International Jl. on E-Learning (2012) 11 (3), 233-245.

Mobile Learning: Integrating Text Messaging into a Community College Pre-Algebra Course

PRINCE BULL
North Carolina Central University, USA
phbull@nccu.edu

CARLOS MCCORMICK
Wake Technical Community College, USA
crmccormick@waketech.edu

This study investigated the use of text messaging as an educational tool in a pre-algebra course at a community college in the central region of North Carolina. The research was conducted in two pre-algebra classes with thirty-three students and one instructor. Data were gathered using qualitative and quantitative methods. A mixed method design utilizing surveys, focus groups, and an interview with the instructor was employed to collect data. Quantitative data were analyzed using descriptive statistics. Qualitative data analysis was employed to analyze the thoughts and perceptions of participants and the instructor. Analyses of both qualitative and quantitative data show that participants have favorable dispositions and perceptions to the use of text messaging as an educational tool.

As much as technology is a part of our daily lives, it is also a part of our current educational theoretical framework. Technology is used for many reasons, one of which is to reach learners of multiple learning styles- - whether it is using a liquid crystal projector to meet the needs of visual impaired students, using an MP-3 player to reach students who are musically inclined, or using interactive educational software for students who thrive in an interpersonal setting. On the other hand far less consideration has been given to providing learners with technologies to help them learn whenever and wherever they choose and to support their personal learning throughout a lifetime (Sharples, 2000). According to Thornburg (1999), "We have the opportunity

to use technologies in ways that support modern pedagogical thought devoted to the premise that all are capable of learning, even if the pathways for each learner are different."

Mobile Learning

According to the Horizon Report (2009), there are six areas of emerging technologies that will significantly impact education in the next five years--cloud computing, the use of Geocoded data, personal web tools, semantic-aware applications, smart objects that give ordinary objects the power to recognize their physical location and respond appropriately, and mobile devices. This study focuses on the last of these emerging technologies, mobile devices. One mobile device that could possibly have a big impact in education is the cell phone. This study focused on the impact of using text messaging as an educational tool in a pre-algebra class at a community college. The cell phone is a tool instructors and students are starting to use to extend teaching and learning beyond the walls of the traditional classroom. The cell phone is currently being used in a variety of ways; students are able to take quizzes via the cell phone; students can communicate with instructors and peers, check their daily class schedule, register for classes, conduct Internet searches, engage in social networking, and even check on the dining hall menu (Kharif, 2008). According to William Rankin (2008), co-director of mobile learning research at Abilene Christian University, "This is a new platform for learning, in the same way a laptop or a desktop was a new platform."

When mobile devices are used in education they fall within the category of M-Learning. What is M-Learning? Mcconatha and Praul (2008) define mobile learning as learning accomplished with the use of small, portable computing devices. Lee and Chan (2007) define it as "the acquisition of any knowledge and skill through using mobile technology, anywhere, anytime." O'Malley defines M-Learning as any learning that happens when the learner is not at a fixed, predetermined location via mobile technology. While the definitions from these authors do not provide a concrete definition, they all agreed that M-Learning is learning via a mobile device. John Traxler (2007) states that there are some people who view mobile learning as mobility of learning in terms of the learner's experiences of learning with mobile devices. Traxler also believes that mobile learning will support a wide variety of conceptions of teaching uniquely placed to support learning that is personalized, authentic, and situated. In their study of using mobile devices, Chan and Lee identified seven key attributes of mobile learning: spontaneity, personalization, informality, context-sensitivity, portability, ubiquity, and pervasiveness. Instructional technologists, instructors, and administrators are trying to find effective ways to integrate mobile learning in traditional and online settings. Despite not having one concise definition or a theoretical

framework, M-Learning has the potential to have a big impact in education. According to the Benefits & Compensation Digest (2008), there is a good possibility that M-Learning will permeate our lives in the future to meet the increasing demand for quality, flexibility training, and to fulfill the needs of lifelong learning.

As M-Learning grows, cell phones and one of their prominent features-- text messaging, also known as Short Message Service (SMS)-- will pay a significant role in this new learning phenomenon addressed in this study. Cell phones are particularly popular with teenagers and college students. In Varda's (2004) article, Rebecca Noah, an AT&T wireless spokeswoman, states, "Students are most interested in using cell phones because of their flexibility." Ball State Media Relations Director Marc Ransford states that "text messaging has overtaken e-mail and instant messaging as the main form of communication, as 94 percent of students send and receive text messages." Like cell phones the use of text messaging is relatively new in terms of its use in education. Despite being a new tool in education, institutions, administration, staff, and faculty are experimenting with text messaging in a variety of ways. In a study done by Cavus and Ibrahim (2007), text messaging was used to help students learn new English words. Using special software on the instructor's computer, a new word was sent out to students every half an hour via text messages in order to help students become familiar with new English words. The experiment received favorable marks from participants. Participants expressed their satisfaction and enjoyment of learning away from the classroom. Students in the Cavus and Ibrahim study recommended that other instructors should also use mobile phone based teaching to support their teaching activities in the classroom.

With any new integration, there are positives and negatives. As text messaging, cell phones, and M-Learning move through their initial stages of pedagogical development, issues need to be addressed. One of the big issues with text messaging is dealing with its own lingo (e.g., "your" "spelled "UR," problems cut down to "Probs.") For some educators this presents a problem. Labrow (2004) expressed his concerns on this issue, "Times change, and letter writing isn't the formal thing that it was. But these low standards of communication now pervade our everyday lives". As for the use of cell phones in education, Noble (2009), president of the Canadian Teachers' Federation, does not object to the use of cell phones in education, but he has some concerns about its negative effects on teaching and learning, stating: "We have serious concerns about their misuses (e.g., cheating on exams, cyber bullying or just being disruptive in class." With some of the positives and the negatives of using text messaging in education outlined, there is the need to validate its pedagogical and technological integration in education. Labrow sums up this view when he states that, "mobile Learning

could be great -- but let's get it right, and let's not be seduced by the speed and availability of mobile media."

Theoretical Framework

According to Traxler (2007), mobile learning is essentially personal, contextual and situated; this means it is "noisy." Being "noisy" is a possible reason why at the time of this study M-learning does not have a concrete definition or a simple theoretical framework as it relates to education. The study is guided by the learning theory of informal and lifelong learning (Muyinda, 2007). According to Muyinda, "the learning theory of informal and lifelong learning promotes activities that support learning outside of a dedicated learning environment." Mobile technologies can support informal learning that can be intentional or accidental (Sharples, 2000). The use of mobile learning, especially text messaging via the cell phone, could be used to informally address problem-based learning. Mobile learning will help people blend formal and informal learning and manage their studies across life and career transitions (Peng, Su, Chou & Tsai, 2009). On the other hand Naismith, et al. (2004) define informal and lifelong learning as activities that support learning outside a dedicated learning environment and formal curriculum.

Importance of the Study

This research seeks to discover the effectiveness of text messaging as a teaching tool in a pre-algebra course. Second, the research seeks to gain an understanding of students' perceptions of text messaging as an educational tool. Text messaging, a form of mobile learning, is relatively new when it comes to education. Finally, the research seeks to build upon previous research to define the role of mobile technologies like cell phones, smart phones and PDA's in education. Is mobile learning just a fad or is it something that can be an effective teaching tool for every student? This research provides insight into this question.

Research Questions

As stated earlier, the purpose of this study was to investigate the impact of using text messaging as an educational tool in a pre-algebra class at a community college in the central region of North Carolina. This study seeks to prove that the integration of text messaging in the pre-algebra course will positively impact the perceptions of students to the use of text messaging in the pre-algebra course.

This research seeks to reject the hypothesis that students did not have a more positive disposition to text messaging as an instructional tool after the

integration in the pre-algebra course. This research was guided by the following research questions:

1. How effective was text messaging as an instructional tool in a pre-algebra course?

2. What are students' perceptions to text messaging as an educational tool?

3. In what ways can text messaging be used to enhance the educational experience?

4. To what extent can text messaging be utilized to support communication, reflection, and interest, and thus provide pedagogically rich learning environments that engage and motivate the learner?

Participants

The research was conducted in two pre-algebra classes at a community college located in the central region of North Carolina. Thirty-three students and one instructor volunteered to participate in the study.

Research Design

The study conducted in spring 2010, utilized both qualitative and quantitative design methodologies. Participants completed a pre-survey at the beginning of the course and a post-survey at the end of the course. (See Table 1.) They also participated in a focus group session at the end of the treatment. The purpose of the focus group was to collect and analyze information on the perceptions of participants on the use of text messaging and cellular telephones in their pre-algebra course. The recorded session was transcribed and analyzed. The data were analyzed using triangulation to identify patterns and common themes. The following are examples of questions posed during the focus group discussion:

1. What are some of your thoughts about having text messages sent to you as part of your pre-algebra course?

2. How did the text messages enhance your participation in class?

3. What types of text messages did you like the most during this experience?

4. What are your views on using text messaging in education?

The course instructor provided the text messages researchers sent out to students. The normal routine for the instructor was to provide the text messages to the researchers at the beginning of the week. Researchers would check daily with the instructor to see if there were any last minute text messages the instructor would like to send out that were not given to the researcher at the beginning of the week. Generally, the instructor provided

four text messages to send out during the week. However, there were several weeks students received a text message everyday, (Monday – Friday). Researchers sent out text messages at various times of the day, mainly between the hours of 10 a.m. - 8 p.m., Monday - Sunday via a smart phone (Apple iPhone). Each text was archived for the purpose of discussing the text message at the end of the experiment with the focus group and the instructor and to group them into categories. (See Table 2.) For the purposes of this research, the text message delivery was a one-way communication from instructor to students. This was done to maintain privacy for the instructor, reduce contact hours with students, and prevent constant engagement.

Table 1
Pre and Post-Survey Text Messaging and Cell Phone Educational Uses Instruments

Instructions: Place an 'x' between each adjective pair to indicate how you feel about text messaging in your pre-algebra course.								
To me, text messaging in education is:								
	1	2	3	4	5	6	7	
unimportant								important
boring								interesting
irrelevant								relevant
unexciting								exciting
means nothing								means a lot
unappealing								appealing
mundane								fascinating
worthless								valuable
uninvolving								involving
not needed								needed

Instructions: Place an 'x' between each adjective pair to indicate how you feel about cell phone use in your pre-algebra course.								
To me, cell phone use in education is:								
	1	2	3	4	5	6	7	
unimportant								important
boring								interesting
irrelevant								relevant
unexciting								exciting
means nothing								means a lot
unappealing								appealing
mundane								fascinating
worthless								valuable
uninvolving								involving
not needed								needed

The surveys were used to understand the participants' perceptions of text messaging in a pre-algebra classroom. The survey allowed participants to rank both text messaging and cell phone in 10 categories; Important, Interesting, Relevant, Exciting, Means a lot, Appealing, Fascinating, Valuable, Involving, and Needed on a 7 point scale. The participants ranked each category from 1-7 with one being the lowest and seven being the highest. The mean was compared on a 70 point scale. A gain of 5 points from the pretest to the posttest would be deemed as statistically significant in this study.

The instrument was developed by researchers. Using SPSS (now IBM PASW) the Cronbach alpha reliability test was done on the instrument. The reliability of the instrument was determined at .973. Cronbach's alpha reliability coefficient normally ranges between 0 and 1. However, there is actually no lower limit to the coefficient. The closer Cronbach's alpha coefficient is to 1.0 the greater the internal consistency of the items in the scale. It should also be noted that an alpha of .8 is a reasonable goal. It should also be noted that while a high value for Cronbach's alpha indicates good internal consistency of the items in the scale, it does not mean that the scale is one-dimensional.

Conclusions and Findings

Qualitative Findings

The results acquired from this study clearly provide evidence that text messaging is a viable tool that can enhance the teaching and learning experiences of students. The qualitative analysis yielded several themes from the study. Students liked the fact that they can get reminders, practice problems, and updates right on their mobile devices. No longer did they have to wait in long lines to use a computer at the school lab or worry about finding a hot spot so they could log onto their e-mail accounts. They were excited about the opportunity of receiving text messages. When asked during the focus group session how often they would like to get educational text messages, one student said, "Bring it on! I would like to get a text everyday." Text Messaging is a way of life for a lot of people. One participant commented, "I'd rather text than talk to people on the phone." If texting is that important to students and is something that they feel is not an invasion of their privacy, which was the common response from all students who participated, it is important that this piece of technology is investigated by the faculty, staff and administrators at the high school and college level. Text messaging has the potential to revolutionize teaching and learning mathematics and learning in general. Imagine students entering a mathematics class and believing mathematics could be fun and exciting. Text messaging could possibly provide this experience. Below are qualitative analyses to specific questions.

How effective was text messaging as a tool in the Pre-Algebra course?

Participants stated that text messaging is an effective way to remind students about quizzes, labs, and other related mathematics assignments. As Vanessa puts it, "It was helpful as far as remembering if I had a test or quiz the next day. With me working, I would tend to forget and every time I would get off work, I would see I had a text message. So, it helped me prepare for class." Some participants felt content related text messages helped them with their assignments. As Josh puts it, "the problems helped jog my memory and kept me thinking what was going on that day. I never solved the problem, but if I got a text and it was a decimal problem, I was like okay that's what we studied today." Fatima stated that mnemonics sent out via text messaging made a difference: "The sayings were good because they helped remind me how to set up formulas when solving a problem."

What are your perceptions of integrating text messaging in your math class?

For the majority of the participants receiving text messages was nothing new. However, this was the first time for all students to receive text messages in an academic setting. Participants felt it was good to get text messages, especially getting practice problems. As one student put it, "The text did not make it more exciting or fun. It just helped a lot."

What would have made the text messaging experience more appealing to you as a student?

Participants felt that providing actual mathematical problems with corresponding formulas would have enhanced the experience. Walter stated, "I can agree with sending formulas. Some people struggle in math. If you send problems and the formula, it takes the text a little bit further and would be helpful to a lot of kids who are having a hard time." Some participants felt that feedback via text messaging would have enhanced their experience. Thomas stated, "If you send a problem out and we sent it back and got it wrong, tell us to use a particular rule to solve the problem." Others wanted more practice problems that would help them prepare for class.

Table 2
Sample Text Messages

1. Math - Reminder you have a quiz tomorrow. Be sure that you can solve a percent problem by using both an equation and a proportion.
2. Math - If you would like extra help, you may stay after on Thursday in LE 14 from 2:00-4:00. Bring material to work on or questions.
3. Math - A tree has an 8 ft. shadow. A man places a 10 ft. ladder from the top of the tree to the end of the shadow. How tall is the tree beside it with a 6 ft. shadow? Please show your work and turn in tomorrow for the chance to win a frosty.
4. Math - Are congruent triangles similar? Hint: Think about the definition of similar triangles.
5. Math - Reminder: You have a test tomorrow.
6. Math - Is the following a true proportion? 5 is to 12 as 10 is to 24.
7. Math - A saying we used today was "King Henry Died While Drinking Chocolate Milk." it stands for kilo, hecto, deka, whole unit, deci, centi, milli.
8. Math - Remember the Excel lab must be done using Excel. If you do not have the program at home, you can find it in the computer labs here on campus.
9. Math - Now is a good time to start preparing for the final. Do you know where all of you old tests are?
10. Math - Remember that all assignments are not worth the same. Use the grade breakdown sheet to average your grades. Also the extra lab is due tomorrow.
11. Solve the following problem (0.5x+7=0.2x+2.5).

What are the perceptions of the course instructor to the use of text messaging in her course?

The instructor in this study felt the use of text messaging in her course both "helped and hurt" students in the following areas:

1. It helped from the standpoint of being able to send reminders to student about upcoming tests, quizzes or reminded them about lab due dates.

2. On the other hand, students became dependent on the text messaging and not on the traditional calendar, class information, or course delivery tools. She further stated, "I had students complain if I did not send a text to remind them that they had a test or quiz. In that way it hurts. Students became dependent on the text messages. I felt like they were not listening to me in class. I was resending information that we have talked about in class, posted on Blackboard, and also displayed on the calendar I provided them each month."

3. The instructor felt that she was limited as to the types of text messages she could send. She stated, "Mathematical texts are hard to send because you cannot text [use] division symbols. You cannot make fractions. There is a lot of stuff that I could not text."

4. The instructors felt that sending all the formulas via text messaging and promoting the use of cell phones in the classroom could promote cheating. As she put it, "I think about students who I have to take their cell phones away now because they are text messaging in class when they are not supposed to. I would be thinking the students may have all the formulas on their phones, which would make me worry and be concerned about students cheating on my test."

Quantitative Findings

While the qualitative data did provide depth to the research with encouraging results, the quantitative data provided both limited and statistically significant findings. It was clear from the data that after the integration of text messaging, participants demonstrated a more favorable perception toward text messaging. The qualitative data yielded positive findings on the attitudes of students toward integrating text messaging as an instructional tool. In general, the research shows that students preferred text messaging over email as a form of class communication. Therefore, participants were responsive to text messaging as a form of communication. Participants were also able to separate work, social, and academic communications, and accepted text messages as an extension of their education outside the walls of the classroom.

Descriptive statistics were used to compare the means of the pre-survey and the post-survey. On a 70-point scale, the mean for the pre-survey for text messaging was 52, which shows a favorable disposition toward the use of text messaging in the algebra course. The post-survey mean was 57, which shows a significant gain of 5 point towards a more favorable disposition to the use of text messaging in their education. (See Table 3.) A gain of 5 points is statistically significant in this study.

From the analysis of Table 3, it is clear that participants felt that text messaging in education was "important" and "valuable" with the largest post-survey mean gains of 7 points followed by "relevant," "appealing," and "involving" with post-survey mean gains of 6 points. "Needed" gained 5 points in the post-survey mean. With six out of ten categories gaining 5+ points, it is clear participants had a positive disposition to the use of text messaging in their pre-algebra course.

Table 3
Text Messaging Mean Scores for Pre-and Post-Survey on a 70 Point Scale

Text Messaging	Pre	Post
Important	54	61
Interesting	55	59
Relevant	54	60
Exciting	51	54
Means a lot	51	55
Appealing	49	55
Fascinating	51	52
Valuable	54	61
Involving	53	59
Needed	53	58
Total- Mean	52	57

The results for the use of cell phones were not as statistically significant as those of text messaging. (See Table 4.) This could be attributed to the fact that participants use their cell phones as an everyday tool. They did not see it as a novel tool in their classroom. Also, the focus was not on the cell phone as the instructional tool, but on text messaging delivered via the cell phone.

Table 4
Cell Phone Mean Scores for Pre- and Post-Survey on a 70 Point Scale

Cellular Telephones	Pre	Post
Important	62	63
Interesting	56	59
Relevant	55	58
Means a lot	57	56
Appealing	54	56
Fascinating	54	54
Valuable	58	59
Involving	53	58
Needed	58	60
Total-Mean	56	57

For analyzing the data on cell phone use in education descriptive analysis were used to compare the means of the pre-survey and the post-survey. On a 70-point scale the mean for the pre-survey was 56, which shows a very favorable disposition toward the use of text messaging in their algebra course. However, the post-survey mean of 57 did not show a more positive disposition after the integration of text messaging. Though this was not statistically significant, it showed a positive disposition towards using cell phone in education.

Conclusions

It is clear from the descriptive statistical analysis that there was a position shift from the pre survey mean to the post-survey mean towards a more favorable disposition towards use of text messaging as an instructional tool. This study is unique in that there was a favorable disposition towards the use of text messaging resulting from a one-way delivery of information from the instructor to students. Imagine what the outcome would have been if students had the opportunity to engage the instructor in a two-way text messaging communication system. The use of text messaging in instruction has great potential that we as educators have to tap into. As educators, we need to explore and continue to investigate the uses of text messaging in education. What is unique about this technology and delivery is that most students have access to the technology and expertise needed to facilitate this delivery, which means that it should be cost effective to academic institutions to put in place. The use of text messaging as the leading form of electronic communication for college students in social networking electronic environments makes this mode of delivery an appealing system to students. It is incumbent upon academic institutions to explore creative ways to facilitate instructional delivery through text messaging and conduct sustained research on its effectiveness in enhancing the intellectual climate of the institution. In as much as the findings from both qualitative and quantitative analyses in this study are very encouraging, one should be cautious in extrapolating beyond this study because of limitations. First, the sample size in the study was small. With only 33 students participating, one could expect skewed results. Second, the study was conducted within four weeks and not the entire semester. A lengthier study may have significant implications for integration. Also, the text message communication was a one-way communication from the instructor to the student. Even with these limitations the research yielded positive results on the use of text messaging instruction.

References

Cavus, N. & Ibrahim, N. (2009). M-learning: An experiment in using SMS to support learning new English language words. *British Journal of Educational Technology, 40*(1), 78-91.

Chan, A. & Lee, M. J. (2007). Pervasive, lifestyle-integrated mobile learning for distance learners. *The Journal of Open and Distance Learning, 22*(3), 201-218.

Harley, D., Winn, S., Pemberton, S., & Wilcox, P. (2007). Using texting to support students' transition to university. *Innovations in Education and Teaching International, 44*(3), 229-241.

Kharif, O. (2008). Cell phones make headway in education. *Business Week, 8*.

Labrow, P. (2004). Why learning faster is not always better. *IT Training, 1*(2), 20.

Johnson, L., Levine, A., & Smith, R. (2009). *The 2009 Horizon Report*. Austin, Texas: The New Media Consortium.

Marklein, M.B. (2003, October 29) Colleges catch cell phone wave. *USA TODAY, 1-3*.

McConatha, D. & Praul, M. (2007). *Mobile learning in the classroom: An empirical assessment of a new tool for students and teachers*. Paper presented at Washington Interactive Technologies Conference 2007, Arlington, VA. Retrieved March 6, 2010 from http://www.hotlavasoftware.com/article_info.php?articles_id=14.

Ransford, M. (2009). *Survey finds smart phones transforming mobile lifestyles of college students.* Retrieved September 7, 2010 from http://www.bsu.edu/news/article/0,1370,--61565,00.html.

Muyinda, Paul B. (2007) MLearning: pedagogical, technical and organisational hypes and realities, *Campus-Wide Information Systems*, *24*(2), pp. 97–104.

Naismith, L., Lonsdale, P., Vavoula, G. and Sharples, M. (2004), *Literature Review in Mobile Technologies and Learning, Report 11*. A Report for Nesta FuturesLab.

Peng, H., Su, Y., Chou, C., & Chin-Chung, T. (2009). Ubiquitous knowledge construction: Mobile learning re-defined and a conceptual framework. *Innovations in Education and Teaching International, 46*(2), 171-183.

Rankin, W. (2008), co-director of mobile learning research at Abilene Christian University. Retrieved September 7, 2010, from http://corpu.com/weekly/article/mobile-learning/

Sharples, M. (2000). The design of personal mobile technologies for lifelong learning. *Computers and Education, 34*, 177-193.

Simone, R. (2008). International foundation. Benefits and Compensation Digest, 18700 W. Bluemound Rd. Brookfield, WI 53045. Retrieved September 7, 2010 from https://webportal.ifebp.org/Purchase/CatalogSearchResults.aspx?Option=1&ProductTypeText=&ProductTypeValue=&Title=&Author=&ProductDesc=E-Learning+to+M-Learning&Custom1=All&Custom2=All&Custom3=All&Custom4=All&Demographics=productnumber%24%7c.

Thornburg, D. D. (1999). *Technology in K-12 education: envisioning a new future*. Retrieved February 16, 2010 from http://www.coedu.usf.edu/IT/Research/nets.htm

Traxler, J. (2007). Defining, discussing, and evaluating mobile learning: The moving finger writes and having writ.... International Review of Research in Open and Distance Learning, 8(2), 1-12.

Varda, C. (2004). Cell phone popularity soars. *The Daily Collegian Online*, 1-4.