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Mobile Learning

An Evaluation of the Effectiveness of 3G Smart Phone Convergence Devices in an Online Class in Business, Career, and Technical Education

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Summary

During the Fall of 2003, the East Carolina University Center for Wireless and Mobile Computing and Sprint PCS/Airgate Communications implemented a project to evaluate the potential of 3G smart phone/handheld computers (3GCD's) for mobile learning. The first environment that was selected for testing this technology involved on-campus freshman Teaching Fellows in the College of Education. In the spring of 2004, the project was expanded to evaluate the use of the devices with twenty-four students taking an online class in Business, Career, and Technical Education. This article will share information on of the use of 3GCD's with online students.

Keywords: smart phone, convergence device, mobile learning

Introduction: An Evaluation of the Effectiveness of 3G Smart Phone Convergence Devices in an Online Class

The race to stay up to date with the latest technology requires educators to work hard to constantly update instructional strategies and learning activities to meet these changes. Often the quest for something new and different requires research, introspection of personal

experiences, and even trial and error. Sometimes new technology is developed and marketed to potential users in education without much consideration for how it will be used by learners, and what it will accomplish in classrooms and laboratories. It may end up never being diffused and adopted by many users, and may exist in the marketplace only as *technology* in *search of a problem.*

In this research, efforts were made to address the educational needs of learners and identify the potential for creating a wireless mobile classroom. The population under study consisted of mobile learners enrolled in an online class that did not meet together in a face to face learning environment. With this type of technology, learners could be located in any location where cellular coverage was available.

The problem to be addressed by the technological solution (application of 3G Smart Phone Convergence Devices) dealt with the students' ability to integrate with and accept a wireless lifestyle. The technology chosen to solve the problem was the Toshiba AudioVox THERA 2032 3G Smart Phone/Handheld computer coupled with a Sprint 3G Vision account, providing both voice and data services. The applications that were selected for the device and used by students in the study included: 1) browsing the Internet to obtain course web pages or lessons, 2) sending and receiving e-mail using Outlook, 3) using Instant Messenger to collaborate with others, 4) using the 3G Smart Phone for voice communications, 5) accessing course content on Secure Digital (SD) media cards, and 6) voice recording providing reminders on tasks to complete.

In the Spring semester of 2004 the Department of Business, Career, and Technical Education (BCTE) and the Center for Wireless & Mobile Computing (CWMC) collaborated to design and conduct this research. An online section of BCTE 5388, Seminar in Business Education, was selected as the test environment. Twenty-four students enrolled in this course and were provided with 3G Smart Phones and Sprint Vision accounts. The students were geographically located both in and out of the state of North Carolina. Funding was provided by the CWMC and Sprint PCS/Airgate for providing devices and cell phone accounts to the students. Students in the test class were taught how to use Smart Phone tools with PDA (personal digital assistant) software, cell phone features, and Internet applications to complete the goals and learning activities in the course.

The Problem and Opportunity

Educators face a multitude of challenges as they attempt to integrate wireless handheld technology into the curriculum. To make classrooms truly wireless, instructors are faced with the challenge of wireless service to geographically displaced locations. Furthermore, even if a campus is totally wireless, once the PDA is removed from campus, wireless access may disappear because of the absence of external wireless local area networks. There is a need for advanced mobility because all learning does not happen on campus (Fallon 2003).

PDAs have been available for years, but they are now truly mobile, being able to connect wirelessly to the Internet more frequently to send and receive information. Mobility provides a

tremendous learning opportunity for those that take advantage of it. It has provided many online students, which are distant from resident campuses, the ability to work, travel and attend school without the hassle of being connected to a network. The University of South Dakota was one of the first universities to require the use of handheld computers (PDA's) in this country. Students use them in field research projects. Examples of how the technology was used include measuring acidity in river water and training musicians on pitch. South Dakota has also moved towards integrating technology by making sure students have "sync" stations, where devices can be placed for synchronizing data or uploading and downloading files (Carlson, 2002).

PDA's were an important part of the OWLS (Online Wireless Learning Program), project funded by the U.S. Department of Education (FIPSE/LAAP), Ericsson, and ECU (J. Barry DuVall, 1999-2002). PDA's were used by students in several different continents to sync to PC desktops and receive weekly lessons. PDA's were also used by students working with the Center for Wireless & Mobile Computing and the Department of Criminal Justice to receive lessons in Afghanistan and Iraq (*Mobile Soldier's Course on a Chip*).
Today many vendors are developing multipurpose convergence devices that merge PDA technology with wireless networking, high speed smart phones, and more robust software. When these types of devices become more refined, the PDA will likely become a general-purpose information appliance, smaller and more portable but otherwise filling the same function as the PC.

Cellular telephone service providers who wish to increase connectivity between students and instructors must also address wireless issues. These include concerns such as coverage in remote areas and roaming, which may include additional charges for service.

Aside from wireless connectivity, there are other issues that raise concern for educators who wish to integrate handhelds into their curriculum. These issues stem from lack of knowledge on how to work the device, lack of knowledge on how to use specific software programs, and lack of enthusiasm from IT staff about providing training for both Palm OS (Operating System) and Pocket PC devices. Another issue that may surface would deal with the creation of software that can be used with different applications.

Technology is now available that can be used by educators to respond to these needs. For the first time in the history of humankind, information processing technology has become affordable and advanced enough for students and teachers to be able to access the Internet just about anywhere and at anytime both on and off campus. This means that students can use convergence devices to surf the Internet, view their email, send Instant Messages to peers, and respond to questions from their classmates and instructor, just about anywhere in the United States. They will be able to communicate on an unlimited basis day or night, seven days a week.

Project Goals

There were three major goals for our research. The first goal was to assess the integration and use of 3G Smart Phone/handheld computer convergence devices in an off campus, online classroom setting. We were also interested in determining if students were ready to integrate and adapt to a wireless lifestyle. Data was obtained from comments in virtual chat sessions, and discussion groups by students enrolled in the test course. The third goal of this research was to provide an overview of student perceptions based on the use of wireless communications and Smart Phone PDA's to complete an upper level college course.

Methodology

The population in this study consisted of twenty-four students enrolled in BCTE 5388, Seminar in Vocational Education, an online course offered by the Department of Business, Career and Technical Education in the spring of 2004. The population represented a diverse group of students consisting of freshman, sophomore, juniors, seniors and graduate level students. Toshiba AudioVox THERA 2032 3G Smart Phone/Handheld computers with Sprint PCS Vision 3G voice and data accounts were provided to students in this study. Topics covered in the course included the use of 3GCD's for voice communication, email, instant messaging, chat, ActiveSync, Word, Excel, Internet browsing, scheduling, accessing content from AvantGo, and business communications exploration.

The instructor developed course modules tailored for use on the handheld computer. Students used the 3GCD's for the purposes of completing course material. Students were assigned to a control or experimental group. Both groups received identical course material to complete. However one group was given an additional communications component to complete. For example, the students who were required to communicate more often were required to call the professor on specific dates using the 3GCD. These students were also required to email and chat with students within their team. The information gathered was used to help determine wireless mobility as well as ascertain the methods and strategies that should be incorporated in future courses to improve learning effectiveness.

Data Collection and Analysis

A survey instrument consisting of 110 questions was developed and administered to the two randomly formed groups, each consisting of twelve students. One group was randomly designated to be the experimental group. During the semester, control group students were taught using the modules created for learning various PDA functions. The experimental group was taught using the same modules and was also provided further direction to increase communication using tools and applications offered by the 3GCD. The objectives and grading scale were the same for both groups. Students in both groups were pre-tested and post-tested during the Spring 2004 term. The data from the two groups were compared using cross tabulations and chi-square. Data was collected and calculated using SPSS.

Results of the Study

The frequencies and percentages for survey questions regarding the use of 3GCD Smart Phone were obtained. Questions were asked concerning the use of the 3GCD Smart Phone and contrasted with the independent variables (students who were required to increase communication) and dependent variable (students that had the ability but were not required to increase communication). The majority of students from both groups rated the use of the 3GCD Smart Phone convergence device to communicate with professor as very helpful (75%). 58.3% of the students said that the 3GCD was effective in communicating with team members. 50% of the students who were required to increase communications found the devices to be very useful in completing assignments. However no significant difference was found between the use of the 3GCD and increase in grade point average.

Further analysis of the two groups showed that there was little difference between the two variables. In most instances the two groups found the device to be useful or very useful to the completion of assignments as well as with communicating with other students.

Analysis of the 3GCD Smart Phone was also calculated based on student's perceptions of their confidence in using the device and use of the device to perform various tasks. Tables 1.1 through 1.4 provide a graphic representation of data on use of the 3GCD to support communication and interaction with classmates and instructor.

Table 1.1

Data Analysis -- 3GCD Smart Phone—Completing Assignments

Group Placement * 3GCD Completing Assignments Cross Tabulation

			3GCD Completing Assignments			
			Not Very Useful	Useful	Very Useful	Total
Group Placement	Without Communication	Count	2	5	1	8
		% within Group Placement	25.0%	62.5%	12.5%	100.0%
	With Communication	Count	1	1	2	4
		% within Group Placement	25.0%	25.0%	50.0%	100.0%
Total		Count	3	6	3	12
		% within Group Placement	25.0%	50.0%	25.0%	100.0%

Participants were asked to identify if the 3GCD device was helpful in completing assignments. Students in both the communication and without communication group found the 3GCD device to be useful/very useful at (75%).

Table 1.2

Data Analysis -- 3GCD Smart Phone—Communication with Classmates

Group Placement * 3GCD Use of Instant Messenger to Communicate with Classmates Cross Tabulation

			3GCD Use of Instant Messenger to communicate with classmates			
			2	3	4	Total
Group Placement	Without Communication	Count	2	2	4	8
		% within Group Placement	25.0%	25.0%	50.0%	100.0%
	With Communication	Count	1		3	4
		% within Group Placement	25.0%		75.0%	100.0%
Total		Count	3	2	7	12
		% within Group Placement	25.0%	16.7%	58.3%	100.0%

Respondents were asked if the use of Instant Messenger to communicate with classmates was a useful component to increase communication among classmates and team members. There was no significant difference between the two groups. All students overwhelmingly agreed that Instant Messenger was useful/very useful (75%).

Table 1.3

Data Analysis -- 3GCD Smart Phone—Communicating with Professor

Group Placement * 3GCD Use of Email to Communicate with Professor Cross Tabulation

			3GCD Use of email to communicate with professor			
			Not Very Useful	Useful	Very Useful	Total
Group Placement	Without Communication	Count	2	2	4	8
		% within Group Placement	25.0%	25.0%	50.0%	100.0%
	With Communication	Count		1	3	4
		% within Group Placement		25.0%	75.0%	100.0%
Total		Count	2	3	7	12
		% within Group Placement	16.7%	25.0%	58.3%	100.0%

Participants in the communication group found that the increased use of the 3GCD was extremely useful/very useful in increasing communication efforts with the professor at (100%). However both groups were found the communication method useful.

Table 1.4

Data Analysis -- 3GCD Smart Phone—Working on Team Assignments

Group Placement * 3GCD; The ability to Work in Teams to Complete Assignments Cross Tabulation

			3GCD The ability to work in teams to compl assignments				
			Not at all Useful	Not Very Useful	Useful	Very Usefu	Total
Group Placement	Without Communication	Count		2	4	2	8
		% within Group Placement		25.0%	50.0%	25.0%	100.0%
	With Communication	Count	1	1	2		4
		% within Group Placement	25.0%	25.0%	50.0%		100.0%
Total		Count	1	3	6	2	12
		% within Group Placement	8.3%	25.0%	50.0%	16.7%	100.0%

Respondents were asked if the use of the 3GCD Smart Phone increased the ability to complete team assignments. Interestingly those students who were made to communicate more frequently with team members and complete more assignments using the Smart Phone found it to be less useful (50%). Whereas the students who were not required to communicate as often with team members found the device to be useful/very useful (75%) in completing assignments.

Tables 1.5 through 1.8 provide a graphic representation of data on design features and performance of the Toshiba Audiovox 3GCD.

Table 1.5

Data Analysis -- 3GCD Smart Phone—Screen Size

Group Placement * Was the Screen Size of the Convergence Device Adequate? Cross Tabulation

			Was the screen size of the convergence device adequate?				
			Not at all good	not very good	good	very good	Total
Group Placement	Without Communication	Count	1	4	3		8
		% within Group Placement	12.5%	50.0%	37.5%		100.0%
	With Communication	Count	1	1	1	1	4
		% within Group Placement	25.0%	25.0%	25.0%	25.0%	100.0%
Total		Count	2	5	4	1	12
		% within Group Placement	16.7%	41.7%	33.3%	8.3%	100.0%

Respondents were asked if the screen size of the 3GCD Smart Phone was adequate. The data indicates that the combined group found the screen size to be not very good at (41.7%). However (33.3%) found it to be good.

Table 1.6

Data Analysis -- 3GCD Smart Phone—Data Communication

Group Placement * Evaluate the Performance of the Data Communication Using the Smart Phone in Areas wi Sprint Coverage Cross Tabulation.

			Evaluate the performance of the data communication using the smart phone in areas with Sprint coverage.				
			Not at all good	not very good	good	very good	Total
Group Placement	Without Communication	Count	1	2	4	1	
		% within Group Placement	12.5%	25.0%	50.0%	12.5%	100.0
	With Communication	Count	1		2	1	
		% within Group Placement	25.0%		50.0%	25.0%	100.0
Total		Count	2	2	6	2	1
		% within Group Placement	16.7%	16.7%	50.0%	16.7%	100.0

50% of Participants found the data communication component good when using the Smart Phone within the Sprint Coverage area.

Table 1.7

Data Analysis -- 3GCD Smart Phone—PCS Coverage

Group Placement * How do You Rate the Spring PCS Coverage in Your Area? Cross Tabulation

			How do you rate the Sprint PCS Coverage in your area?				
			Not at all good	not very good	good	very good	Total
Group Placement	Without Communication	Count	1	2	2	3	8
		% within Group Placement	12.5%	25.0%	25.0%	37.5%	100.0%
	With Communication	Count	1	1	2		4
		% within Group Placement	25.0%	25.0%	50.0%		100.0%
Total		Count	2	3	4	3	12
		% within Group Placement	16.7%	25.0%	33.3%	25.0%	100.0%

Respondents were asked to rate the Sprint PCS Coverage in their area. Both groups (41.7%) found that the coverage in their geographic area was Not at all good/not very good. While 58.3% found the coverage to be good/very good.

Table 1.8

Data Analysis -- 3GCD Smart Phone—Battery Life

Group Placement * Life of Battery Cross Tabulation

			Life of battery				
			Not at all good	not very good	good	very good	Total
Group Placement	Without Communication	Count		4	4		8
		% within Group Placement		50.0%	50.0%		100.0%
	With Communication	Count	1	2		1	4
		% within Group Placement	25.0%	50.0%		25.0%	100.0%
Total		Count	1	6	4	1	12
		% within Group Placement	8.3%	50.0%	33.3%	8.3%	100.0%

Please note that all participants were provided with an extended life battery pack for the 3GCD Smart Phone. This was taken into consideration when responding to the following question. Respondents were asked if the life of the battery was good. (58.3%) indicated that it was not at all good/not very good compared to (41.6%) who found it good/very good.

Summary and Conclusion

The technology of convergence devices, combining features from smart phones, handheld computers, compact media, and wireless connectivity is rapidly changing. It is likely that these types of devices will soon be widely adopted and have significant impact on teaching and learning. When the study was conducted, these devices were still in the early phases of development. The study enabled testing of these devices with online students. This provided a more challenging environment because students located throughout the United States and never had the opportunity to meet face to face. All communication had to be conducted from a distance.

Findings of the study indicated that 3G convergence devices can be helpful in expanding opportunities for mobile learning. Students indicated that the 3GCD's used in this study did enhance the teaching and learning process. Findings from the study also indicated that there is a need to continue forming partnerships with hardware and software companies that are developing new technologies to help educators provide students with improved solutions for advancing learning opportunities. The study also found that it is increasingly important for telecommunication service providers to expand their coverage area. Better access would make it easier and more feasible for rural students in remote locations to adapt to a mobile lifestyle. However, this may not be possible with current models for funding infrastructure to support towers and networks.

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