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The Potential Use of Mobile Communication in the Classroom

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ABSTRACT

The emergence of technology into higher education has drastically altered the nature and quality of learning experiences. Over the past twenty years, the advancement of technology and the evolvement of computer hardware and software have shifted the needs and expectations of students and faculty in performing their educational duties. Recently, demands among higher educational communities have centered on the need for increased mobility with regards to technology. In the fall of 2008, a number of schools, namely the University of Maryland, Freed-Hardeman University, and Abilene Christian University, issued mobile hand-held devices to a group of incoming students in an effort to meet the demands for increased mobility in educational technology. With this technology, these institutions aim to enhance the learning environment as well as increase interactions between the students and the faculty.

The Technology Acceptance Model (TAM) attempts to examine user acceptance of new technology by measuring user perceived usefulness and perceived ease of use of the newly issued technology. A survey taken a Bryant University in Smithfield, RI in February 2009 studied the potential student acceptance of new mobile hand-held technology. Statistical analysis found that all TAM factors measured in the survey were required to be combined in order to achieve acceptable reliability levels on the Cronbach's alpha scale. Statistical analysis also found significant differences in the mean responses between the freshman/sophomore group and the junior/senior group of students. Also, significant differences were found between students with a Communication major and those students with Accounting, Actuarial Mathematics, and Marketing Majors.

INTRODUCTION

Educational institutions, specifically higher educational establishments, constantly seek new techniques and opportunities to improve the quality of education. In the past ten years, this goal has been aided by technological innovation. The introduction of computers revolutionized the education sector. With the application of computers and computer software, students obtained the ability to produce higher quality work more efficiently. Word processing programs allow students to easily edit their documents, eliminating the need to completely rewrite certain sections containing mistakes. Spreadsheet software allows students the capability to calculate and analyze figures in a fraction of the time while presenting this information in a clear and organized manner.

Though the development of computer hardware and software continued to address the needs of students, higher educational institutions continued to seek new opportunities. Mobility quickly became the focus of technological innovation. While a majority of students had access to desktop computers, whether located in accessible libraries, dorm rooms, or at home, a growing need for portability emerged. This void was met with the growth of laptop computer systems. Today, nearly all higher education institutions strongly encourage their students to obtain laptop computers prior to enrollment in classes. Laptops allow for increased mobility, permitting students to accomplish the same tasks desktop computers offer while eliminating the burden of remaining in a static location throughout the process. The launch of wireless Internet cards furthered technology mobility as students no longer required the attachment of Ethernet cords to their computers to gain access to the Internet.

While laptops have satisfied the needs for mobility in the recent past, it appears there is a rising need for increased mobility in the future. Although laptops have become progressively lighter as technology continues to advance, students find it strenuous to carry more with them to the classroom considering the oppressive weight of textbooks. The advancement of wireless and cellular devices presents a possible solution to this problem. Many technologically driven businesses and corporations have recently introduced devices that perform functions similar to laptops and computers. Unlike computers or laptops, however, these devices fit securely in the students' pockets, once again presenting a solution to the

mobility needs of educational institutions. A number of colleges and universities throughout the United States have already integrated these mobile devices into their curriculum. These institutions have taken the first steps towards providing their students the educational opportunities of tomorrow.

This paper will examine the opportunities Mobile Learning (m-learning) presents to higher educational classroom experience. M-Learning is the process of learning with assistance from a mobile, wireless device. For the purpose of this paper, hand-held mobile devices will refer to smart phone cellular devices such as Personal Digital Assistants, or PDAs, as well as select upscale mp3 players with Internet accessibility. Section I will discuss the advancement of technological innovation within educational institutions and the move towards mobility. Section II of this paper will look further into the integration process of new technology and how select schools have already accomplished this feat. Section III will examine the results of a survey conducted at Bryant University concerning whether or not students at this institution would be willing to participate and utilize these mobile devices. Lastly, recommendations will be made for higher educational institutions seeking to incorporate mobile devices into their respective curriculum.

Scope and Limitations

The purpose of this project is to provide preliminary information necessary for institutions seeking to incorporate mobile technology onto their campus. This paper will not examine the technical requirements necessary to incorporate such technology into an institution's curriculum. Although specific hand-held mobile devices will be referenced in sections of this paper, the capabilities and overall best choice of devices will not be discussed. The adoption of mobile technology requires the efforts of all members partaking in the educational process, including administrators, educators, and students. The following will focus primarily on the adoption and acceptance of mobile technology from the student perspective. Although faculty acceptance is an integral part of the adoption process, student acceptance will be the primary focus of this paper as students are the driving force behind why higher educational institutions adopt new technologies. This paper is designed to give an overview of the current state of

technological advances in higher education as well as pave the way for successful integration through campus acceptance of this technology.

LITERATURE REVIEW

While the topic of Mobile Learning may be a relatively new area, a growing amount of literature has emerged that deals with this subject matter. The following section will examine publications dealing with m-learning of the recent past.

In 2002, Hasan Altalib of George Mason University published a paper titled *The Use of Mobile-Wireless Technology in Education* exploring the growth and influence of technology in education. This paper identifies a "wireless revolution" taking place and how educational institutions have begun to embrace the benefits associated with mobile technology. Wireless devices and mobile learning allow for education to reach beyond the traditional walls of the classroom. Students have continuous access to course materials and assignments and possess the ability to easily communicate with fellow peers and educators with assistance from wireless mobile devices. A number of higher educational institutions have implemented the use of wireless technology to allow convenient access to educational resources as well as provide students with an additional technological resource to collect information essential to their learning.

A major impact influenced by the use of mobile-wireless technology is the process by which students learn and create knowledge with assistance from these devices. The paper discusses the notion of "constructivism learning" where knowledge is created and learned as a result of active participation rather than inactive acceptance of information, or passive learning. Mobile-wireless technology advocates active participation on behalf of students. Placing mobile devices in the hands of students encourages them to engage in increased collection of knowledge through research of Internet sources and allows access to class materials in order to promote individualized meaningful study routines. Students no longer consider themselves as passive elements of their education, but rather active participants, significantly contributing to class discussion and energetically communicating with other students to work towards the creation of knowledge and learning. (Altalib, 2002)

In April 2003, Ruth Reynard of *Campus Technology* published a report titled "Mobile Learning in Higher Education" discussing the advantages that are associated in learning with

assistance from mobile devices. Reynard identifies the change in learning environment that has occurred in the recent past and the need for educators to adapt their teaching styles to reach their students with new and meaningful methods. The author notes that faculty educators need to move from a traditional linear model of education, where information flows in a logical progression from educator to student, to a model that suggests a continuous cycle of information and connections.

The new model of education presented in this report applies directly to m-learning. Knowing information is readily available allows students to customize their learning experiences around a schedule that best fits them. Reynard suggests that students are more likely to understand material presented to them in a meaningful fashion. Providing students with more outlets with which to understand information allows for greater customization, ultimately increasing learning potential. The author also suggests that learning environments that incorporate mobile devices also allow students to maximize connections between faculty, other students, and the campus community as a whole. Mobile devices allow and encourage students to extend their learning experiences outside of the classroom walls and beyond allotted class time. Learning environments that integrate mobile technology, rather than limiting students to a traditional linear flow of information from the educator, encourage students to participate throughout the educational process. (Reynard, 2008)

In 2003, the *Journal of Computer Assisted Learning* published a report titled "Unlocking the Learning Value of Wireless Devices" which calls for further research regarding the realm of use and effectiveness of mobile technology in a classroom setting. This article identifies a number of advantages associated with the use of mobile devices in education. Wireless technology can be utilized as a tutor, supplying software applications to students in an effort to generate higher quality studying habits on the go. PDAs and Smartphones can also act as a tutee, as students learn to program their devices to better assist their efforts in education, simultaneously building technical skills necessary for the future. Mobile devices are used as effective tools in educational settings as well, allowing for more efficient collection and analysis of information leading to a more meaningful and enlightening educational experience.

Although there are numerous potential benefits inherent in the use of mobile wireless devices in an educational setting, this article states more research and knowledge is necessary in order to fully understand the potential of this technology. Connectivity is one of the issues expressed here, regarding access to Internet resources as well as communication between participants within the classroom, referring to both students and educators. Research concerning the effectiveness of learning with mobile devices is called into question regarding limited input opportunities of current devices and concerns of social communication breakdown. Further research relating to this subject matter is necessary for the successful integration and adoption of mobile technology into the classroom environment of tomorrow. The author concludes that the use of wireless mobile technology in education will succeed should future researchers aim to understand the effects these devices will have on student and teacher experiences in educational settings. (Roschelle, 2003)

In 2007, *EDUCAUSE* Quarterly published a report titled "Always Connected, But Hard to Reach" examining the views of higher educational students and the utilization of technology available to them. The author, Raju Rishi, states that colleges and universities find it troublesome to connect and relay information to students using mobile technology despite the fact that students are constantly using computers and other mobile devices, such as cellular phones. This report discusses how traditional channels of communicating with students have become ineffective. Colleges and universities conventionally rely on email announcements to communicate vital information to their student bodies. However, this has become an inefficient process as students may manage multiple email accounts, resulting in the message going unread for multiple weeks at a time. Landline phones are also quickly becoming an unproductive means by which to communicate with students as students may leave telephones unplugged or fail to respond to voicemail left on their landline phones.

This report proposes that colleges and universities alike must identify and recognize that the mobile revolution has arrived. Administrators need to realize traditional channels of communication have given way to more technologically advanced, and more effective means of communication. Students of the current generation view messages from different media sources in varying degrees of importance. For example, a message sent via a mobile device,

whether it is a text message or phone call, is perceived to be more urgent than a message sent via email. This message is sent to a source which is perceived as direct contact to the receiver as students constantly carry their mobile devices with them at all times. Mobile devices also allow students the ability to perform multiple tasks simultaneously, from accessing the Internet to communicating with peers and faculty. Students enjoy the freedom they gain with the use of mobile devices as they are not required to remain in one place while communicating with others or while media multitasking. This freedom can be applied to higher educational learning where students can learn class material in a way that best suits their current state of affairs. Today's students demand an interactive role in learning and communication, benefits achieved with the assistance of mobile devices. (Rishi, 2007)

In April of 2007, the Australian Flexible Learning Network published a report titled "A Guide to Working With M-Learning Standards" to inform teachers and developers of the various aspects of mobile learning and how to unite mobile technology and current teaching practices to develop a learning enriched environment. The guide helps to outline a number of key aspects essential to the successful implementation of a mobile learning environment, such as the capabilities of certain mobile devices and the pros and cons associated with particular equipment. The guide also devotes an entire section outlining different features of m-learning, such as the use of audio, video, and document files that can be accessed from mobile devices, and which files work best in certain situations. This guide dives deeper into the more technical characteristics of the network that must exist in order for mobile learning to be successful.

An important aspect of m-learning the guide helps to outline is how and when different players in the mobile learning venture know the efforts put forth have been successful. The different players identified are the learners, the teachers, and the developers. Learners recognize that m-learning is working when the experience enhances the context of the learning, it enables flexible and convenient use, materials and software are easily accessible and uncomplicated, and it allows users the power to use mobile devices they currently own. Teachers identify an efficient mobile learning environment when the approach enhances teaching strategy without sacrificing other considerations in the teaching approach, equal

learning materials are available across a variety of different media, and the environment responds to meet the diverse needs of students. Developers will recognize success in m-learning when the approach enhances the learning environment without significant technical difficulty, resources can be accessed through a variety different of media, and m-learning resources are made widely available to all. The guide provides a plethora of information for institutions seeking to establish initial goals in their quest to implement a mobile learning initiative. (O'Connel & Smith, 2007)

Electronic Devices in Schools (2008) includes a compilation of reports dictating on the advantages and disadvantages to allowing electronic devices in schools. The publication presents an argument for one side of the to mobile technology issue, followed by a counter argument regarding the same matter. This book allows its audience to examine the conflicting views that are associated with technological use in a learning environment. Electronic devices that are examined in this publication include mp3 players, such as iPods, traditional cellular phones, and Personal Digital Assistants, or PDAs.

As noted earlier, this publication examines both positive and negative aspects associated with utilizing electronic devices in an educational setting. Authors who discuss the negative aspects focus on issues such as cheating and loss of attention in class as a result of this equipment being present. However, dissenting authors present the counter argument by stating that such devices are visible signs of the changing environment. Students are showing great interest and fascination towards these devices and find new and inventive ways to store information on this hardware. The use of electronic devices for meaningful educational activities would hold students attention longer than traditional forms of teaching. A ban on cell phones or PDAs would drastically reduce communication between students and peers. This publication helps to identify that students at younger ages are becoming more technically knowledgeable than ever before and that educational institutions should not prohibit the use of PDAs or cell phones but rather encourage students and teachers to further their knowledge of technological innovations and use these advances to promote the learning styles of tomorrow. (Hamilton, 2008)

In 2008, the National Science Foundation published a report titled *Using Android in Education for Mobile Development* researching the newly released software package Android, developed by Google, for educational use. Android is the result of the Open Handset Alliance, a group of more than 30 technology and mobile companies whose purpose it is to cultivate open standards for mobile technology devices. The open nature of this software platform allows for a number of advantages in comparison to other available software packages. Android provides mobile technology users the basic features of any mobile software package, including contact lists, datebooks, and Internet browser. However, this software is equipped with a Software Development Kit (SDK) as well which allows users to create their own applications for personal use. This development is key to educational use as teachers and students are now allowed the opportunity to create educational applications supplemental to traditional course materials to enhance learning ability. Another important aspect identified in this report is the growing community of Android enthusiasts. This community can be accessed by educators as a resource in the creating of educational applications developed from the SDK if any problems present themselves. The release of Android by the Open Handset Alliance signifies the initiation of software development that can have a significant impact in the use of mobile device technology in education. (Baker & Noler, 2008)

In 2008, *Benefits and Compensation Digest* published an article titled "Tools and Techniques: From E-Learning to M-Learning?" examining the shift of education via technological resources from traditional desktop technology to mobile wireless devices. This article identifies the increase in usage of laptop computers, PDAs, cell phones, and smart phones as the source of why m-learning has experienced such significant growth in the recent past. The author states mobile devices are becoming the preferred tools of organizations with which to educate their professionals and existing staff as a result of the many technological benefits. These devices allow users the ability to conduct their education anywhere there is a point of connectivity and material can easily be referenced and shared between peers using mobile device technology.

The focus of this article may be directed towards young professionals, but the context should attract considerable attention from educational institutions. New wireless mobile technology is quickly becoming the preferred means of communicating education and training protocols of many companies and organizations. As a result, these organizations will encourage graduating students to quickly adopt and adequately utilize this technology to the best of their ability. Those students who have substantial exposure to current applications of mobile wireless technology will have a significant advantage over others who may have lacked the development of these skills during their undergraduate experiences. If organizations are going to encourage the use of mobile devices to further educate their staff, higher educational institutions should encourage exposure to similar technology during the education process to prepare students for employer expectations in the workplace. ("Tools & Techniques: From E-Learning to M-Learning?," 2008)

In 2009, *BusinessWeek* published an article titled "Get Cell Phones into Schools" discussing traditional styles of delivering education and the need for technology use in schools. The article argues school systems are committed to a style of teaching parallel to techniques used in the 19th Century. This style of teaching promotes a linear, source deliverance of information to students who are expected to memorize details and specifics, essential to a time where sources and publications were limited and not easily accessible. However, 21st Century tools, such as Internet search engines, allow users the ability to research any number of topics and deliver information in a fraction of the time, diminishing the reliance on the over-memorization of similar facts. Students already carry wireless mobile devices with them to the classroom. The authors of this article argue that rather than eliminating this technology from educational settings, allow students to utilize technology available to them. The emergence of these new technologies should be embraced by educators in an effort to enhance classroom experience and promote the educational efforts of their students. (Norris & Soloway, 2009)

In 2009, The Joan Ganz Cooney Center at Sesame Workshop released a statement titled "Joan Ganz Cooney Center Calls for New National Strategy to Invest in Mobile Learning and a Digital Teacher Corps" examining the results of a study focusing on the potential of mobile

learning. The article states that experts project mobile devices will be the primary means of Internet access by the year 2020. The increase on reliance of mobile devices has sparked influence at the Joan Ganz Cooney Center to examine the potential of mobile devices in an educational setting. The report released as a result of this study makes a number of recommendations concerning the integration of wireless mobile technology into the classroom, including a call to the government to invest in the research and development related to mobile technology and to establish a Digital Teachers Corps as a resource where teachers can educate and share experiences to prepare and promote educators to utilize mobile technology. While a number of obstacles present challenges as to the successful adoption of wireless mobile devices in education, considering a lack of information related to large-scale evaluation of success or the concern of this technology's disruptive nature, it is apparent the interest of mobile technology for educational use is becoming an issue of growing concern and gaining attention from a number of different organizations. (Lefkowitz, 2009)

The learning and teaching environment of higher educational institutions is continuously being altered and revolutionized as a result of the technological advances of the past decade. Clearly, the influence of technology has had a dramatic effect on the opportunities and expectations students have today of the communication of educational materials throughout class periods . This paper will examine the various opportunities higher educational institutions should be examining in order to provide students a unique and meaningful educational experience. The following will focus primarily on predicting student acceptance of a new technology presented to them in an educational setting based upon the theories identified in the Technology Acceptance Model (TAM), a model that forecasts whether users will accept a new technology based upon perceived usefulness and perceived ease of use of the new technology. This model will be examined further later in this paper. The overall goal of this project is to provide a basis on which higher educational institutions can rely to commence the integration of mobile technology into their current curriculum, to communicate relevant course material and information to students in a meaningful fashion.

PROGRESSION OF TECHNOLOGY AND EXPECTATIONS

The nature of everyday life has drastically changed as a result of the advances made in technology over the past twenty years by means of either direct or indirect influence. Numerous industries and organizations, especially those associated with higher education, have been significantly influenced by this rise in technology. The introduction of new equipment and software has ultimately lead to a change in students, faculty, and higher educational administrators' views and expectations of communication during class periods as well as outside the classroom walls. This section examines the advances in technology throughout the past twenty years specific to educational institutions and how these advances have continued to shape and alter the views of students and faculty alike.

The technological growth realized in the recent past lends itself back to the early 1990s. During this time period, the engineering of computer software, specifically computer operating systems, revolutionized the technological era. The introduction of Microsoft's Windows operating system and Apple's Macintosh operating system presented a more user friendly interface between an individual and computer program capabilities. (Yoffie & Slind, 2008) Students were being exposed to a tool which could create, store, and access documents and other data saved within the computer system's hard drive. Expectations regarding work and projects began to increase as faculty members identified and embraced the benefits associated with the use of computer technology. Demand for technology of this nature grew again as businesses began looking for students who were technologically knowledgeable in an effort to increase productivity and efficiency in the workplace. To continue attracting students to their respective establishments, administrators of higher educational institutions met these demands through an effort to provide students with computer access throughout campus.

Initially, computers supplied by higher education institutions were in the form of desktop computer workstations. These workstations were situated within campus libraries, computer lab rooms, and even in select classrooms where this technology would be utilized. Eventually, students even began purchasing desktop computers themselves for their own personal use within dorm rooms and off-campus housing locations. While computer exposure

continued to rise, so too did the development of computer software to complement this technology. Examples of this development could be found in the form of more efficient, user friendly operating systems to meet the growing demands and needs of both students and faculty. The campus community ultimately became reliant and dependent upon the tools and services provided by this technology in their efforts to complete everyday tasks and educational projects.

The increased student and faculty exposure to computers and computer software drastically changed the face of education, specifically with regard to communication between fellow peers and colleagues. Further development and progress resulting in the release of word processing and spreadsheet software increased expectations among faculty and administrators for students presenting their projects and research findings. The growth of the Internet may be regarded as one of the most significant factors in altering communication expectations among students, faculty, and administrators in higher education. Information became more readily available as Internet accessibility shifted from a luxury service to a commodity, presented to the campus community in the form of desktop computer workstations located throughout campus and, in certain situations, student dorm rooms. Students were now encouraged and better prepared to become more active participants in classroom discussions, sharing ideas and thoughts they had researched online. This shifted the classroom communication model from a more linear lecture style of education to an increased cyclical, feedback and response approach. Email created an additional avenue of communication between members of higher educational institutions. Discussion relating to concerns arising from class projects and content were no longer limited to scheduled class time and faculty availability to students on campus. Conversely, students embraced email technology in an attempt to enhance communication between themselves and their educators, empowering students to become more active participants in their educational goals both in and out of the classroom.

While efforts to increase technological innovations continued throughout the 1990s, the needs and expectations of members of the educational community appeared to surpass the resources available at the time. Desktop computers located in college and university libraries, labs, and

classrooms were not readily available due to high demand. Libraries and lab rooms were only available during specified times, limiting user access to computer terminals during periods which best situated their schedules. A significant investment was necessary in order to supply an ample number of computer workstations to the campus community. As the demand for computers continued to rise, considerable financial straits were experienced by educational administrators as they found themselves unable to meet this ever-growing demand for technology. (Oblinger & Rush, 1997)

Students who determined the purchase of their own personal computer for educational use as an alternative to institutionally supplied technology also experienced significant difficulties. Again, financial difficulties played a major role. Recommendations prepared by schools and universities for students seeking to purchase their own computer systems were estimated at costs ranging between $2,250 and $2,500 in addition to the already rising costs of higher education. ("Desktop Computing Recommendations for Penn: 1999-2000 Annual Update Guide for Local Support Providers," 1999) Even those students who possessed their own computers discovered problems with both software compatibility between their equipment and equipment located on campus, as well as connectivity issues due to a lack of funding provided for Internet ports in dorm rooms. Perhaps the most problematic issue facing members of higher educational institutions was the lack of mobility inherent in the use of desktop computer workstations. Users were forced to remain in a static location in order to reap the benefits associated with the use of computer technology. This lack of mobility, in addition to other limitations associated with desktops, restricted students and faculty to access necessary tools in an ideal environment.

In an effort to address a number of issues associated with the use of computers on campus, administrators began searching for alternatives to better accommodate user needs and expectations. One alternative that appeared to present a number of solutions was the smaller, more portable laptop computer. Laptop computers could perform the same tasks as their larger, desktop counterparts but offered increased user value in the form of improved mobility to accommodate daily routines. Colleges and universities studied and acknowledged the

change in expectations among their respective communities and ultimately decided to initiate a change in technology with a central focus on mobility.

Higher educational institutions began to introduce and offer laptop computers to their students and faculty as early as 1994. (Oblinger & Rush, 1997) Laptop programs were announced throughout a number of colleges and universities to facilitate the process of integrating this technology onto campus and into the classroom. A number of benefits were associated with an institutionally operated laptop program. All members of campus were provided the same equipment regarding the physical laptops themselves as well as the software preloaded onto these machines, minimizing any compatibility issues experienced through the desktop era. Many universities included the cost associated with the issuance of laptop computers into the current tuition, helping to lessen the financial burden associated with independent user purchases of similar technology. Most importantly, campuses became a place of constant connectivity. With the reduction of costs related to the continuous update of desktop computer technology, more financial resources could be allocated towards developing a network infrastructure throughout campus. Faculty and student needs and expectations were once again being met as a result of a technology shift towards the use of laptop computer systems.

While a number of benefits are provided as a result of laptop computer integration, they are often met with numerous costs as well. In order for the successful implementation of technology based program such as the laptop initiative seen throughout colleges and universities nationwide, a considerable amount of training among students, faculty, and administrators would be necessary. Often times this problem was resolved in the form of an extra computer class required of students, adding another requirement onto an already challenging and demanding course load. Also, a significant investment by educational institutions was necessary in order to achieve the desired benefits associated with laptop computers. In an effort to build a functional and reliable infrastructure for students and faculty, The University of Minnesota, Crookston spent an estimated $504,000 in 1997, an increase in spending of 14% from costs in 1996. (Oblinger & Rush, 1997)

Higher educational institutions, however, after weighing both the costs and benefits associated with laptop implementation, believed the benefits far outweighed the costs. The introduction of new technology allowed students to learn and develop technical skills required by various employers after graduation. Communication throughout campus was increased also as students, faculty, and administrators could remain in constant contact through tools such as email. Furthermore, classroom experience was improved according to the views of students and faculty members alike. A 1995 survey at UMC tailored toward assessing campus acceptance of laptop technology discovered that 78% of students believed notebook computers enhanced learning ability while 92% of faculty members believed this technology expanded learning opportunities. (Oblinger & Rush, 1997)

Unfortunately, as opportunities continue to present themselves as a result of technological advancement, the demands of students and faculty progressed at rates where current technology resources were unable to meet required needs. Although laptop computers revolutionized the classroom setting for higher education in the late 1990s and into the 21st Century, students and faculty began a trend of not utilizing this technology in the classroom. Though laptops were mobile and could be carried to classrooms and lecture halls, very few students actually brought their machines with them to take notes or refer to other electronic resources throughout class. A recent survey conducted at Freed-Hardeman University found that only 10-20% of students who had access to laptops actually brought their machines with them to class. (Bentley & Scott, 17 Feb 2009) The excess weight laptops created in addition to already burdensome course textbooks resulted in a trend where students ultimately began leaving their laptops behind. Classroom experience potential was once again limited as a result of mobility issues associated with technology in higher educational institutions.

The technological advancements of hand-held mobile devices in the recent past could potentially offer yet another solution to the mobility issues associated with technology use in campus classrooms. Innovations relating to cellular phones, specifically smart phones and personal digital assistants, or PDAs, have brought traditional computer tasks, such as Internet access, email, and even word processing and spreadsheet programs into the palms of technology users. Essentially, cellular phones and other related hand-held mobile devices

have become miniature computers that fit snugly in a person's pocket. The aforementioned survey at Freed-Hardeman University discovered that while students are not bringing laptops to classes, about 96% of students do carry cellular devices with them to all their classes. (Bentley & Scott, 17 Feb 2009) This presents an opportunity whereby colleges and universities can utilize these devices to enhance the educational experience of their students through the use of a new form of technology. While hand-held mobile devices may not completely replace laptops, both devices should be used in conjunction with one another to promote active learning both in and out of the classroom.

Although the views of students and faculty with regards to technology continuously change, the underlying reasons for this shift remain constant. To meet the technological skill demands of post-graduate employers, students are requesting increased exposure to new technologies through classroom experience and projects. A shift in higher educational learning from a traditional linear lecture style to a more collaborative, group oriented discussion has occurred. This learning environment challenges students to express their ideas on subject matters in an effort to encourage the internalization of procedures and knowledge. This shift has been aided as a result of a number of technological innovations of the past twenty years. (Reynard, 2008) A need for increased communication platforms among students, faculty, and administrators has led to technology adoption throughout colleges and universities. These demands and expectations will continue to shift as they have in the past, requiring higher educational institutions to continuously discover new resources which adequately meet the needs of both student and faculty members.

INTEGRATION AT HIGHER EDUCATIONAL INSTITUTIONS

Shifting expectations centering around technology constantly creates a need for the advancement and adoption of new educational techniques in an effort to generate meaningful learning experiences. As demonstrated in the previous section, demands for educational technology use have progressively concentrated around the utility of mobile equipment. While this demand was met through the issuance of laptop computers to students for a number of years, expectations continued to modify themselves, influenced significantly by the development and potential of new technologies. The recent demand for increased mobility has led a number of institutions to focus efforts and research toward the use of hand-held mobile devices. These hand-held devices, specifically those characterized as Smartphones, meet both the technological needs of students and faculty members while fulfilling the mobility needs of the current environment.

In the Fall of 2008, a number of colleges and universities initiated a movement towards a new educational era by issuing mobile hand-held devices to select groups of students on campus. Three examples of these institutions are the University of Maryland, Freed-Hardeman University, and Abilene Christian University. The following section will examine the programs these educational institutions have established in an effort to expose their students and faculty to the most recent technological advancements available. The discussion will focus around the goals and views of each program as well as address any issues or concerns the administrators at these colleges and universities have expressed to evaluate the success of adopting mobile hand-held devices into the higher education curriculum.

University of Maryland

Competition in the higher education sector has grown becoming increasingly aggressive over the past few decades as a result of the continuous rise of tuition costs and limited number of scholarships provided by colleges and universities to fund educational efforts. The University of Maryland recognized the competitive nature of this environment and saw technology as a driving point to attract new and intelligent students to their university. In the Fall of 2008, The University of Maryland launched the *Mobility Initiative Projec*t in an effort to "enhance the student education experience by examining the role that mobile Internet access devices

might have in the future of instruction, learning and the social growth of students on campus." (OIT, 2008) Students who received merit scholarships were provided either an Apple iPhone 3G or iPod Touch; the choice was left to the students receiving the equipment. Administrators at the University of Maryland believe offering this equipment to scholarship recipients would act as a selling point in the recruitment process for the University. Providing students with the latest technology available in education would attract a new breed of students eager to learn and experiment in enhanced learning environment. (OIT, 2008)

In addition to serving as an attraction point for University of Maryland admissions, the pilot *Mobility Initiative Program* has numerous aspirations for its first year of inception. The devices issued to this small group of students will contain various preloaded software specifically designed to enhance both classroom and campus-wide experiences. A version of the University of Maryland's web portal will be included on these mobile hand-held devices. With this software, students will be able to verify class schedules, access important University news and information, as well as view grade reports right from the palm of their hands. The devices will also be utilized as classroom clickers, allowing all students in the classroom to voice their opinions on questions posed throughout the class, thus resulting in yet another avenue of communication produced by these devices. The *Mobility Initiative* at the University of Maryland has a number of goals it wishes to achieve throughout the adoption process of the program. Among these goals includes enhancing classroom learning experience, promoting increased interaction between faculty members and students, and to promote the University of Maryland's world class status through innovation and technology. ("Mobility Initiative," 2008)

As is common in any pilot program, a number of problems and setbacks needed to be addressed in the early stages of the Mobility Initiative in order for the program to realize the success it has experienced thus far. One of the major difficulties encountered through this integration process was the adoption of hand-held mobile devices for educational use, especially among faculty members. Many professors in higher education, particularly those tenured professors who have taught for a long period of time, prefer the traditional chalk and lecture style of teaching because this approach is so ingrained in their teaching methods.

Introducing new technology and teaching methods creates change and discomfort in the minds of professors, compelling them to reject these new techniques and maintain their original teaching styles. In an interview with Donald Britt Reynolds, Associate Director of Undergraduate Admissions at the University of Maryland, the notion of faculty acceptance of mobile hand-held technology use in the classroom was discussed. Reynolds expressed how very few faculty members had embraced mobile devices to enhance classroom experience, with only 15 professors willing to receive these devices at the inception of the program. Faculty members believed these devices would serve to be more of a distraction to classroom time than actually enhance the learning experiences of their students. (Reynolds, 19 Feb 2009)

Another problem arising from lack of adoption among faculty members is the limited use among students who have received mobile hand-held devices. As noted earlier, only a select group of approximately 150 students were given the opportunity to receive these mobile devices. With such a limited amount of students possessing physical access to these devices, coupled with a limited number of faculty members adopting the *Mobility Initiative* initially, not all classes would incorporate this technology into the curriculum. According to Reynolds, student participation appeared to have decreased as the school year progressed, which may have been the result of a lack of reward since this program encompassed a significant portion of students' time and efforts yet they received no additional credit for their participation. Competing demands of other classes was another issue discussed throughout this interview. If other classes and faculty members are not actively participating in the *Mobility Initiative,* students will not receive the full potential benefits of their mobile devices, resulting in a decrease of utilization among the student participants. (Reynolds, 19 Feb 2009)

The views and efforts exerted by those involved in the *Mobility Initiative* at the University of Maryland should not go unnoticed, however. Administrators leading this initiative have advanced the University into a new era of teaching methods and enhanced classroom experience. Through constant feedback from student and faculty focus groups and surveys, the University of Maryland will continue to shape and create new opportunities to improve faculty-student communication both inside and out of the classroom as well as develop more efficient flows of information to keep the campus connected at all times. The University of

Maryland has taken the initial steps necessary to set itself apart as a technologically advanced educational institution today and well into the future.

Freed-Hardeman University

Recognizing and understanding the technological needs and expectations of students in today's educational environment, administrators at Freed-Hardeman University in Tennessee made the decision to invest in technology for the purpose of enhancing the educational experiences of both its faculty and students. In the Fall of 2008, Freed-Hardeman University launched the iKnow initiative in an effort to "understand the technological needs and expectations of our students and faculty so that we can effectively use information technology to enhance instruction and improve student learning outcomes." ("iKnow Initiative," 2008) All incoming freshmen in the Fall of 2008 received an Apple MacBook and their choice of either an iPhone or iPod Touch. Advisors and administrators of the *iKnow Initiative* anticipate the integration of this pioneering technology will help to differentiate Freed-Hardeman and its students as leaders and innovators for tomorrow's higher educational learning styles. ("iKnow Initiative," 2008)

Administrators overseeing the *iKnow Initiative* at Freed-Hardeman have developed a number of uses and objectives for this technology integration process. One of the major objectives of this program was to level the playing field among students. For the purpose of this research, a phone interview was conducted with John Bentley, Chief Information Officer at Freed-Hardeman University, and Mark Scott, Assistant Professor of Management Information Systems at Freed-Hardeman University. In this interview, Bentley discussed the concerns expressed in a Speak Up survey, conducted by Project Tomorrow, of faculty members centering around access to related technology equipment. Issuing equipment to students would ultimately diminish these concerns and place all students at an equal advantage to one another. Another point expressed by Bentley was the fact that nearly 96% of students at FHU carried cellular devices with them to all their classes as opposed to only 12% of students taking their laptops to class.(Bentley & Scott, 17 Feb 2009) Administrators at Freed-Hardeman University wanted to discover a way to take advantage of a technology students

were already carrying with them to class. The launch of a hand-held mobile device initiative appeared to answer many of these concerns.

The introduction of the *iKnow Initiative* to the Freed-Hardeman campus follows that of a phase implementation. According to Bentley, each member of an incoming freshman class would receive both a MacBook and the mobile hand-held device of their choice. In addition, nearly one fourth of the faculty members would also receive similar equipment in order to integrate this technology into their teaching styles. In the first year, these faculty members were compiled primarily of those who instructed the introductory freshman courses. Upperclassmen were also given the opportunity to participate in the iKnow initiative, but participation was not considered mandatory. Bentley explained how sophomores, juniors, and seniors had already purchased equipment in prior years and how the freshman class stands to receive the maximum benefit as a result of this program. A more widespread implementation process of the initiative, issuing equipment to all freshmen rather than a select group, creates the expectation that this technology will be used throughout an individual's educational career through this particular institution.

The introduction of new technology into the curriculum of Freed-Hardeman University experienced a few difficulties along the way. Again, one of the major issues surrounding this topic was the adoption of this technology into the classroom, especially by faculty members. As noted by Mark Scott, the views and opinions of faculty members ranged from those who embraced technology and hit the ground running with this initiative, all the way to those deep-rooted in traditional chalk board lecture styles of instruction. Fewer problems were experienced on the student segment of the integration process as the younger generation has been surrounded by new technology throughout their lives. One other problem expressed by Scott was the transition of the University from a Windows based environment to a Mac based environment. The MacBook and Apple mobile devices run on an Apple OS X operating system, different from the Microsoft Windows operating system to which professors were accustomed. The need to educate faculty members on the use of this equipment and software posed an integration problem for FHU. The potential benefits of this equipment would not be

realized without proper knowledge on how to utilize the technology. (Bentley & Scott, 17 Feb 2009)

Freed-Hardeman University has taken a more active, hands-on approach in the process of integrating mobile hand-held devices into the curriculum. The campus-wide issuance of mobile devices will be completed at the end of a four year implementation process. When this is complete, the entire Freed-Hardeman campus will have constant access to educational tools and information as well as the ability to connect with other students and faculty members at any time from their portable mobile devices. The iKnow initiative at Freed-Hardeman University will surely create new and efficient avenues of communication through its campus and enhance learning experiences with the aid of innovative technology available today.

Abilene Christian University

Perhaps one of the leaders of the integration of mobile hand-held devices into the higher educational curriculum is Abilene Christian University in Texas. Administrators at ACU focused on the power of communication throughout educational experiences and the potential benefits associated with mobile devices. The vision of the *Connected Initiative* at Abilene Christian University is to "connect learners through engaged, collaborative, distributive, integrated, and evaluative models, all of which combine to produce a profoundly connected learning experience." ("ACU Connected: Mobile Learning," 2009) In the Fall of 2008, incoming freshmen were given the choice of whether to receive an Apple iPhone or iPod touch, similar to the distribution processes seen at both the University of Maryland and Freed-Hardeman University. With assistance from their new mobile devices, students now possessed the ability to access critical information about their courses as well as connect with new friends and peers throughout campus. ("ACU Connected: Mobile Learning," 2009)

One of the major objectives of the *Connected Initiative* is to ultimately enhance the learning experiences and instruction techniques that occur both in and out of the classroom. In an interview with George Saltsman, Director of Educational Technology at Abilene Christian University, Saltsman acknowledged today's society as one characterized as being "information rich." The Internet provides a seemingly infinite amount of information

accessible simply by typing in a few key words or phrases into a search engine, such as Yahoo or Google. With the help of mobile hand-held devices, the power of the Internet now rests in the hands of every student in the classroom. Students can search for relevant information associated with class discussion and offer further insight and analysis to the subject matter more easily and efficiently with support from their iPhone or iPod Touch. (Saltsman, 18 Feb 2009) This constant inflow of information from the Internet is just one of the many ways administrators at Abilene Christian University foresee these hand-held mobile devices enhancing classroom experience and furthering learning and understanding of class material.

Communication is the essence behind a successful educational experience, especially at higher educational colleges and universities. Saltsman discussed how information collected from incoming students found nearly 98% of students at ACU had cell phones. After considering the recent progression of technology, Saltsman and other administrators realized the trend of cellular devices to increasingly include more media features, such as cameras built into the phone and Internet access. Over time, these devices have become miniature computers that fit in the pockets of students who carry them to class every day. These media features possess an inherent value which can enrich classroom time and result in more meaningful learning experiences. Saltsman acknowledged the power of mass communication and the influence websites such as YouTube have had in reaching a large amount of people and the potential impact on society. Saltsman and Abilene Christian University realize businesses and employers have recognized this impact as well and have taken the obligation to educate their students on these issues to better prepare them for post-graduate employment opportunities. (Saltsman, 18 Feb 2009)

Faculty members once again appear to be the leading force in opposition to the adoption of hand-held mobile devices into the curriculum at Abilene Christian University. Students of the younger generation view these devices as tools to access important information ranging from lecture podcasts to grading information. Faculty members, however, view a higher risk associated with the utilization of mobile devices in the classroom. Saltsman explained that faculty members are responsible for the education and communication of course material to

all students and these devices pose a potential distraction in the classroom which could ultimately hinder classroom performance. (Saltsman, 18 Feb 2009) Of course not all faculty members share these same views, but it's interesting to note the varying levels of acceptance not only at ACU, but across the board of all colleges and universities. Those faculty members who are technologically driven individuals will continue to embrace the technology and may educate others on the potential benefits and disadvantages associated with these new devices. The leading resistance in new mobile technology learning initiatives is the adoption among faculty members in higher educational curriculums.

TECHNOLOGY ACCEPTANCE MODEL

User acceptance of new technologies is perhaps the most important variable to examine during the adoption stages of a new technological initiative. The success or failure of any program is directly dependent upon whether or not the intended users believe these new technologies will increase their efficiency to perform necessary tasks. Predicting whether users will conform and accept new technology can be a difficult undertaking as a number of variables could ultimately shift users' opinions one way or another. In 1989, Fred Davis at the University of Michigan developed the Technology Acceptance Model (TAM) which claims to identify and help predict whether users will successfully adopt new technology presented to them. (Davis, 1989) The TAM suggests user acceptance is most dependent upon two basic variables

- Users' Perceived Usefulness of New Technology
- Users' Perceived Ease of Use of New Technology

A number of studies have been performed in recent years which help to reaffirm the initial findings of Davis' TAM as relevant to the present time. In 2002, a study at George Washington University examined the relevance of Davis' TAM as it applies to the adoption of electronic collaboration technology today. The study concluded the Technology Acceptance Model still applies and is relevant to user acceptance and adoption of technology in the present environment. This research also indicates that increased usage of a new technology among users will improve their perceived usefulness and ease of use, thus resulting in successful adoption of new technology. (Dasgupta, Granger, & McGarry, 2002) In 2007, a study was published which examined both student and faculty acceptance of campus portals using the TAM as a framework in measuring the results. The study found acceptance of new technology requires users to perceive the technology as both easy to use and be useful as well. While the presence of one variable in essential, it alone is not enough to ensure successful adoption of new technology. (Abuhamdieh & Sehwail, 2007) The research performed throughout these studies suggest the theories expressed through the Technology Acceptance Model, despite its introduction twenty years ago, remain relevant regardless of the

advancement of technology and the shifting expectations of technology users in the present environment.

When making a large investment in new technology, administrators want to ensure successful implementation of this technology and reduce any uncertainty as to whether potential users will ultimately adopt the new equipment. The Technology Acceptance Model provides a foundation from which these administrators can determine whether or not users will be more apt to adopt new technology. Gauging potential users perceived usefulness and ease of use of this technology can provide relevant information regarding whether or not administrators should make such a significant investment. Applying analysis of this manner may result in more informed decision making among administrators, which could ultimately result in whether or not significant technological investments should be made.

With the potential benefits inherent in the Technology Acceptance Model which may lead administrators to develop more informed and rational evaluations of the community, it would seem apparent many institutions and organizations would apply this model to reduce the fear of making an incorrect decision. However, the opposite was the case with regards to the University of Maryland, Freed-Hardeman University, and Abilene Christian University and their efforts of implementing hand-held mobile technology into their respective curriculums. Administrators from these educational institutions did attempt to determine potential users' behaviors through interviews and surveys. However, this process was purely a gathering of information and did not rely on the findings of a model such as the TAM. In fact, administrators at these respective universities, while they admitted they had heard of the Technology Acceptance Model, also declared they needed to research this theory in order to discover the underlying assumptions associated with the TAM. So, while the benefits associated with implementing the TAM to assess potential user acceptance of new technology appear valuable, those higher educational institutions who have implemented this new technology did not apply this theory to reduce their uncertainty of whether their investment was a smart decision.

Perhaps the reason behind why the TAM was not used to determine potential users' acceptance of new technology at these institutions is the overall lack of knowledge about this

theory. Surely if these universities had more knowledge and information regarding this theory, administrators would have applied the TAM in rationalizing such a significant investment. While each institution had their own respective reasoning behind why they decided to implement a mobile learning initiative, data supporting their decisions would surely have been greatly appreciated. More information and knowledge concerning the Technology Acceptance Model needs to be conducted in order for higher educational institutions, as well as a range of other organizations, to take advantage of the benefits associated with this theory.

The following section will utilize the Technology Acceptance Model and apply it to the students of Bryant University in Smithfield, RI. The purpose of this study is to gauge student acceptance of a new technology at a higher educational institution which is currently up to date in terms of technological advancements.

EXAMINATION OF TECHNOLOGY ACCEPTANCE MODEL: BRYANT UNIVERSITY

General Procedure

A survey consisting of various questions was administered to a range of students at Bryant University with the goal of gathering information concerning student demographics, current student technology use, and student acceptance to a new technology based on the findings of the Technology Acceptance Model. An example of the survey administered to these students can be found in *Appendix A.* The final section of the survey, which was to gauge student acceptance to new technology based upon the theories expressed in the TAM, required students to read a portion of a New York Times article entitled ""Welcome Freshman, Have an iPod" written by Jonathan D. Glater and published on August 12, 2008 which described the mobile initiative projects of a number of schools, including Freed-Hardeman University and Abilene Christian University. The students were then required to rate a number of questions aimed to gauge the students' perceived ease of use and perceived usefulness of this technology. These questions were slightly altered from survey questions included in 2007 study entitled "Elucidating User Behavior of Mobile Learning: A Perspective of the Extended Technology Acceptance Model" written by Jen-Hung Huang, Yu-Ru Lin, and Shu-Ting Chuang. (Huang, Lin, & Chuang, 2006) The questions which measured Perceived Ease of Use (PEU) and Perceived Usefulness (PU) were as follows:

- **PEU1**- Using this technology would save me a lot of time.
- **PEU2**- Using this technology would require a good amount of my effort.
- **PEU3**- This technology would not be easy to use.
- **PU1**- This technology would not enhance my learning experience.
- **PU2**- My interactions using this technology in a classroom setting would be understandable.
- **PU3**- Overall, this technology would be useful.

The students were also asked to rate whether they felt this technology would add no value to class time, act as a supplement to class time, or act as a substitute for class time.

Data Collection

The data used in this study was collected in February of 2008 from various students at Bryant University. The survey was administered to students in their dorm rooms who immediately completed the survey and handed the results back to the researcher. The researcher attempted to collect as many survey respondents as possible (n=185) and was available on site if respondents had any questions. In an attempt to receive respondents of all class levels, surveys were administered in at least every dorm building and residence area throughout Bryant University. All data was collected in person.

Participants

Respondents of the survey were all current undergraduate students living on campus at Bryant University in Smithfield, RI. In all, 185 participants completed a survey for this research. Participant class level included freshmen (n=36, 20% of sample), sophomores (n=60, 32% of sample), juniors (n=42, 23% of sample), and seniors (n=47, 25% of sample). With regards to gender, 54% of the sample were men (n=100) and 46% were women (n=85). Throughout the sample, 9 different declared majors were identified in the survey data. These declared majors included Accounting (n=40, 22% of sample), Actuarial Mathematics (n=11, 6% of sample), Communication (n=7, 4% of sample), Economics (n=4, 2% of sample), Finance (n=37, 20% of sample), International Business (n=4, 2% of sample), Management (n=28, 15% of sample), Marketing (n=32, 17% of sample), and Psychology (n=6, 3% of sample). Also, a group of students replied their declared major as Undeclared (n=16, 9% of sample).

In terms of current technology use among these students, a majority of students declared they spend between 1-3 hours using a computer each day (n=48, 26% of sample) and 3-5 hours using a computer each day (n=107, 58% of sample), with only about 25 students responding they use the computer more than 5 hours each day (14% of sample). With regards to laptop use in a classroom setting, 56 students (30%) of students say they never bring their laptop to class, 30 students (16%) say they bring their laptop to class at least one day per week, 48 students (26%) say they bring their laptop at least twice a week to class, 28 students (15%) say they bring their laptop at least 3 times per week, and 23 students (12%) declared they bring their laptop 4 or more times to class each week. Finally, concerning which cell phones students own today, 2 students (1%) say they have a simple phone which only makes phone

calls, 87 students (47%) say they have cell phones with phone calling and text messaging capabilities, 67 students (36%) declared they have a phone with text messaging and limited Internet capabilities, and 29 students (16%) responded they own a PDA with Internet and emailing capabilities.

Survey Content and Measurement

The survey used in this research was compiled by the researcher with assistance from a number of sources. The first section of the survey aims to gather demographic information about the student, inquiring about class level, sex, and their declared or intended major study. The second section of the survey examines students' current use of technology available to them on a regular basis. This section examines factors such as time spent on a computer each day, how many times a laptop is brought to class each week, and the type of cell phone students own today. The last section of the survey attempts to examine student acceptance to a new technology according to the theories set forth by the Technology Acceptance Model. After reading the *New York Times* article, students were asked to rate the questions referenced above from *Strongly Disagree* to *Strongly Agree*. Three questions aimed to measure perceived ease of use and three others aimed to measure perceived usefulness. The responses were measured on a scale of 1-5, 5 providing a response which strongly perceived the technology to be easy to use or useful, 1 providing a response which strongly perceived the technology to not be very easy to use or useful, dependent upon the question posed. The data was collected and entered into an SPSS file for statistical analysis. Complete survey responses are summarized in *Appendix B.*

Hypotheses

Surely not all respondents to the survey will have a favorable perceived view of new technology. The purpose of this study is to help determine which variables affect a student's perceived ease of use and perceived usefulness of a new technology. One variable to be measured is how a student's class level affects their perceived views of a new technology. In an a recent interview conducted for the purpose of this research with John Bentley, CIO at Freed-Hardeman University, Bentley described the current higher educational environment as one in which students entering colleges and universities today have always grown up

surrounded by the Internet and constant advancement of technology(Bentley & Scott, 17 Feb 2009). As a result, one hypothesis was determined from this:

> *H_1: Lower-class students will be more willing to accept new mobile technology than upper-class students.*

Another factor which will be examined through this study is whether a student's declared major affects their perceived view and ultimate acceptance to a new technology. Students often choose their intended studies dependent upon their passions and interests. Many fields of study currently incorporate a significant portion of technology into the classroom experience, whereas other completely ignore available technology as it may not be relevant to classroom discussion. This brings about another hypothesis:

> *H_2: Student's declared major will help to predict whether they will be more accepting to a new technology in the classroom.*

Results

In order to run statistical analysis with regards to the data collected from the survey, the survey results which posed questions about perceived ease of use were combined and an average determined for each respondent. The same process was performed for perceived usefulness for each respondent as well. In an effort to produce effective statistical analysis, reliability tests were run on both of these factors to determine whether these survey questions performed similarly to one another. Reliability of the perceived ease of use scale, as assessed by Cronbach's alpha, was .358. Reliability of the perceived usefulness scale, as assessed by Cronbach's alpha, was .327. Both of these reliability results produced reliability levels significantly below acceptable levels. An alternative approach was selected which combined all questions measuring perceived ease of use and perceived usefulness, which, after closer examination of survey questions, will be referred to as perceived efficiency. Reliability of the perceived efficiency scale, as assessed by Cronbach's alpha, was .619. This reliability result produces a level which is acceptable for this research. Perceived efficiency, the variable created from the combination of perceived ease of use and perceived usefulness, will be the variable examined among the hypotheses.

The first hypothesis to be examined is *H_1: Lower-class students will be more willing to accept new mobile technology than upper-class students.* A one-way analysis of variance (ANOVA) was computed to test *H_1*. Class level was selected as the independent variable whereas perceived efficiency was the dependent variable. Perceptions of efficiency were found to vary as a function of class level [$F(3, 184) = 7.323$, $p < .000$]. Post Hoc follow up analyses (Tukey HSD) indicated that freshmen perceived significantly greater efficiency than juniors, while sophomores perceived significantly greater efficiency than juniors and seniors. Juniors perceived significantly less efficiency than freshmen and sophomores, while seniors perceived significantly less efficiency than sophomores. No significant differences were found between freshmen and sophomores, as well as between juniors and seniors.

TABLE 1

Means and Standard Deviations for Perceived Efficiency
As a Function of Class Level

Class Level	Efficiency
Freshmen	$3.75^{a,b}$ (.681)
Sophomores	3.82^{a} (.483)
Juniors	3.42^{c} (.441)
Seniors	$3.50^{b, c}$ (.357)
Total	3.64 (.517)

Note: Cell Ns range from 1 to 4. Scores could range from 1 (low) to 5 (high). Numbers in parentheses are cell standard deviations. Means with any superscript letters in common do not significantly differ ($p < .05$)

From the results expressed in TABLE 1 above, *H_1* that perceived efficiency differs as a function of class level is supported. Those respondents at lower class levels perceived greater efficiency than those respondents at higher class levels.

The second hypothesis to be examined was *H_2: Student's declared major will help to predict whether they will be more accepting to a new technology in the classroom.* A one-way analysis (ANOVA) was computed to test *H_2* that perceived efficiency would differ as a function of declared major. Student declared major was selected as the independent variable and perceived efficiency mean was the dependent variable. Perceptions of efficiency were found to vary as a function of declared major [$F (9, 184) = 2.323$, $p < .01$]. Post Hoc follow up analyses (Tukey HSD) showed that Accounting, Actuarial Mathematics, and Marketing majors perceived significantly greater efficiency than Communication majors. No other significant differences were observed.

From the results expressed in TABLE 2 below, *H_2* that perceived efficiency differs as a function of student declared major is supported slightly. Students with declared majors of Accounting, Actuarial Mathematics, and Marketing perceived greater efficiency than students with declared majors of Communication.

TABLE 2

Means and Standard Deviations for Perceived Efficiency
As a Function of Declared Major

Declared Major	Efficiency
Accounting	3.69[a] (.535)
Actuarial Mathematics	3.94 [a] (.559)
Communication	3.00[b] (.577)
Economics	3.21 [a, b] (.250)
Finance	3.64 [a, b] (.425)
International Business	3.75 [a, b] (.289)
Management	3.58 [a, b] (.578)
Marketing	3.72 [a] (.445)
Psychology	3.72 [a, b] (.327)
Undeclared	3.54 [a, b] (.576)
Total	3.64 (.517)

Note: Cell Ns range from 1 to 10. Scores could range from 1 (low) to 5 (high). Numbers in parentheses are cell standard deviations. Means with any superscript letters in common do not significantly differ ($p < .05$)

Discussion

The advancement of new technology has had a significant impact on our society, especially when considering the impact on higher education. Incoming students and a number of faculty members continuously alter their expectations as new advancements in technology are introduced. These shifting needs and expectations require administrators to seek new technologies in an effort to meet the demands of both students and faculty. Colleges and

universities want to be certain their campuses accept and adopt these new technologies as this effort requires a significant investment. Though the Technology Acceptance Model theorizes potential users will accept and adopt a new technology based upon a user's perceived usefulness and perceived ease of use, little research has been conducted to determine which group of students would be more accepting to a new technology.

This study aimed to examine how students differ on a number of different variables and whether these variables helped in determining whether or not these students would be more accepting to a new technology. The first attribute examined was perceived efficiency differences as a function of student class level. As mentioned previously, John Bentley discussed an environment where incoming students have never known a technological life without the Internet available to them at their command. Younger generations today have constantly been surrounded and bombarded with the latest and greatest technologies available. While the upper-class college students have been exposed to a wide array of technology, the younger generation always appears to have the upper hand as they receive the same technology at younger ages. For this reason, the hypothesis was formed that lower-class levels will be more willing to adopt this technology than upper-class levels. When both questions posed for PEU and PU were combined, the perceived efficiency means for freshmen, sophomores, juniors, and seniors were 3.75, 3.82, 3.42, and 3.50, respectively. The statistical analysis found a significant difference between the sophomore and junior mean. Also, homogeneous subsets linked freshmen and sophomores together as well as juniors and seniors together on this matter. As a result, it appears there is a difference between lower-class levels and upper-class levels, where both freshmen and sophomores may be more willing to adopt this new technology more so than juniors and seniors.

Another aspect which was examined through this study was whether or not declared major was an indicator as to whether students would be more willing to accept and adopt a new technology. The means of the combined overall questions to gauge perceived efficiency ranged from a high of 3.94 among the Actuarial Mathematics majors, to a low of 3.00 among the Communication majors, with a median score of 3.64. Statistical analysis discovered significant differences with regards to Communication majors when compared with

Accounting, Actuarial Mathematic, and Marketing majors. The Communication major mean score was much lower than the responses provided by students who were declared majors of these other three fields. While the data does not determine which major is more accepting to a new technology with any statistical significance, the data points out those students who have declared Communication as their major may be least willing to adopt this technology. Communication has a lot to do with face-to-face interaction, reading non-verbal cues and providing instant feedback during conversation. Adopting a mobile hand-held technology device could potentially eliminate a number of non-verbal cues. The elimination of this aspect of communication would greatly hinder conversation from the standpoint of a Communication major. Thus, this may explain why Communication majors may not be willing to accept and adopt a technology of this nature.

The 2007 study conducted by Abuhamdieh and Sehwail, referenced in the *Technology Acceptance Model* section of this paper, discussed the importance of a user perceiving a new technology to be both easy to use and useful in order for that user to fully accept and adopt the new technology. While at least one of these factors is necessary for adoption, it is not sufficient enough for the user to completely accept and use the new technology. This study initially looked to examine both perceived ease of use and usefulness as completely different factors in determining whether a segment of students would be more willing to adopt a new technology. However, after running reliability tests for the means of each factor separately, the Cronbach's alpha reliability figures proved to be well below acceptable rates. Nevertheless, when both factors were combined and means determined at the new efficiency variable level, Cronbach's alpha reliability figures improved significantly to acceptable levels. What this finding determines is that when students were taking the survey, they determined all questions to measure one factor. After further examination of these survey questions, this potential factor could be described as perceived efficiency, which is a combination of both perceived ease of use and perceived usefulness. This finding is consistent with the Abuhamdieh and Sehwail finding where both factors are necessary in order for a potential user to fully accept and adopt a new technology.

The findings of this study need to be examined with caution. First, the surveys administered in this research were not distributed to a random sample, but rather a convenience sampling which examined respondents who were present in their dorm rooms during the administration process. This method of conducting a survey could potentially exclude a segment of students who had work or other obligations during this time, such as membership on a sports team or any other extracurricular activity. Also, the survey was administered at Bryant University located in Rhode Island exclusively, a private university which includes an undergraduate enrollment of 3,300 students. The opinions and behaviors of students on this campus may differ significantly from those of other colleges and universities. Thus, the results expressed above may only be applicable to students at Bryant and may not be representative of the entire college population of the world. Also, a number of previous studies examined perceived usefulness and perceived ease of use after users have been exposed to this technology, whereas this study examined these factors prior to potential user exposure, which relies heavily on their past experiences with similar technology. This variable could significantly influence the results of this research.

While the results of this study have identified potential characteristics for determining student acceptance towards a new technology, further research is still necessary. Another important factor in determining campus-wide acceptance of a new technology includes the opinions and attitudes of the faculty. Future research should examine which factors have significant influence in determining whether faculty members are more willing to accept and adopt a new technology. Also, future research should expand the findings of this study. The respondents in this research came from a private university with a limited number of offered majors. Perhaps the examination of a much larger institution which offers a wider variety of majors to study would identify more significant differences as to whether declared major plays a significant role in determining student acceptance of a new technology. Future research should also continue to identify student characteristics which help determine their acceptance as well. Research should also examine the factors of perceived ease of use and perceived usefulness of this technology following user exposure to hand-held mobile technology to determine the validity of the results of this research.

CONCLUSION

Technology continues to be an important aspect of any higher educational experience. Continuous technology advancement continues to alter the needs and expectations of faculty and students alike. The advancement of technology presents new areas of improvement, and opportunities to enhance classroom experience both in and out of the classroom. Computer software allows for more efficient editing techniques through word processing programs or greater analysis of data collections in the form of spreadsheet programs. Over time, student and faculty needs shifted to a call for increased mobility as stationary desktop computers proved inefficient at times when needed for certain assignments. This need was met by the issuance of laptops to members of the community, appeasing the demand for increased mobility at least for the time being. Students and faculty members could now perform computing tasks at their convenience wherever they desired. Again, mobility became a key concern as laptops were viewed as heavy and excessive weight in addition to bulky textbooks. A potential solution to this concern presents itself in the advancement of hand-held mobile technology which has produced much lighter and more portable devices which can perform many similar tasks to desktop computers and laptops.

A number of schools in the fall of 2008 issued hand-held mobile devices to a group of incoming freshmen, which mostly consisted of iPhones or iPod touches. These schools, which included the University of Maryland, Freed-Hardeman University, and Abilene Christian University, aimed to improve their technology availability on campus by providing students with a tool to communicate with peers and faculty as well as prepare themselves better for classroom discussion. One common problem found among these institutions was the notion of certain faculty pushback. Some faculty members, who enjoy learning about new technology, embraced these devices and used them frequently throughout class time, whereas other professors remained steadfast to their classic teaching techniques and did not utilize the devices in the classroom.

The Technology Acceptance Model (TAM) was studied and brought about during 1989 in a study conducted by Fred Davis. Davis theorizes through the TAM that user acceptance to a new technology is dependent upon user perceived usefulness and user perceived ease of use

of the new technology. This theory could be directly applied to the situations at these higher educational institutions to determine whether students and faculty members have favorable views toward this technology and would thus accept and adopt these hand-held mobile devices. However, administrators at these institutions did not take advantage of the potential benefits associated with the TAM theory. Research based on this theory applied to user acceptance to new technology could offer significant information regarding the success of these mobility initiatives.

A study conducted at Bryant University in Smithfield, RI attempted to examine potential user acceptance to new hand-held mobile technology as a function of both student class level and student declared major. The survey results discovered that freshman and sophomore class levels perceived higher efficiency with regards to hand-held mobile technology than compared with juniors and seniors. Also, research results discovered that Communication majors perceived significantly lower levels of efficiency of hand-held mobile technology when compared to Accounting, Actuarial Mathematics, and Marketing majors. Although caution should be taken when applying these results, these findings could act as building blocks for a number of higher educational institutions seeking to improve technology through the introduction and integration of hand-held mobile devices into their respective curriculums.

Technology will continue to change as numerous advancements are made each and every day throughout the world. As technology continues to make great strides, students and faculty will also continue to alter their needs and expectations with regards to technology utilization in their educational efforts. Administrators need to continually seek these new technologies to ensure their college or university is up-to-date with regards to meeting the demands of the members of their campus. Numerous meetings and conventions are being conducted for the sole purpose of updating higher educational institutions on the latest and greatest technologies. In order to ensure increased efficiency and fulfillment of student and faculty technological demands, higher educational institutions must constantly research and integrate new technologies onto their campus before their technological availability is viewed as obsolete, decreasing the ability to attract the brightest minds and leaders of tomorrow.

APPENDICES

Appendix A- Technology Acceptance Model Survey: Bryant University

Appendix B- Complete Survey Data Results

Appendix A – Technology Acceptance Model Survey: Bryant University

Honors Project Survey

The following survey aims to collect information regarding current views and usage of technology among college level students. Information provided by this survey will be used for a Bryant University Honors Program Capstone project entitled "The Potential Use of Mobile Technology in the Classroom" examining the possibility of integrating mobile devices into higher education. This information will be used for academic use and all personal information will be kept private. Thank you for your time and support.

Personal Information

Class Level
Freshman ____ Sophomore ____ Junior ____ Senior ____

Sex
Female ____ Male ____

Declared/Intended Major

_____

Declared/Intended Minor

_____

Technology Use

How much time do you spend on the computer each day?

0-1 Hours ____ 1-3 Hours ____ 3-5 Hours ____ 7-10 Hours ____ 10+ ____

How many times do you bring your laptop to class with you each week?

Never ____ 1 Day ____ 2 Days ____ 3 Days ____ 4+ Days____

Which of the following best describes the features of your current cell phone?

Phone Calls Only _____
Phone with Text Message _____
Phone with Text, Picture, and Limited Internet _____
PDA with Email and Internet Capabilities _____
No Phone _____

How much time do you spend with your cell phone each day? (Calls, Texting, Internet, etc)

0-1 Hours ____ 1-3 Hours ____ 3-5 Hours ____ 7-10 Hours ____ 10+ ____

Please read the following excerpt from a New York Times article entitled "Welcome Freshman, Have an iPod" written by Jonathan D. Glater and published on August 12, 2008 by and rate the subsequent questions:

"Taking a step that professors may view as a bit counterproductive, some universities are doling out Apple iPhones and Internet-capable iPods to students. The always-on Internet devices raise some novel possibilities, like tracking where students congregate. With far less controversy, colleges could send messages about canceled classes, delayed buses, campus crises or just the cafeteria menu. While schools emphasize its usefulness — online research in class and instant polling of students, for example — a big part of the attraction is, undoubtedly, that the iPhone is cool and a hit with students."

Using this technology would save me a lot of time.

Strongly Disagree____ Disagree____ Neither Agree nor Disagree____ Agree____ Strongly Agree ____

This technology would not enhance my learning experience.

Strongly Disagree____ Disagree____ Neither Agree nor Disagree____ Agree____ Strongly Agree ____

Using this technology would require a good amount of my effort.

Strongly Disagree____ Disagree____ Neither Agree nor Disagree____ Agree____ Strongly Agree ____

My interactions using this technology in a classroom setting would be understandable.

Strongly Disagree____ Disagree____ Neither Agree nor Disagree____ Agree____ Strongly Agree ____

This technology would not be easy to use.

Strongly Disagree____ Disagree____ Neither Agree nor Disagree____ Agree____ Strongly Agree ____

Overall, this technology would be useful.

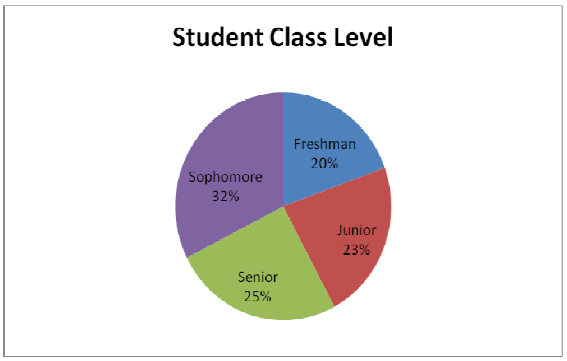
Strongly Disagree____ Disagree____ Neither Agree nor Disagree____ Agree____ Strongly Agree ____

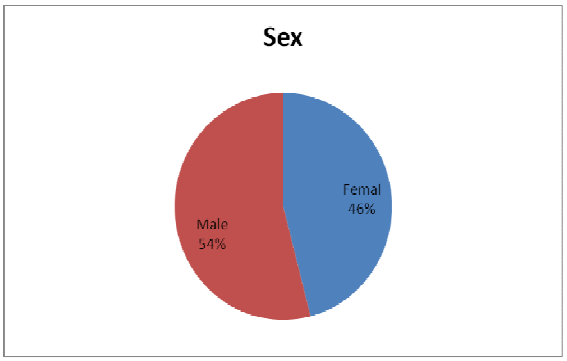
I would perceive the value added of material resulting from this technology (i.e. podcasts, lecture slides, etc.) as:

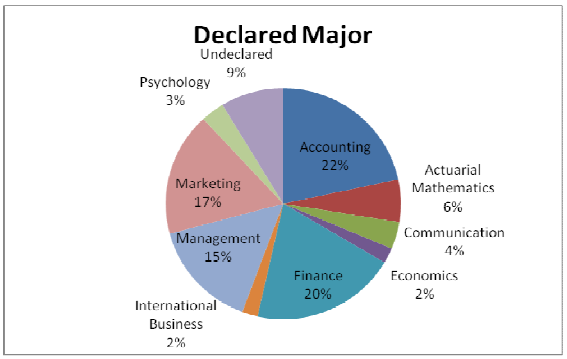
No Value Added _____ Somewhat Supplemental to Class _____

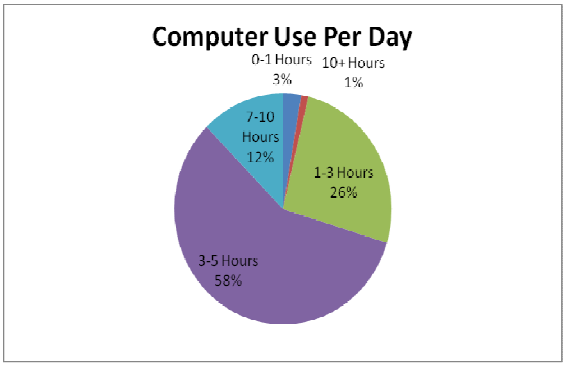
Very Supplemental to Class _____ A Substitute to Class _____

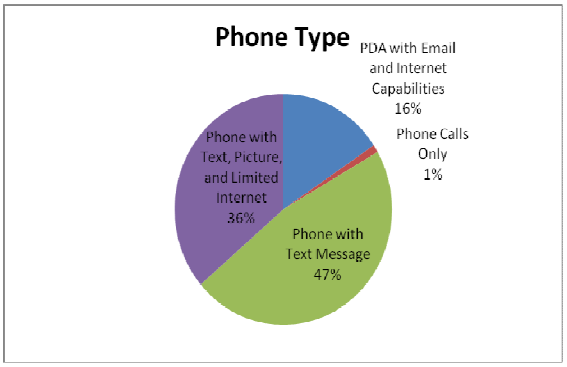
Appendix B – Complete Survey Data Results

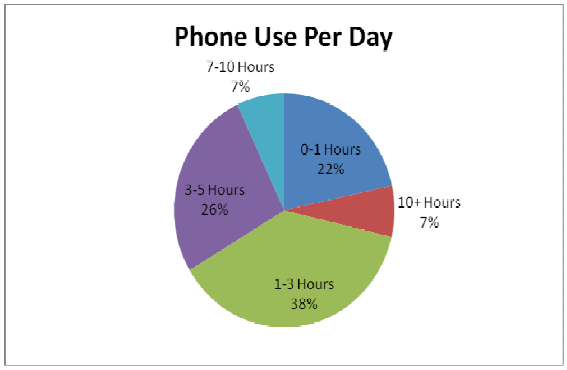


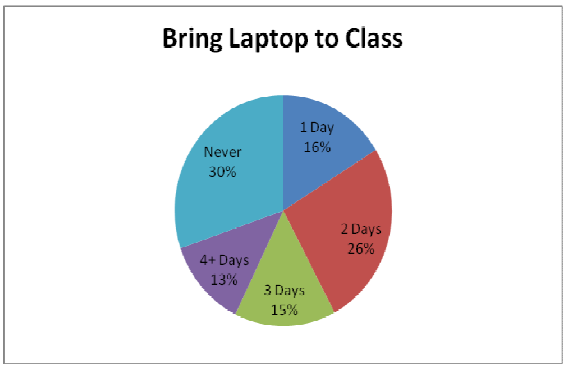


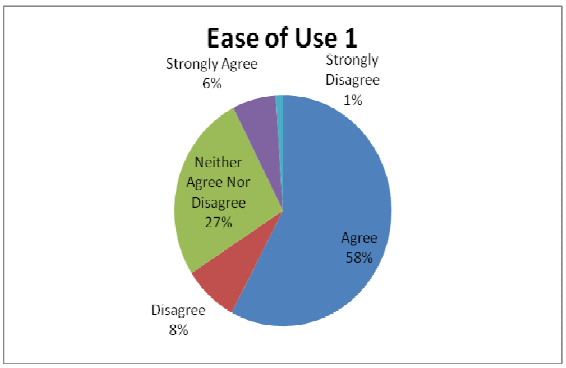


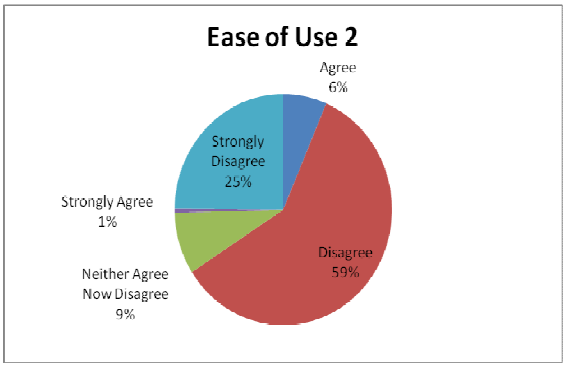


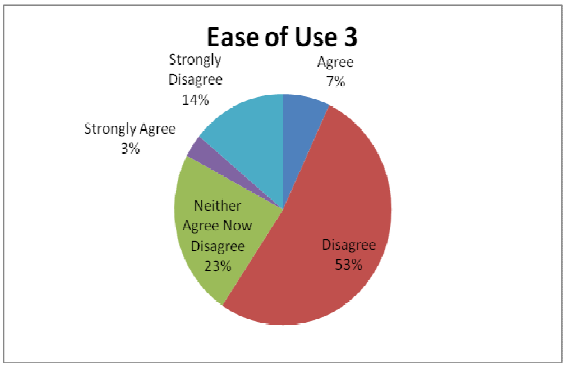


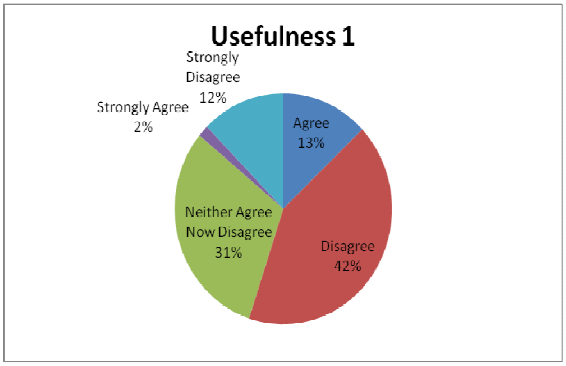


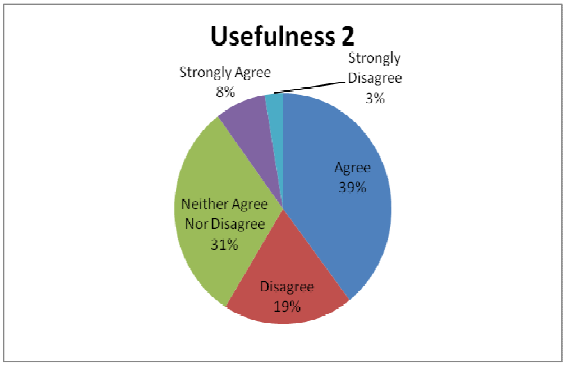


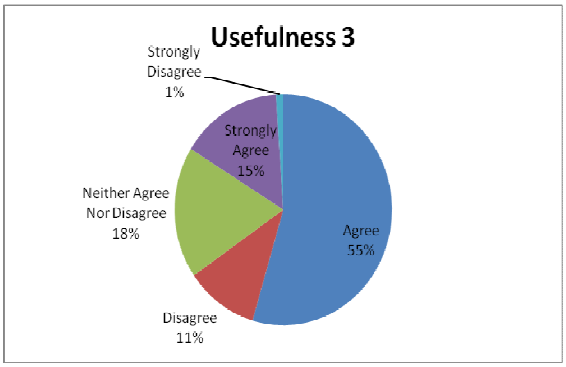


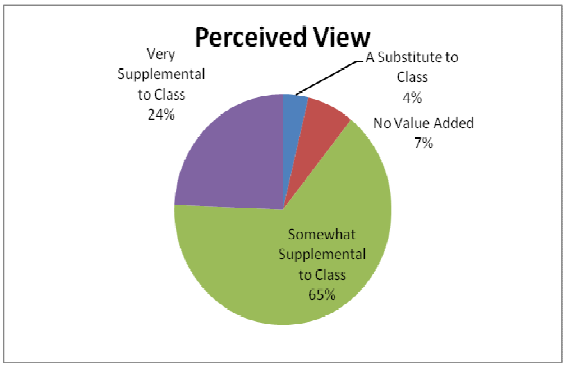

Ease of Use 2
Agree 6%
Strongly Disagree 25%
Strongly Agree 1%
Disagree 59%
Neither Agree Now Disagree 9%


Ease of Use 3
Strongly Disagree 14%
Agree 7%
Strongly Agree 3%
Neither Agree Now Disagree 23%
Disagree 53%


Usefulness 1
Strongly Disagree 12%
Strongly Agree 2%
Agree 13%
Neither Agree Now Disagree 31%
Disagree 42%


Usefulness 2
Strongly Agree 8%
Strongly Disagree 3%
Agree 39%
Neither Agree Nor Disagree 31%
Disagree 19%


Usefulness 3
Strongly Disagree 1%
Strongly Agree 15%
Neither Agree Nor Disagree 18%
Agree 55%
Disagree 11%


Perceived View
Very Supplemental to Class 24%
A Substitute to Class 4%
No Value Added 7%
Somewhat Supplemental to Class 65%

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