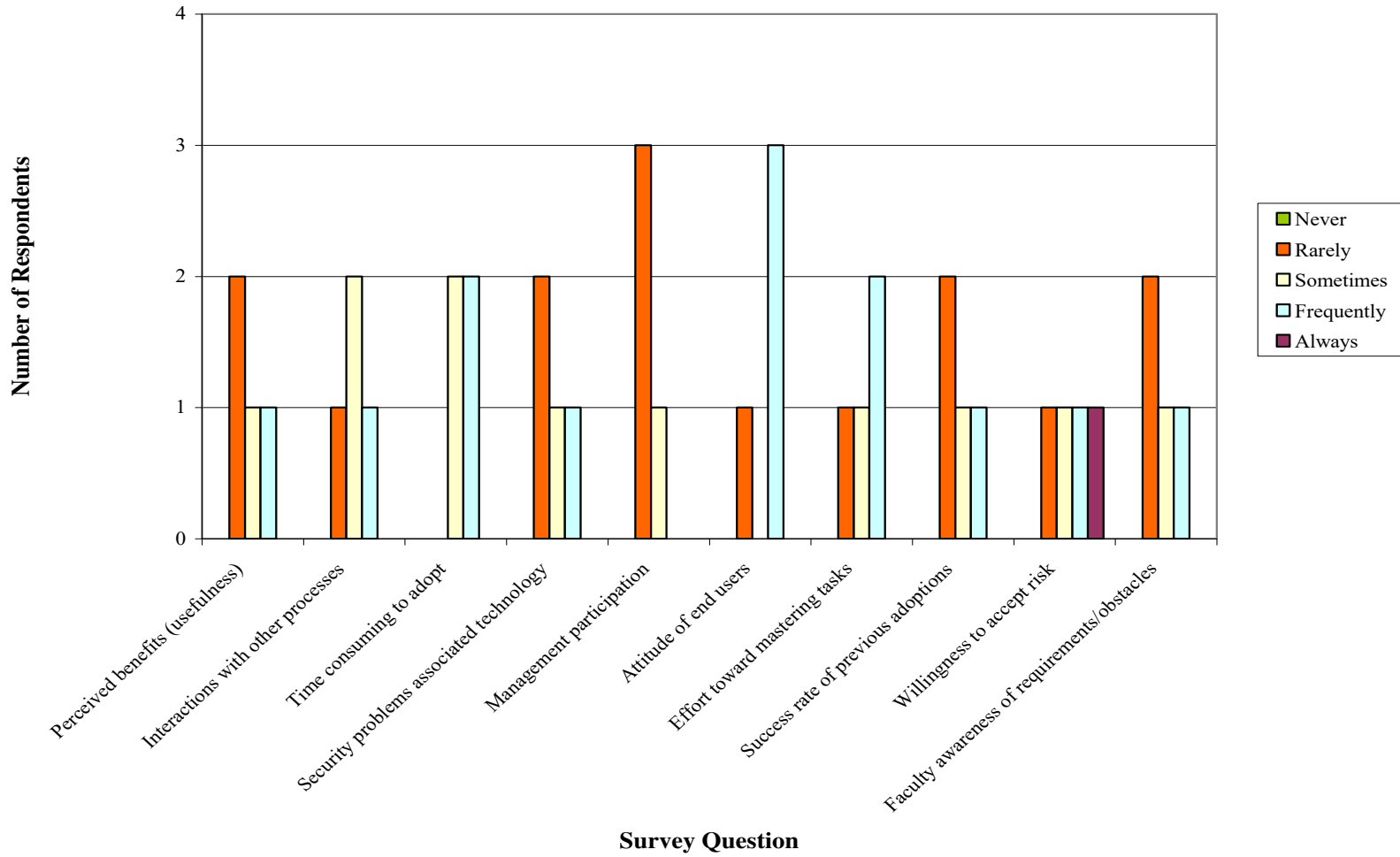


Figure 101: Diffusion Responses—Carnegie Research Institutions

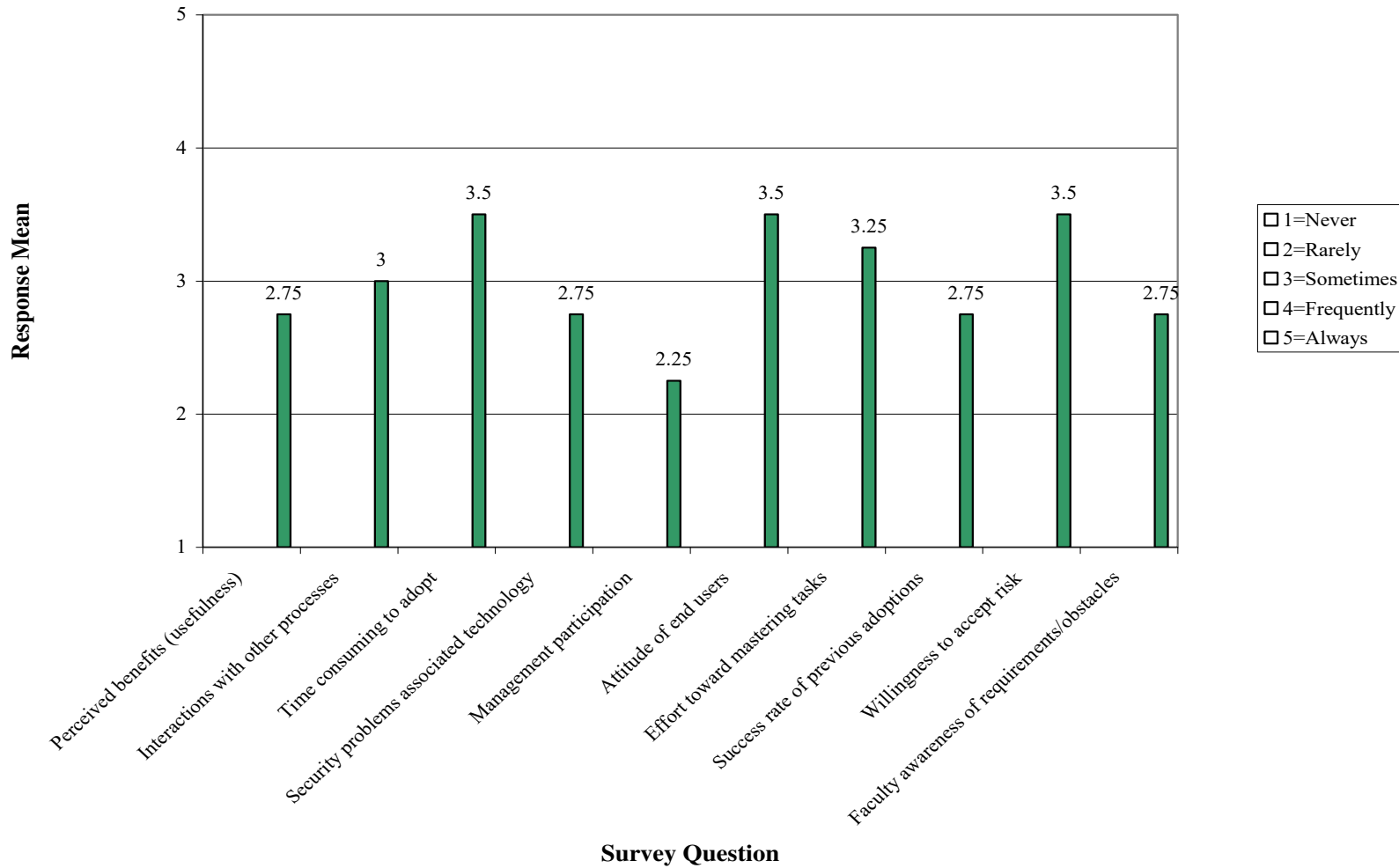


Figure 102: Diffusion Responses Mean—Carnegie Research Institutions

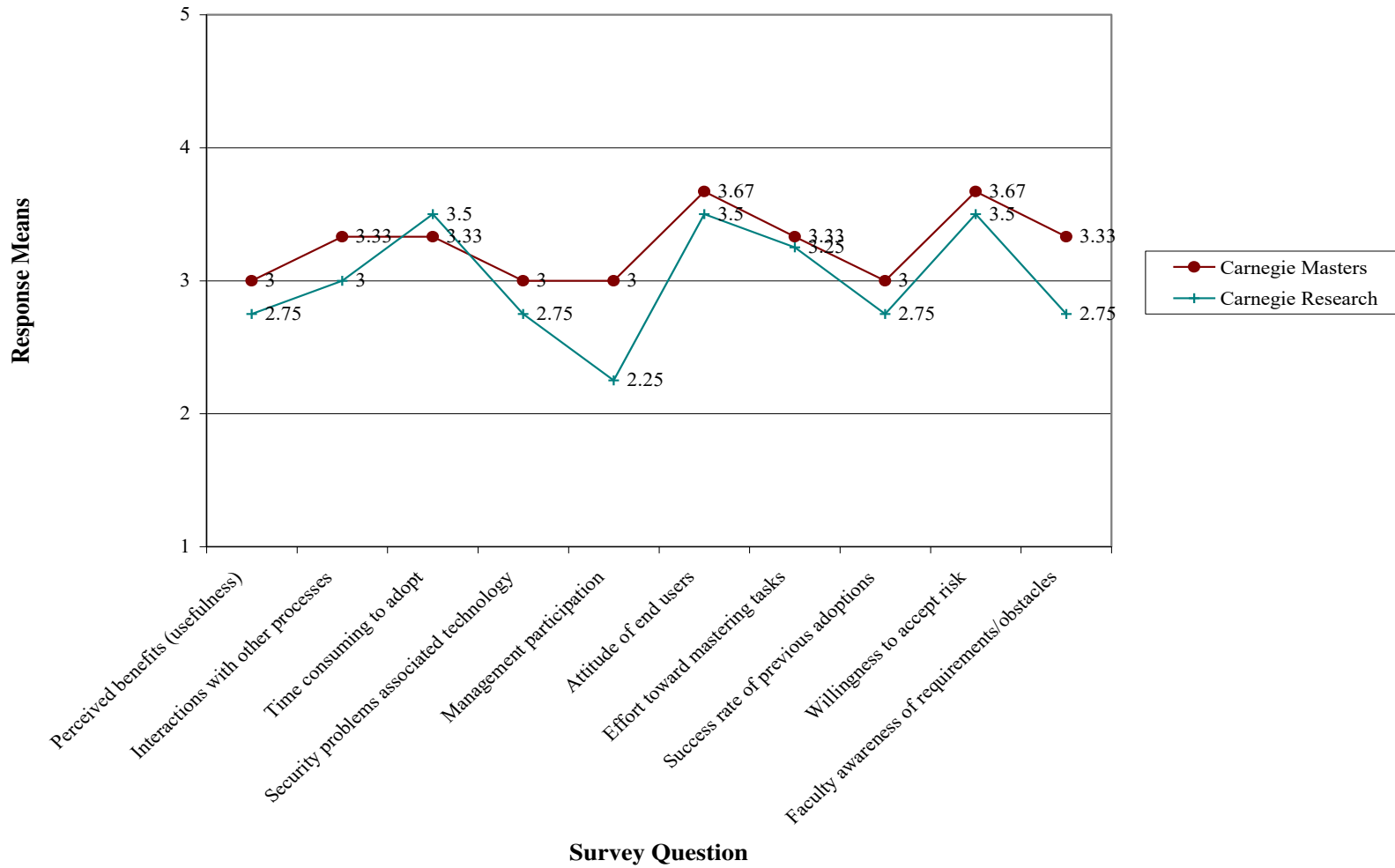


Figure 103: Diffusion Responses Mean Comparison—Carnegie Master’s and Research Institutions

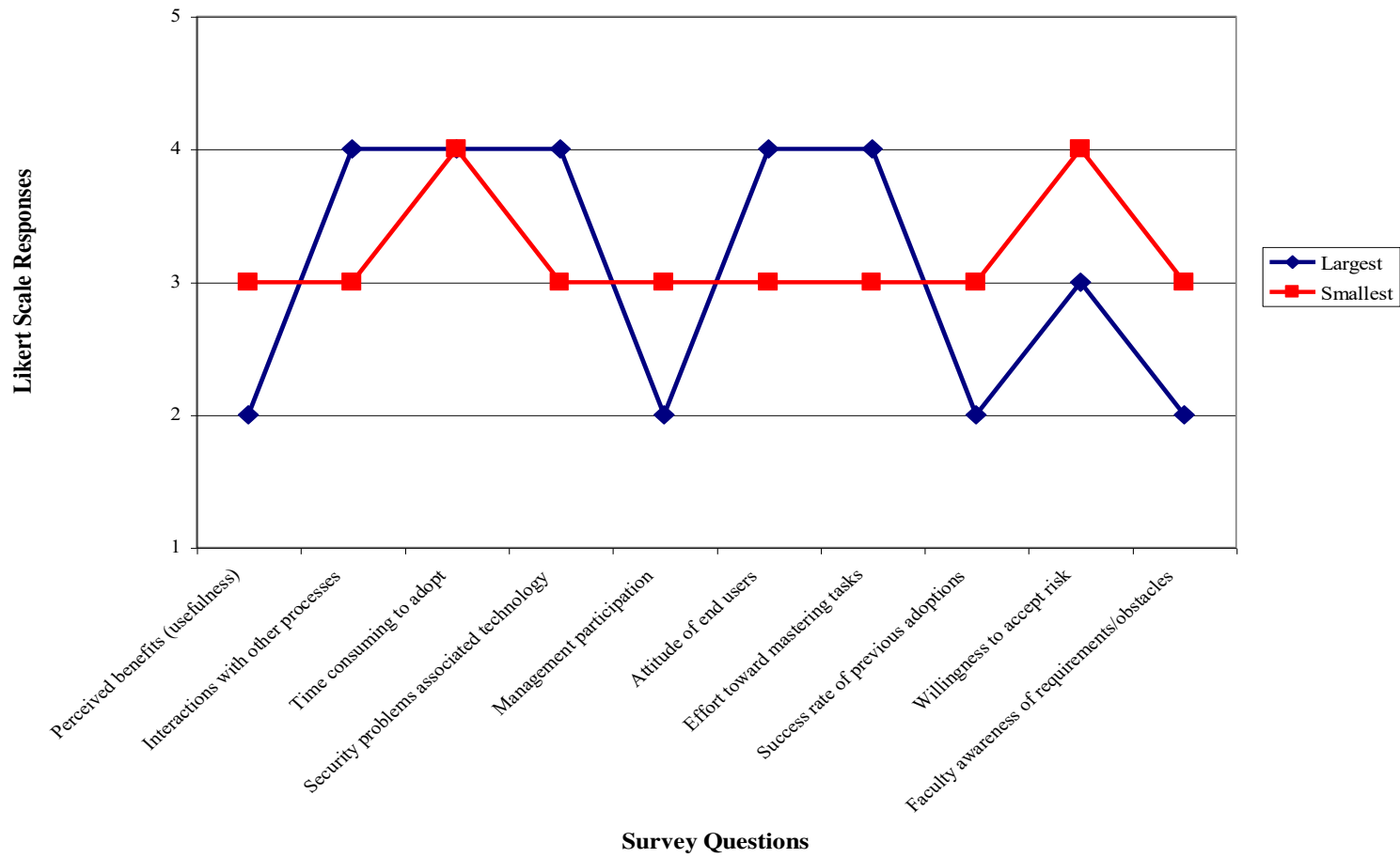


Figure 104: Diffusion Comparison—Largest Institution (by enrollment)/Smallest Institution (by enrollment)

Research Question 4

Data for Research Question 4, “What were the most/least problematic mechanisms or factors in regards to examining innovative educational technologies by Florida’s SUS institutions?” were captured on the Survey (Appendix F) by the respondents inputting actual responses directly into Solutions statements 4.1 through 4.3 which asked overall, “What strategies were employed to resolve issues encountered during the adoption process?” Respondents were allowed space in which to comment directly. Solutions statement 4.1 was about which strategies the respondent used to address problems during the planning stage of an adoption process. Four respondents commented. One respondent stated that committees with broad representation, end-user involvement and feedback, and training were key strategies used to address problems. A second respondent stated that ground up involvement, using faculty for needs assessment and doing a thorough environmental scanning of internal needs and external adoption of the new technology was a strategy used at his/her respective institution. A third respondent commented that his/her institution established a plan to communicate early and often. It was also relayed that both college specific support personnel and early adopters were brought together in the planning process to ensure a successful acceptance and adoption by the key individuals. The fourth respondent submitted that both education and communication were important in order to achieve broad support, commitment, and recognition of need.

In addition, statements 1.4 and 1.5, with a mean of 3.71 indicated that these were the most problematic factors when planning for the adoption of educational technologies, while statement 1.8, with a mean of 2.71 was the least problematic factor when making an examination of the planning stage.

Solutions statement 4.2 asked which strategies the respondent used to address problems during the implementation stage of an adoption process. Five respondents commented. One respondent stated that during implementation, the strategies that worked best for his/her institution included using committees with broad representation, end-user involvement and feedback, frequent communication with stakeholders, and tasking of groups to address problem areas were things to consider. A second respondent stated that training and communicating were paramount in that if these were not done during the implementation stage, no new technology would be accepted. The third respondent commented that a strategy would vary based on what type of technology was being implemented. From a general level, continuous feedback with the agility to adjust the plan based on the information gathered, e.g., additional or better training, changes to custom software, or working with a vendor to address errors and bugs, would be a key strategy. The fourth respondent stated that pilot groups would be a key strategy during the implementation stage.

In addition, statement 2.4, with a mean of 3.57 indicated that this was the most problematic factor when implementing the adoption of educational technologies, while

statement 2.10, with a mean of 2.71, was the least problematic factor when making an examination of the implementation stage.

Solutions statement 4.3 asked which strategies the respondent used to address problems during the diffusion stage of an adoption process. Four respondents commented. One respondent stated that his/her institution used the strategy of engaging committees with broad representation, end-user involvement and feedback, frequent communications to stakeholders, and involving successful end users in training new users as key to the diffusion stage. A second respondent commented that during the diffusion stage one had to ensure that the new technology was implemented on time and on budget and that communicating and training were keys to the successful diffusion of new technologies. A third respondent wrote that the strategies used during the implementation stage would be similar to those used in the diffusion stage, but the speed of resolution would become more critical. The final respondent stated that during the diffusion stage, providing adequate support and training while promoting user participation would add to the successful diffusion of technologies during the adoption process.

In addition, statements 3.6 and 3.9, both with a mean of 3.57, indicated these were the most problematic factors when diffusing educational technologies, while statement 3.5, with a mean of 2.57, was the least problematic factor when making an examination of the diffusion stage. Table 6 summarizes the most and least problematic factors or mechanisms from the data.

Table 6

Research Question 4: Most\Least Problematic Factors

	Planning	Implementation	Diffusion
Most	Standardizing planning models	Resistance to change due to fear of unfamiliar	Attitude of end users to change way to complete their work
	Defining/measuring budget benefits		Acceptance of high risk with untried technologies
Least	Guidelines for usage	Developing effective time frames/schedules	Participation of management

Summary

This chapter presented an analysis of the collected data used to answer the research questions that guided this study. Chapter Five, a summary and several conclusions, draws from the data analysis as well as recommendations for planning, implementing, and diffusing educational technologies.

CHAPTER FIVE: DISCUSSION, CONCLUSION & RECOMMENDATION

Overview

This chapter addresses the meaning of the results regarding the relationship among survey items and the relationship among questions. It provides recommendations for further research and conclusion concepts.

Discussion

When this researcher began contemplating this dissertation, the concept of how institutions of higher learning planned, implemented, and diffused information regarding a technology for use by the staff, faculty, and students was always the primary consideration. This researcher felt that the areas of innovation and change management were neglected. In the December 2009 issue of the *International Review of Research in Open and Distance Learning*, authors Zawacki-Richter, Bäcker, and Vogt (2009) arrived at the same conclusion. Their ten year review of every article “published in the five prominent” and widely read “distance education journals between 2000 and 2008” (p. 21) found that only 28% (or approximately 194) of the 695 articles dealt with the “meso level” which included “management, organization, and technology” (p. 23). The paucity of meso level type research was disappointing to the authors and they warned that in order to “guide (the) practice, practitioners in the field should not rely on under-informed trial and error, but on sound research and empirical investigation on the effectiveness of managerial interventions for education innovation” (p. 45). This researcher agreed with the conclusions by the authors in that more research needed to be performed in order to

gather lessons learned in strategy formulation, management of innovation, and diffusion of emerging and disruptive technologies for education. Hence, this research regarding planning, implementation, and diffusion of educational technologies in institutions of higher learning became more timely and critical.

Research Question 1

Which planning strategies to incorporate educational technologies were considered by Florida's SUS institutions?

This research question delved into the concept of having and using a planning strategy in order to incorporate educational technologies into the learning environment. Planning generates strategic guidelines for technology development based on organizational goals (Tanoglu & Basoglu, 2005). The data analysis of the survey's respondents showed that the more research an institution of higher learning did, then planning for such things as emerging and disruptive technologies were not as problematic as it was for institutions that did less research and had smaller student enrollment. The planning stage was where the greatest spread between those Carnegie Master's versus Carnegie Research institutions and the smallest enrollment institution (almost 10,000 students) versus the largest enrollment institution (over 53,000 students). The smallest enrollment institutions, which were Carnegie Master's level, found that gathering technology needs across departments and the pressures for quick solutions to complex problems were highly problematic. In addition, the smaller enrollment institutions also found it difficult to standardize planning models, define and measure the possible benefits for budgets, and coordinating timeframes/scheduling for projects were also

highly problematic. One would not think this so of a smaller institution. Instead, one would believe that coordinating and scheduling would be easier in a smaller organization. Because this does not appear so, it would behoove a smaller organization to either add IT staff or outsource the planning stage before adopting an educational technology into their learning environment. Furthermore, because these were the most problematic of factors when planning for educational technologies, they received the most consideration by master's institutions. The institutions with the largest enrollment found planning was at the most sometimes problematic. This researcher concluded that the Carnegie Research institutions (which also have the largest enrollments), while they may consider these factors, only sometimes or rarely were they problematic.

Respondents were asked to share details of strategies used by their institutions to combat or ameliorate problems encountered during the planning process. There were two major themes expressed by respondents: involvement and communication. Involvement included bringing end-users into planning early in the process including faculty and early adopters. Once the decision to initiate an educational technology into the institution was begun, it was critical to its success to have involvement and support from within the organization, departments, schools, divisions, administration, faculty, and stakeholders. Gladwell's (2002) framework dealing with the importance of facilitation, along with Rogers' (2003) stages of diffusion, were relevant in that buy-in, which is strengthened by involvement and communication, was essential to the success of planning, implementing, and diffusing the technology systems wide. More importantly after those steps,

according to survey results, was the feedback and acceptance of the process and ultimately the technology perceived as viable and beneficial. Early and often communication, a sub-set of involvement, was critical not only in the planning stages in order to achieve broad support, commitment, and recognition of need, but in all stages.

Research Question 2

What are the common descriptive patterns of implementation of innovative educational technologies by Florida's SUS institutions?

This research question was established in order to understand common descriptive patterns of implementation of educational technologies. Implementation was defined by Ahmed et al. (2007) as "everything that takes place from the moment the system is purchased until the system is fulfilling its purpose for members of the organization" (p. 6). The data analysis of the survey's respondents showed that the least problematic, and therefore most easily incorporated into the process of implementation, were the abilities to develop general procedures to implement the technology, develop timeframes and scheduling effectively, and setting standards for consistency and efficiency. At the Carnegie Master's institutions, respondents indicated consistent agreement with these findings but additionally scored managing systems with regard to the rapidly changing technology, individual competence and adaptation to technologies, and adequate training being provided for students and faculty as patterns easily and consistently incorporated into the implementation process.

At the Carnegie Research institutions respondents did not have the same pattern of response as the Carnegie Master's institution respondents. The items illustrating a

pattern included the institution's ability to focus resources that enhanced end-user technological ability, developing general procedures to implement educational technologies, developing timeframes and scheduling effectively, and setting standards for consistency and efficiency. However, consistent with Ahmed et al. (2007) findings, Carnegie Research institutions, as well as the overall findings, indicated that resistance to change due to fear of the unfamiliar was the step in the process requiring the most attention. The Carnegie Master's institutions indicated during the implementation process an adequate qualified support staff was not available and there was difficulty coordinating implementation across departments. The respondent's responses supported Gladwell's (2002) theoretical framework in that an institution must ensure the barriers to successful adoption, and the lack of support due to attitude/resistance to change to fear, were overcome. The other potential barrier was unfamiliarity with the technology, both real and perceived. Mounting these barriers would go a long way in ensuring implementation by faculty, staff, and stakeholders.

This researcher noted several common patterns among the respondent institutions when they provided strategies or solutions that ameliorated some of the most problematic issues. First, the use of committees, task groups, or pilot groups throughout the implementation process to discover and correct problem areas, errors, and bugs was an apparent common strategic pattern. In addition, adequate training and communication among the various stakeholders were paramount with one Survey respondent indicating, "No new technology will be accepted if there is no communication and training." One

central idea garnered from these inputs was the conclusion that strategies to address the various committees, task groups and initial groups must include professional development, technology holders continuously keeping them aware of how implementation affects programs, and training of all, would ensure successful adoption. The support must be available, current, useable, and adaptable.

Research Question 3

What are the challenges and opportunities associated with the diffusion of innovative educational technologies by Florida's SUS institutions?

This research question was established in order to understand challenges and opportunities associated with the diffusion of educational technologies. Diffusion was defined by Ahmed et al. (2007) as managing "change and the adoption of new technology solutions by the organization and its members" (p. 5). While planning and implementation were the primary functions of IT departments within institutions, diffusion was launched primarily by members of the entire organization. The challenges faced by the group of respondents included addressing the attitude of end-users and the change to their work process and the willingness to accept high risk from untried technologies. Institutions viewed management participation as an opportunity to maximize end-user buy in and maximum acceptance of the new technology. Respondents at the Master's level agreed that the greatest challenges were the attitude of the end-user and the willingness to accept risk, which was consistent with the overall findings of the Survey. The opportunities that yielded the best return during diffusion included the perceived benefits or the usefulness of the technology by the end-user,

according to the respondents. As with the research and overall findings, management participation was seen as an opportunity. In addition, other opportunities, i.e., those factors that had the lowest problematic rating, included security and knowing the success rates of previous technology adoptions. At the Research level, there was agreement that the attitude of the end-user and the willingness to accept risk were considered challenges to be overcome during the diffusion process. In addition, larger institutions faced the challenge of the amount of time consumed to adopt a new technology solution. Like the Master's level and the overall respondent data, the inclusion of management during diffusion presented opportunities for acceptance.

The respondent institutions then provided strategies used to facilitate diffusion and acceptance of the new technology by members of their organization. Support and training were expressed by respondents as critical to diffusion of the technology as well as the quick, appropriate resolution to problems. One respondent stated that involvement of successful end-users in training new users presented a significant opportunity to ensure successful diffusion. A more elaborate discussion on diffusion is presented later in this chapter.

Research Question 4

What were the most/least problematic mechanisms or factors in regards to examining innovative educational technologies by Florida's SUS institutions?

This research question was established in order to understand the most and least problematic mechanisms or factors in regards to examining innovative educational

technologies. The Survey revealed that the *attitudes of end users relevant to change*, the *willingness to accept risk*, and the *cost benefits relevant to the budget* were the most problematic factors. The least problematic factor was *management participation in adoption of educational technology solutions*. This augurs well for Florida's SUS institutions because leadership is of the utmost importance.

Conceptual Framework Revisited

Due to the sample size and purposive group selection, it was difficult to draw conclusions regarding Rogers' (2003) assertion that there were five critical steps in three stages to the adoption (diffusion) of an innovation. This researcher cannot definitely state that Rogers' assertions were applicable or that there was a significant relationship among planning, implementation, and diffusion. Instead, Gladwell's *Tipping Point* (2002) research provided a better framework for interpreting respondent data in this particular study. His research was about what caused an innovation to be either widely accepted or why it failed miserably rather than lock-step stages as articulated by Rogers. Gladwell proposed that change agents were keys to understanding adoption or diffusion of technology. In the open-ended questions, respondents reiterated that communication was critical throughout the entire adoption process, which included planning, implementation, and diffusion. Therefore, Gladwell's body of research was a better framework for interpreting the findings.

For example, management participation in the adoption of educational technology solutions was least problematic in all the respondents' surveys as well as the variables.

By all accounts, management became the “messenger” that Gladwell believed was critical for adoption because management was the “connector” who possessed a large circle of influence, but managers associated with the “right kind of people” and were at least willing to stay in contact with the people they worked with because they were useful in perpetrating the innovation (Gladwell, 2002, p. 48).

The most problematic issues were the *attitudes of end users relevant to change*, the *willingness to accept risk*, and the *cost benefits relevant to the budget*. Using Gladwell’s framework, these most problematic issues might be well explained by using change agents for understanding. The power of context was sensitivity to the “conditions and circumstances of the times and places in which they occur” (p. 139). This researcher found that a most problematic issue was justifying the expense of new innovation in comparison with the current budget condition, as the literature search found the SUS institutions were experiencing smaller budgets along with unprecedented student population growth.

It would not be prudent of this researcher to dismiss or deem irrelevant the Diffusion of Innovation theory that Rogers (2003) articulated. Though the steps and stages described by Rogers could not be validated by this research, he did however elaborate on, “the categories of adopters ... innovators, early adopters, early majority, late majority, and laggards” (Rogers, 1962, p. 150). Rogers opined that one of the greatest problems in diffusing an innovation, as this research demonstrated, was resistance to change and how the end user attitude significantly impacted the speed with

which an innovation was diffused. Survey respondents indicated that attitude and resistance were highly problematic. During the implementation phase, 57% (4 of 7) respondents indicated they frequently faced resistance to change and while during the diffusion phase, 71% (5 of 7) indicated the attitude of the end user was frequently problematic. The late majority and laggards that Rogers detailed in his work, were most likely those delaying the diffusion of a new educational technology. His research reminds that during the planning stage, institutions are not preparing end users for the change to achieve the buy in and cooperation needed to diffuse it throughout the institution. It must be remembered that the respondents were the CIOs of SUS institutions and are *de facto* planners, responsible for the ultimate success or failure of the technology implementation.

Therefore, this researcher believed that it would behoove institutions to carefully consider the framework of Gladwell, whose work really updated Roger's 1995 research on diffusion of innovation, as key to planning for, implementing of, and diffusion of educational technologies. Rogers' (1995) research showed how the diffusion process was divided into the activities of initiation and implementation. These were further broken down into sub-stages that included "agenda setting, matching, redefining/restructuring, clarifying, and routinizing" (p. 392). Further research would take Roger's work and expand the Survey (Appendix F) to incorporate these stages after creating the appropriate corresponding questions. This could clarify the idea of the concept of an educational technology versus actually changing an existing system into a new technology. This

would also show how institutions perceived technology as either a complete change or just a refinement in their IT system.

Significant Findings of the Study

A complete comparison of the mean scores between Carnegie institutions for this planning statement is at Figure 7. One key finding is that 71% (5 of 7) of the respondents stated it was critical that more flexibility must be given during the planning for new educational technology and not be overly dependent upon a standardized model which may or may not be of any use. The implementation portion of the Survey found that 57% (4 of 7) of the respondents at least frequently felt resistance to change was the most problematic area. In the diffusion section of the Survey, 71% (5 of 7) indicated the attitude of end users was frequently problematic and in addition, 57% (4 of 7) indicated the willingness to accept risk from untried educational technologies was at least frequently problematic.

Finally, data demonstrated that Master's (smaller) institutions found it more difficult to plan for a technology adoption than Research (larger) institutions. There may be several explanations for this: first, Research institutions are more adept at planning for such an adoption as they do it more frequently in order to accommodate the size and preferences of a diverse community of learners; second, Master's and smaller institutions may not view technology as critical to their mission and the culture of the organization may not support constant innovation because students may have selected the institution based on the personal, individual and face-to-face nature of the learning environment;

third, the shortening life cycle of technology products require smaller technology staffs to keep up with the ever changing environment and they may not be able to keep pace; fourth, at Master's and smaller institutions the staff wear many hats and there may be only a few IT professionals making it difficult to coordinate planning across the departments whereas, larger and Research institutions have IT representation within colleges, departments and divisions to coordinate any technology adoption effort; fifth, the institutions offered several suggestions for ameliorating issues during the planning stage, but these suggestions are time consuming and labor intensive; and finally, the small sample size obtained in this study may not appropriately represent either the Master's (smaller) or Research (larger) institutions and therefore, is not generalizable to any other population.

Implications for Practice and Policy

When considering a new educational technology, the institution must anticipate the need for a cultural transition to maximize the benefits of the technology to the organization. The first step would begin even before the planning stage of the adoption with the selection of the technology. End-users and stakeholders representing various levels should be instrumental in the selection of the innovative technology. Any team should include early adopters who can energize end users and communicate the value of the technology adoption. This practice would minimize negative attitudes and resistance to change by demonstrating a clear benefit and creating "champions" for the project.

One of the most far thinking implications of the researcher's work was understanding, as Parry (2009) stated, the "big-picture portfolio that hinges on worrying about this question: How can a university organize and preserve the deluge of digital data before it washes away—and preserve it for uses that have not been imagined yet?" (¶1) Not only do SUS institutions have to be prepared to answer this question and practice, but every institution of higher learning, if it intends to remain relevant as a tower of knowledge transmission, must have a strategic planning, implementing, and diffusing capability. As stated in Chapter Two, that while technology changes rapidly, people do not because they, at times, only want to use what is familiar to them and only adopt technology when they see a clear benefit either in productivity or in savings. Educators and education are a domain that inherently involves people as both practitioners and clients and therefore when thinking about the diffusion of technologies in educational settings, one needs to think as much about what people will want and are likely to do as about the new technologies that will be available. It will ultimately become necessary for traditional institutions, such as Florida's State University System, to accommodate more students with existing resources, which means pressure to take advantage of the potential savings offered by technology, which were not so great before. Now the job of the CIO of an institution of higher learning, may, for all intents and purposes, be "to connect all the dots and then act as a catalyst. ... (and) to give initiatives special status and funding and personally monitor them on a monthly or quarterly basis" (Immelt, Govindarajan & Trimble, 2009, p. 62).

Siemens (2009) echoed the same thoughts as he suggested that “the battle for control of information and interaction has already been won by the individual” (§1). He felt that the universities which have not yet recognized this may continue to limp along for a while, but their stance was not tenable. Disruptive technologies in the form of “laptops and wireless devices were increasingly present in academic settings, so rather than assuming that their use takes away” attention, institutions should seek to “understand how they can reconfigure themselves in ways that might allow for new methods of engagement” (§2).

Recommendations for Future Research

Recommendations for future research in the area of emerging and disruptive technologies for education include:

1. Expand the study of Florida institutions to community colleges and private institutions. Involve and survey additional educational organizations’ CIOs in various regions of the United States in order to examine and evaluate issues related to planning, implementation, and diffusing a new technology solution. A study of a larger group would also allow statistical analysis beyond the scope of this research to evaluate the validity of Rogers’ (2003) steps and determine if a statistically significant relationship exists between and among the steps.

2. Comparison case studies of institutions implementing new educational technologies. This may be performed in conjunction with the above recommendation. This is a frequent methodology used by the *EDUCAUSE* staff. Institutions who respond

to the quantitative survey would be asked, based on pre-determined criteria, to participate in a case study. This type of investigation would lend itself to and enrich the data from the qualitative study.

3. The original premise of this dissertation was to compare the adoption of technology by businesses in Florida with institutions of higher learning. Thus, it is recommended for future research. The scope was much too broad, but this researcher feels there might be many lessons learned. Businesses, driven by profits, are more likely to investigate and implement the use of technology for more diverse and cost saving purposes significantly faster than educational institutions. “Changing circumstances, near constant ... innovation and aggressive competition illustrate that *efficiency* ... is no longer enough; *adaptability* is just as important to remain best-in-class” (Meloro, Snyder, Jones & Moore, 2005, p. 1). This is exactly what proprietary higher education institutions have done and private and public colleges and universities might have to do the same in order to compete.

4. Zawacki-Richter et al. (2009) found that much more research regarding innovative changes in educational institutions needed to be accomplished “on the meso level” and “in particular ... (in) management of change and innovation, costs, organizational development and infrastructure for online student and faculty support, professional development, and quality assurance” (p. 44).

5. This study found that during implementation and/or diffusion, successful adoption was frequently inhibited by the attitude of the end user or resistance to change

on the part of users. It would be prudent to study end users and their attitudes during the adoption of an educational technology. This researcher recommends studying the various levels of stakeholders, from students to faculty and line staff to senior administrators, to determine the different levels of resistance and the underlying causes and whether it is rational or irrational.

6. Hardly a day goes by without a new technology coming on the scene that will change the way people live their lives. Given this, and the shortening life cycle of these technologies, is it reasonable to assume that Rogers' (2003) lockstep process of diffusing an innovation might become as obsolete as yesterday's technologies? Or do Gladwell's "change agents" offer a more expedient methodology for guiding a technology adoption? An in depth research analysis might be important.

Researcher Reflection and Conclusion

It was hoped that institutions of higher learning would all aspire to be organizations where good work and great learning are hallmarks of excellence. Higher education institutions must also have a commitment towards adoption of new innovations via the various emerging technologies and collaborate wisely with the business, local, internal, stakeholder, and outside communities. Knowing how to plan, implement, and diffuse those technologies is one of the most important decisions an institution can make because it can and will have an impact far into the future. This researcher has come to the conclusion that Drucker's claim, "thirty years from now the big university campuses will be relics ..." (Lenzner & Johnson, 1997, p. 127), is wrong. He based his prediction

upon the idea that institutions of higher learning were Ivory Towers, places filled with people who looked down on those who entered. This researcher now believes that institutions have become, or will become, WiFi Towers, where technology allows ideas to be transmitted to all...anytime, anyplace, and anywhere a learner happens to be, thus providing immediate access for a lifetime of learning.

Emerging and disruptive technologies have changed enough to ensure this as well as change the face and vision of higher educational institutions. While some of Florida's SUS institutions were planning for the better and greater use of these technologies to advance the cause of learning, others were content to rest on their laurels. Perhaps these institutions can benefit from the lessons learned from this research so they can better plan their programs to achieve, if they have realized them, strategic technology goals. Regardless, the "mouse" has not rested concerning how mobile devices, ubiquitous computing, and disruptive innovations will create emerging learning opportunities for higher learning institutions coping with understanding the knowledge driven society of the 21st Century and beyond.

APPENDIX A: PRE-NOTICE LETTER FOR SURVEY

Dear (insert name):

In about a week, you will receive an email from me that requests you contribute to a study I am conducting as part of my doctoral dissertation at the University of Central Florida.

You are one of eleven SUS Chief Information Officers being asked to participate in this small, elite and unique group of respondents. I hope you understand and appreciate how critical it is that you complete the survey which asks for your experiences with planning, implementing and diffusing educational technologies at your institution.

I am writing now because studies show advance notice of such an email allows you to recognize the request to complete the survey as legitimate and vetted. Also enclosed is a copy of the Informed Consent Document. Please read this carefully and let me know if you have any questions regarding participation in the study. Your responses will play a critical role in determining how SUS institutions in Florida implement technologies. Let me also assure you that your responses will be confidential and secure. Please notify me if you would prefer to complete a paper version of the survey and I will be happy to supply you with the questionnaire and self-addressed stamped envelope.

Thank you so much for your time and consideration. Without participation from professionals like you, my study would not be possible. My contact information is in the signature block below if you have any questions or concerns.

Sincerely,

Deborah J. Bradford

Deborah J. Bradford
Associate Director
Regional Campuses Enrollment Services
University of Central Florida
407-666-5530
dbradfor@mail.ucf.edu

Enclosure

1. Informed Consent Document



EMERGING AND DISRUPTIVE TECHNOLOGIES FOR EDUCATION: AN
ANALYSIS OF PLANNING, IMPLEMENTATION, AND DIFFUSION IN
FLORIDA'S ELEVEN STATE UNIVERSITY SYSTEM INSTITUTIONS

Principal Investigator(s): Deborah J. Bradford

Sub-Investigator(s): N/A

Faculty Supervisor: Dr. Rosa Cintrón

Sponsor: Department of Educational Research, Technology and
Leadership, College of Education, University of Central
Florida

Introduction: Researchers at the University of Central Florida (UCF) study many topics. To do this we need the help of people who agree to take part in a research study. You are being invited to take part in a research study which will include 11 people in Florida. You have been asked to take part in this research study because you are the Chief Information Officer of a Florida State University System Institution. You must be 18 years of age or older to be included in the research study and sign this form. You can read this form and agree to take part right now, or take the form home with you to study before you decide.

The person doing this research is Deborah J. Bradford a doctoral student in the Educational Research, Technology and Leadership Department at the University of Central Florida. Because the researcher is a graduate student, she is being guided by Dr. Rosa Cintrón, a UCF faculty supervisor in the Educational Research, Technology and Leadership Department in the College of Education.

What you should know about a research study:

- Someone will explain this research study to you.
- A research study is something you volunteer for.

- Whether or not you take part is up to you.
- You should take part in this study only if you want to.
- You can choose not to take part in the research study.
- You can agree to take part now and later change your mind.
- Whatever you decide it will not be held against you.
- Feel free to ask all the questions you want before you decide.

Purpose of the research study: The purpose of this study is to collect data relevant to the adoption and implementation of emerging educational technologies at your institution.

What you will be asked to do in the study: You will be asked to complete a survey containing four sections. Three sections of the survey—planning, implementation, and diffusion—contain a series of items. Indicate the degree to which each item presents a **PROBLEM** at each stage in the adoption process. Please answer all items and if your institution encountered a difficulty not mentioned, feel free to indicate that issue in the space provided at the end of each section. The fourth section asks three questions about strategies used to resolve issues faced during the implementation process. You do not have to answer every question or complete every task. You will not lose any benefits if you skip questions or tasks.

Location: The survey will be delivered to you via email. A link will direct you to the survey via the SurveyMonkey.com survey product.

Time required: We expect that it will take you about 15 minutes to complete the survey. It may take longer if you wish to supply additional written information.

Risks: There are no reasonably foreseeable risks or discomforts involved in taking part in this study.

Benefits: There are no expected benefits to you for taking part in this study. However, sharing your experiences and solutions to problems might benefit each institution as they move forward with implementation of emerging educational technologies.

Compensation or payment: There is no compensation or other payment to you for taking part in this study.

Confidentiality: Individual responses will be kept confidential with transmission of data via encrypted, secure lines. Data will be reported as summaries only.

Study contact for questions about the study or to report a problem: If you have questions, concerns, or complaints, please contact: Deborah J. Bradford, Doctoral Student, Educational Research, Technology and Leadership Department, College of Education, at (407) 882-2004 or Dr. Rosa Cintrón, Faculty Supervisor, Department of Educational Research, Technology and Leadership at (407) 823-1248 or by email at rcintron@mail.ucf.edu.

IRB contact about your rights in the study or to report a complaint: Research at the University of Central Florida involving human participants is carried out under the oversight of the Institutional Review Board (UCF IRB). For information about the rights of people who take part in research, please contact: Institutional Review Board, University of Central Florida, Office of Research & Commercialization, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246 or by telephone at (407) 823-2901. You may also talk to them for any of the following:

- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.
- You want to get information or provide input about this research.

APPENDIX B: COVER LETTER EMAIL AND LINK TO SURVEY

Dear (insert name):

I am writing to request your participation in a study of the diffusion of educational technologies in Florida higher education institutions. This study is part of my doctoral dissertation at the University of Central Florida.

You were selected to participate in the study as a result of your title or position which identifies you as responsible for planning, implementing and diffusing educational technologies at your institution. I am contacting institutional Chief Information Officers or decision-makers responsible for teaching and learning technologies.

The results of the survey will be used to identify patterns of adoption, strategies used to incorporate technologies, and challenges/factors that influenced the adaptation of educational technologies.

It will take about 15 minutes to complete the survey. You may decide to spend additional time discussing some unique situations your institution encountered that are not covered by the items in the survey. The results of the survey will be strictly confidential and reported only as summaries where no individual answers might be identified. Transmission of results within SurveyMonkey.com and to me will be encrypted for additional security. Begin the survey by clicking this link or copy and paste the link into your browser:

http://www.surveymonkey.com/s.aspx?sm=2uTO6ha6MOqHqd_2bs65O9cA_3d_3d

If you have any questions, comments or concerns regarding the study, I am happy to discuss them with you. All my contact information is available in the signature block below.

Thank you very much for participating in the study.

Sincerely,

Deborah J. Bradford

Deborah J. Bradford
Associate Director
Regional Campuses Enrollment Services
University of Central Florida
407-666-5530
dbradfor@mail.ucf.edu

APPENDIX C: THANK YOU/REMINDER EMAIL (THIRD CONTACT)

Dear (insert name):

Last week you received an email requesting your participation in a survey regarding the implementation of educational technologies in your institution.

If you have already responded, thank you so much for sharing your knowledge and experiences. I am especially grateful for your participation since it is only through the participation of higher education professionals like yourself that this study is possible.

If you have not yet completed the survey, please do so by clicking on this link:

http://www.surveymonkey.com/s.aspx?sm=2uTO6ha6MOqHqd_2bs65O9cA_3d_3d

It only takes about 15 minutes of your time to complete the survey. If you are experiencing difficulty or would like a paper copy of the survey, please get in touch with me via phone or email. My contact information is listed below.

Sincerely,

Deborah J. Bradford

Deborah J. Bradford
Associate Director
Regional Campuses Enrollment Services
University of Central Florida
407-666-5530
dbradfor@mail.ucf.edu

**APPENDIX D: ENCOURAGEMENT TO PARTICIPATE/LINK TO
SURVEY (FOURTH CONTACT)**

Dear (insert name):

I sent you an email about three weeks ago asking you to provide responses to a survey regarding educational technology implementation at your institution. To my knowledge, the survey has not been submitted.

Other higher education professionals have responded and provided valuable insight into planning, implementation and diffusion of technology at their institutions. Your input is critical to the outcomes of the study and I value your opinions and experiences. I realize your time is extremely valuable and understand if you do not have time to participate. In that case, would you please forward the survey particulars to someone on your staff that would be knowledgeable about these processes?

The survey will take about 15 minutes to complete and is accessible by clicking this link:

http://www.surveymonkey.com/s.aspx?sm=2uTO6ha6MOqHqd_2bs65O9cA_3d_3d

I hope you will take the time to participate as soon as possible. Your responses will be held in the strictest confidence and will be reported as summaries that are not individually identifiable.

Please contact me with any questions or concerns.

Sincerely,

Deborah J. Bradford

Deborah J. Bradford
Associate Director
Regional Campuses Enrollment Services
University of Central Florida
407-666-5530
dbradfor@mail.ucf.edu

**APPENDIX E: FINAL LETTER AND PAPER COPY OF SURVEY
(FIFTH CONTACT)**

Dear (insert name):

Over the past six weeks, I have sent a letter and several emails inviting you to participate in a research study being conducted as part of my doctoral dissertation. The purpose of the study is to examine the ways in which IT departments plan, implement, and diffuse educational technologies at their institutions.

The study will end soon and this is the last attempt I will make encouraging you to participate by completing the enclosed survey or by clicking this link to submit your responses electronically:

http://www.surveymonkey.com/s.aspx?sm=2uTO6ha6MOqHqd_2bs65O9cA_3d_3d

The study population is quite small and therefore your experiences and expertise with the process of diffusing educational technologies is critical to producing valid results.

All responses to the questions are confidential, and if submitted electronically, are encrypted for maximum security. If you feel you have been contacted by mistake or that you are not qualified to respond to the survey, I understand. Please indicate this by returning the survey to me in the self addressed stamped envelope without completing it. Should you determine someone else on your staff has more time or experience, please provide the questionnaire to him or her for completion.

Thank you again for consideration of this request and your time.

Sincerely,

Deborah J. Bradford

Deborah J. Bradford
Associate Director
Regional Campuses Enrollment Services
University of Central Florida
407-666-5530
dbradfor@mail.ucf.edu

Enclosures

1. Educational Technology Implementation Survey
2. Self-addressed stamped envelope

APPENDIX F: SURVEY

EDUCATIONAL TECHNOLOGY IMPLEMENTATION SURVEY

Thank you for participating in this study. The survey collects data relevant to the adoption and implementation of emerging educational technologies at your institution. All information collected will be used for academic purposes, as part of my doctoral dissertation. Individual responses will be kept confidential, anonymous and transmission of data is via encrypted, secure lines. Three sections of the questionnaire—planning, implementation and diffusion—contain a series of items. Indicate the degree to which each item presents a PROBLEM at each stage in the adoption process. Please answer all items and if your institution encountered a difficulty not mentioned, feel free to indicate that issue in the space provided at the end of each section. The fourth section asks three questions about strategies used to resolve issues faced during the implementation process.

Select (1) if the item is never a problem (problem 0% of the time).

Select (2) if the item is rarely a problem (problem 1 – 30% of the time).

Select (3) if the item is sometimes a problem (problem 31 – 60% of the time).

Select (4) if the item is frequently a problem (problem 61 – 90% of the time).

Select (5) if the item is almost always a problem (problem 91 – 100% of the time).

“Educational technology (also called learning technology) is the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources” (Richey, 2008, p. 24). “Educational Technology includes, but is not limited to, software, hardware, as well as Internet applications and activities” (Educational Technology Tools and Advice, 2009, ¶1).

To progress through the survey, use the following navigation:

- Click the Next>> button to move to the next page
- Click the Previous>> button to return to the previous page
- Click the Done>> button to submit your responses

Participation is voluntary and you may exit the survey at any point. By clicking “NEXT”, you acknowledge that you received and read the Informed Consent document and agree to participate. Click “NEXT” to begin the survey and contribute to the study.

DEMOGRAPHIC DATA

How long have you been with your current institution?
How long have you been employed in higher education?
How long have you been a professional in the IT field?
What is your institution's current enrollment?
What is your institution's current Carnegie Research classification?

PLANNING: When PLANNING new educational technologies, how PROBLEMATIC is each of the following?

1.1 Gathering specific educational technology needs across departments	(1) (2) (3) (4) (5)
1.2 Considering relevant emerging technologies	(1) (2) (3) (4) (5)
1.3 Pressure for quick solutions to complex educational problems	(1) (2) (3) (4) (5)
1.4 Standardizing planning models	(1) (2) (3) (4) (5)
1.5 Defining and measuring the possible benefits of technologies for budget	(1) (2) (3) (4) (5)
1.6 Addressing political, internal/external environment concerns	(1) (2) (3) (4) (5)
1.7 Coordinating the timeframes and scheduling all projects	(1) (2) (3) (4) (5)
1.8 Developing guidelines for usage of the new educational technologies	(1) (2) (3) (4) (5)
1.9 Defining the organizational culture	(1) (2) (3) (4) (5)
1.10 Other problems planning for educational technology (please specify):	

IMPLEMENTATION: When IMPLEMENTING new educational technologies, how PROBLEMATIC is each of the following?

2.1 Managing systems with regard to the rapidly changing technology	(1) (2) (3) (4) (5)
2.2 Individual competence and adaptation to new technologies	(1) (2) (3) (4) (5)
2.3 Adequate training is provided for students and faculty	(1) (2) (3) (4) (5)
2.4 Resistance to change due to fear of the unfamiliar	(1) (2) (3) (4) (5)
2.5 The institution has focused resources to enhance technological ability	(1) (2) (3) (4) (5)
2.6 Compatibility of systems and software being addressed early enough	(1) (2) (3) (4) (5)
2.7 The number of qualified support staff is adequate	(1) (2) (3) (4) (5)
2.8 Coordinating educational technology implementation across departments	(1) (2) (3) (4) (5)
2.9 Developing general procedures to implement educational technology	(1) (2) (3) (4) (5)
2.10 Developing the timeframes and scheduling effectively	(1) (2) (3) (4) (5)
2.11 Setting standards for consistency and efficiency	(1) (2) (3) (4) (5)
2.12 Other problems with implementation (please specify):	

DIFFUSION: When considering DIFFUSION of new educational technologies, how PROBLEMATIC is each of the following?

3.1 Perceived benefits (ease of use/usefulness) to adopt educational technology solutions	(1) (2) (3) (4) (5)
3.2 Interaction levels of other processes to adopt educational technology solutions	(1) (2) (3) (4) (5)
3.3 Time consuming to adopt educational technology solutions	(1) (2) (3) (4) (5)
3.4 Security problems associated with educational technology solutions	(1) (2) (3) (4) (5)
3.5 Management participation to adopt educational technology solutions	(1) (2) (3) (4) (5)
3.6 Attitude of end users to change the way to complete their work	(1) (2) (3) (4) (5)
3.7 Effort toward mastering tasks required to use educational technology solutions	(1) (2) (3) (4) (5)
3.8 Success rate of previous educational technology adoptions	(1) (2) (3) (4) (5)
3.9 Willingness to accept high risk from untried educational technologies	(1) (2) (3) (4) (5)
3.10 Extent that faculty are aware of requirements and obstacles associated with educational technology solutions	(1) (2) (3) (4) (5)
3.11 Other problems with educational technology diffusion (please specify):	

SOLUTIONS: What strategies were employed to resolve issues encountered during the adoption process.

4.1 What strategies did you use to address problems during the planning stage of the adoption process?
4.2 What strategies did you use to address problems during the implementation stage of the adoption process?
4.3 What strategies did you use to address problems during the diffusion stage of the adoption process?

Note: Survey modified from Ahmed, H., Daim, T., & Bosoglu, N. (2007). Information technology diffusion in higher education. *Technology in Society*, 29(4), 469-482.

I appreciate that you took time out from your busy schedule to contribute to this study. Your experience, expertise, and opinions are extremely valuable to the findings and in determining the challenges Florida's higher education institutions encounter when diffusing educational technologies into the learning environment.

Let me know (dbradfor@mail.ucf.edu) if you would like a copy of the final results of the study or if you have any questions or concerns.

Click DONE>> to submit your responses!

APPENDIX G: INSTITUTIONAL REVIEW BOARD APPROVAL



University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Approval of Exempt Human Research

From: **UCF Institutional Review Board #1
FWA00000351, IRB00001138**

To: **Deborah J. Bradford**

Date: **November 12, 2009**

Dear Researcher:

On 11/12/2009, the IRB approved the following activity as human participant research that is exempt from regulation:

Type of Review:	Exempt Determination
Project Title:	EMERGING AND DISRUPTIVE TECHNOLOGIES FOR EDUCATION: AN ANALYSIS OF PLANNING, IMPLEMENTATION, AND DIFFUSION BY FLORIDA STATE UNIVERSITY SYSTEM INSTITUTIONS
Investigator:	Deborah J Bradford
IRB Number:	SBE-09-06535
Funding Agency:	
Grant Title:	
Research ID:	N/A

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these changes affect the exempt status of the human research, please contact the IRB.

In the conduct of this research, you are responsible to follow the requirements of the [Investigator Manual](#).

On behalf of Joseph Bielitzki, DVM, UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 11/12/2009 04:25:15 PM EST

A handwritten signature in black ink that reads "Joanne Muratori".

IRB Coordinator

APPENDIX H: PERMISSION TO USE SURVEY

-----Original Message-----

From: Deborah Bradford [mailto:dbradfor@mail.ucf.edu]
Sent: Saturday, August 08, 2009 3:03 PM
To: Tugrul Daim
Subject: Information Technology Diffusion in Higher Education

Dr. Daim:

Please allow me to introduce myself. I am Deborah Bradford a doctoral candidate in Educational Leadership at the University of Central Florida. I am attempting to do exploratory research into the status of Educational Technology Implementation in the State University System of Florida. I was given permission to use two surveys from EDUCAUSE—one on Wireless Technology and the other on e-Learning. Recently, they informed me that no validity or reliability tests were performed on the questionnaires used in either published study. Just today I came across your study of technology implementation at Portland Community College. Your work seems very similar to what I would like to investigate in Florida. The framework for my study is Rogers' Diffusion of Innovation Theory and Gladwell's The Tipping Point. Would it be possible to get a copy of your survey?

Thank you

Deborah J. Bradford
Associate Director, Regional Campuses Enrollment Services
University of Central Florida
12201 Research Parkway, Suite 101
Orlando, FL 32826-0060
Phone: (407) 882-2004
Fax: (407) 823-1399

From: "Tugrul Daim" <tugrul@etm.pdx.edu>
Sent: Monday 8/10/2009 6:17 PM >>>

Dear Deborah

I am attaching my own copy

Regards
Tugrul

Ps - I cannot find the survey questionnaire - one of my students had it. I will send it if I find it

-----Original Message-----

From: Deborah Bradford [mailto:dbradfor@mail.ucf.edu]
Sent: Wednesday, August 12, 2009 8:10 AM
To: Tugrul Daim
Subject: RE: Information Technology Diffusion in Higher Education

Thanks so much Dr. Daim! I have the article you sent and am aware the grid of questions and description, but would like to see the actual survey.

Another question, would you allow me to use this survey if all appropriate credit is attributed to you and the co-authors? Do you have validity and reliability information on the instrument itself?

Thanks again!

Deborah J. Bradford
Associate Director, Regional Campuses Enrollment Services
University of Central Florida
12201 Research Parkway, Suite 101
Orlando, FL 32826-0060
Phone: (407) 882-2004
Fax: (407) 823-1399

From: "Tugrul Daim" tugrul@etm.pdx.edu
Sent: 08/13/09 12:12 PM >>>

Dear Deborah

I found the survey instrument and attached it.

Also please use the attached version of our paper. Thanks to your request, I realized that "Planning" and "Implementation" were mixed up in the pages 8 and 9. I am putting together an erratum request for the change.

The survey was tested minimally for validity and reliability as it was applied in one institute. I would consider adding pretests for validation in your case. Hope this helps.

Best

Tugrul

-----Original Message-----

From: Deborah Bradford [mailto:dbradfor@mail.ucf.edu]
Sent: Monday, August 17, 2009 8:33 AM
To: Tugrul Daim
Subject: RE: Information Technology Diffusion in Higher Education

Dr. Daim:

Does this mean I have your permission to use the survey in my research?
Thank you for your assistance!!

Deborah J. Bradford
Associate Director, Regional Campuses Enrollment Services
University of Central Florida
12201 Research Parkway, Suite 101
Orlando, FL 32826-0060
Phone: (407) 882-2004
Fax: (407) 823-1399

From: "Tugrul Daim" tugrul@etm.pdx.edu
Sent: 08/17/09 12:12 PM >>>

Yes you have it ... thanks

Tugrul

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