Towards a Model of M-Learning in Pakistan

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This study aimed to investigate the use of SMS messages to gather data about student learning in mathematics in two public schools of Punjab. The case study using convenient sampling involved 45 boys and 30 girls from primary boys' and primary girls' public schools. The main objectives of the study were to: i) assess mathematical skills of grade 4 students (ii) find out if SMS can be used to assess mathematical skills of students (iii) find out if the results of SMS testing are the same as paper and pencil test. The researcher developed math assessment for grade 4 students based on the curriculum. Pre and post assessment was done with paper and pencil onsite to see if the results of the SMS assessment show the actual learning of students in the selected units of mathematics. The results of SMS assessment matched the paper and pencil test except the results on the first two questions of addition in which students performed better with the paper and pencil test. It is therefore recommended that testing of mathematical skills of students in upper elementary grades can be done through SMS if the students are informed and the school administration agrees with the approach.

Key words: *SMS assessment; Mathematical skills; Elementary Math Assessment; Public school in Pakistan.*

Introduction

The world's two largest mobile markets are Asia and Africa. Asia Pacific has over 3 billion mobile connections (GSMA-Kearney, 2011a) and Africa has 620m (GSMA-Kearney, 2011b) (Winters, 2013). Mobile phones are now widely used by people belonging to different sectors of Pakistan. According to a statistical report published by Pakistan Telecommunication Authority, the number of mobile users in Pakistan reached 129.6 million at the end of September 2013 (Pakistan Telecom and IT News). Mr. Charlie Schick of Nokia mentioned in his keynote speech of mlearn 2007 that the majority of users of mobile phones have basic features (Schick, 2007). Therefore most of the learners in developing and developed countries use basic mobile phones for voice and SMS communication.

Due to the penetration of mobile phones, there has been an increase in the use of mobile phones to support teaching and learning. It has been realized that Short Message Service or SMS texting on mobile phones holds great promise for education (Traxler, 2005). In the last ten years, several projects of teaching and learning using mobile phones have been reported in the literature. The two broad areas to classify these projects are: 1) Administrative Support and 2) Teaching and learning support (So, S. 2009).

The projects entailing the use of SMS texting for teaching and learning will be briefly discussed here. Scornavacca, Huff, and Marshall (2007, 2009) used a SMS-based classroom interaction system and it was called the TXT-2-LRN system. Using this system, the students were able to send questions or comments to the laptop of the instructor. The instructor was able to read the messages on the screen and then decided when to respond to these messages. A quiz was also given to the students using this system and the results were collected.

In the MOBIlearn project (Bo 2005) a context awareness system was developed that distributed information to museum visitors based on the exhibit they were viewing and based on the time spent in front of the exhibit. The content was shared based on the location of the user and the interest level was

inferred. Based on the contextual information suggestions were also given to the user about other exhibits to visit. The Myartspace project (Sharples *et al.* 2007) supported the pupils to visit the museum with their school and to collect elements in the context by taking pictures, recording audio clips, writing notes and collecting multimedia content by typing in a two-digit exhibit code displayed on the label next to the exhibit. After the visit the resources collected were made available to the student.

Some projects made the content available to the students through mobile phones but in these projects there was no link with the context. Through Skills Arena project students accessed basic arithmetic operations anywhere and anytime. However, there was no link with the context so it did not matter whether the information was accessed in a train or while students were sitting at home (Lee et al. 2004). Project Knowmobile (Smørdal & Gregory 2003) gave students mobile access to a medical database anytime and anywhere. Students could use the information without linking it with the context or the information could be used while students were doing internship in a hospital and hence it was linked with the context.

"From e-learning to m-learning' project was commenced by Sony Ericsson to find out the challenges faced when course material is delivered to a mobile phone. The researchers found out that e-learning content can be accessed on mobile phones. The material was made available to students from different countries and they rated it as being 'satisfying' (Keegan, 2002). The m-learning project by Traxler (2002) also aimed to find out content delivery and collaboration to support underprivileged students using mobile devices. Majority of the participants were unemployed and were under 19 years of age. There was an improvement in students' literacy, numeracy, motivation and independence skills.

Mobile phones can be used for different purposes in the developing countries. In the McKinsey-GSMA (2010) report, Chris Locke, Managing Director of the GSMA Development Fund stated that "mobile has a unique role to play in reaching those who are outside of the scope of traditional schooling", and the other important role is to "overcome weaknesses in the formal education". Considering the high number of mobile users and the problems faced by education sector, it is believed that mobiles can be used to facilitate students in different ways in the developing countries.

As already mentioned, there is a high penetration of mobile phones in Pakistan; therefore a project was designed to assess mathematical skills of grade 4 public school students. The major objectives of the study were to:

a) assess the mathematical skills of grade 4 students;

b) find out if SMS can be used to assess mathematical skills of students;

c) find out if the results of SMS testing are the same as paper and pencil test.

Improvement in education cannot take place unless reliable assessment results are available. This paper describes the mobile assessment designed for public school children in detail.

Sampling

Convenience sampling was done for the study as the researcher was given access to only two public schools in Lahore. The sample population consisted of two primary public schools and grade 4 was chosen for the study as the researcher got permission to conduct study in grade 4 only. One school was the primary school for boys and the other school was the primary school for girls. The mobile numbers of the parents of students were collected by the school administration and were shared with the researcher. There were 45 boys in one school and 30 girls in the second school in grade 4. Both the schools were located in Lahore.

Research Tool

To measure the academic achievement of students a mathematics test was developed for this study and it covered the mathematical content of grade 3 mathematics based on the curriculum being followed in the schools. To ensure the accuracy of the test and to check the difficulty level the test was reviewed by two public school Mathematics teachers who were teaching grade 4 in different schools. The test included items from all the areas of mathematics and students had to choose the right answer from a choice of three and then sent SMS "a", "b" or "c" as the right answer.

Procedure

Before starting the project, a visit to the schools was done to ensure that the students can send "a" "b" or "c" as SMS when asked to choose between three options. However, practice was not done with the actual mobile phones with these students. Informal assessment was done in the class to see if students could read SMS messages writing Urdu place value in English and modifications were made in the SMS messages to be sent after the visit. Students preferred to have "hazaar" written as the place value rather than "thousand". Instructions were kept to a minimum so that the students can recognize the mathematical operation sign to solve the mathematical sums.

The researcher designed the SMS assessment that aligned with the local mathematics curriculum for low cost ordinary cell phones and the coded messages were kept simple enough for children to read and comprehend. SMS messages targeted units on addition, subtraction, multiplication and place value and the SMS messages were broken into three levels. Since students were given three choices for each question therefore questions were designed in such a way that the incorrect responses were based on the mistake students commonly make when doing mathematical calculations. SMS messages pertaining to one unit were sent in order,

starting from the least difficult level, and to keep the students motivated they were not given feedback on the correct or incorrect response but were send SMS of "shahbash" with the name of the child for replying to SMS assessment message.

Phone calls were made after the first round of three SMS messages were sent on addition to find out the reasons from parents whose children were not responding and to get feedback from other parents. Mostly the phones were turned off and the common reason given was that the parent was out of station or was going home late at night. The parents were happy that the government was taking interest in the education of their children and they appreciated the initiative.

A post-test was given in paper and pencil onsite for all the questions send by SMS to the children who participated in the study. The results of the SMS assessment were verified by looking at the actual responses of students and it was noticed that some students did not send "a" "b" or "c"as the response but the response given was in the form of a statement such as "sahee jawab b hai" or "B. 34" and therefore the system was unable to recognize it as the correct answer. These answers even though correct were not included in the number of responses received or the number of correct responses as the format for giving the answer was incorrect. A comparison of assessment of each student on the SMS test and onsite test was done and there were hardly any variations in responses.

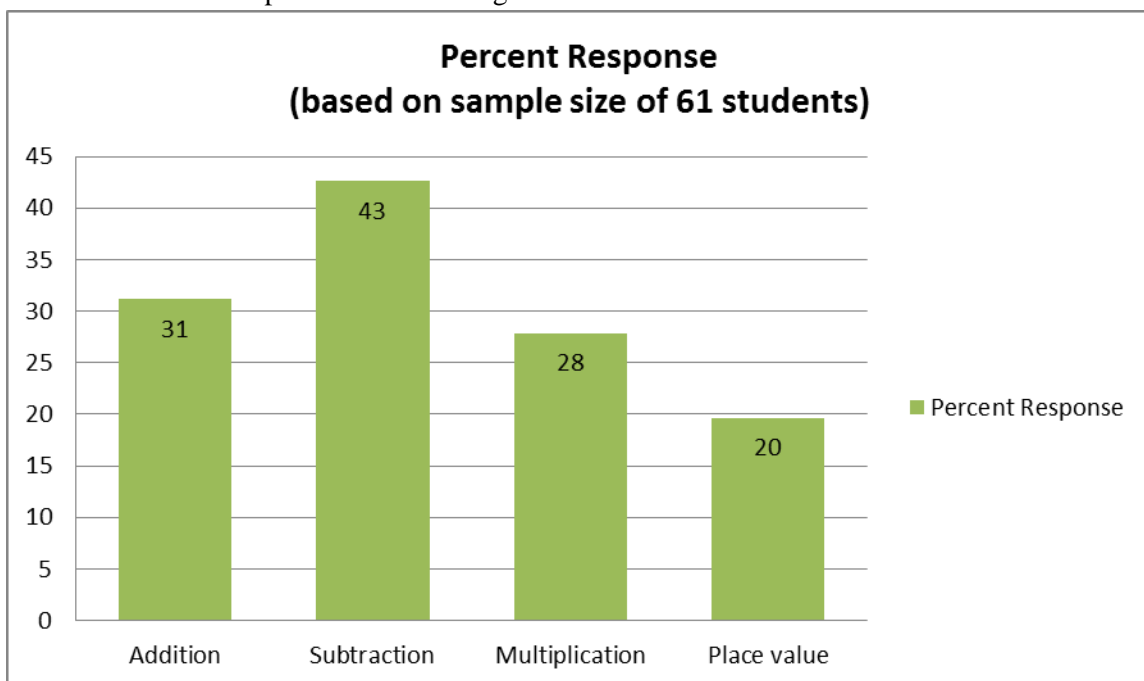**Findings regarding SMS Assessment of Mathematics**

The rationale of the pilot project was to explore the potential of mobile phones for assessment of grade 4 students in mathematics. The results indicate that the mobile phones provide the platform for a modality of assessment that can complement formal assessment and one that can prove more convenient for low income children as low cost phones were

used for this purpose and the cost of sending one SMS was 10 paisa.

On the first unit of addition 31% of students responded, the highest response rate was on the second unit and then the response rate again declined in multiplication whereas place value showed the least response from students. After the first unit, phone calls were made to the parents and that might have increased the motivation of students to respond in the second unit of subtraction.

The graph showing the percentage of students who responded to different SMS assessment messages on different units is given below:

Percent Response
(based on sample size of 61 students)

Unit	Percent Response
Addition	31
Subtraction	43
Multiplication	28
Place value	20

In the first unit on addition, there is a 30% difference in the correct responses of students received through SMS and onsite test for the first two addition questions and that may be due to the fact that students were still learning to send SMS messages. Students performed 30% better on the paper and pencil test on the two addition questions compared to the results received through SMS. In the other units there is no difference in the responses received through SMS and the test done through paper and pencil.

In the last questions on place value there is a low response rate of students. During the onsite visit it was noticed that the students found it difficult to read the Urdu place value of numbers written in English and that might be the reason of the lowest response rate in this unit.

Discussion

This pilot project explored the use of mobile phones for assessing the mathematical skills of grade four students in two public schools of Punjab. The assessment project was started by a government organization in coordination with the school department and they wanted to make sure that the technology used should be one that all kids have access to, so there was no better way to start than with a simple SMS based system. The project took the form of SMS based assessment of mathematics of students of grade 4 and the messages were sent on the mobile numbers given by the parents of these students to the school administration.

The results of this study give a new direction on how SMS messages can be used for assessment

of mathematical skills of students. This study extends the findings of Anderson, (2006); Belawati, (2005); Chun & Tsui, (2010); Stead, (2006) who explored how m-technologies can be used within traditional classroom setting, field learning experiences and distance education systems to provide access to resources and improve the learning experiences of students belonging to disadvantaged communities. The need of findings new ways in which m-learning can be used to support learning needs of disadvantaged learners has been advocated by different researchers and this study explores one such option in the area of assessment.

In Pakistan, despite improvements in educational indicators, such as enrolment, significant challenges remain with regard to the delivery of quality education in the public schools. It is difficult to get accurate data on student learning as teachers teach to the test since their performance is assessed by the assessment of students. The results of this study are valuable as low cost option of student assessment is explored in which school administration or teachers are not involved. In this study, no difference was found between the responses of boys and girls in both the schools. This may be due to the fact that both the schools are located in Lahore and in both the schools visit was done by the researcher to involve the students in the project. Since the public schools were located in Lahore, there was support from school administration and personal visits were made by the researcher so the results of this study may not be generalizable to all public schools.

Recommendations

On the basis of the findings of this study and the discussion it can be inferred that SMS can be used for assessment of mathematical skills of students in the public schools of Punjab. Therefore, it is recommended that:

1.   Assessment of students can be done throughout the year using SMS service as

low cost is involved and the results will get more reliable with time as students learn to reply to SMS messages.

2.   SMS is an easy way to involve parents in the learning process of students as parents of students in this study appreciated that interest was being taken by the government in the education of their children.

3.   The results of SMS assessment need to be shared with the teachers and the school so that changes can be made in the teaching approaches accordingly.

4.   The design and delivery of SMS assessment needs to be done by an independent department that is not linked with the education department so that the confidentiality of questions can be maintained to ensure reliability of collected data.

Suggestions for Further Research

1.   As already mentioned there were some students who did not send "a", "b" or "c"as SMS for the correct response and therefore their responses were not marked correct. Practice needs to be done with the students by their teachers so that they learn to reply to SMS messages appropriately. This can be done by initially sending simple messages just to make sure that students get practice in responding to SMS messages appropriately.

2.   Students may find it difficult to read the Urdu place value in English therefore option of sending SMS in Urdu can be explored. Students can easily read messages and place value in Urdu.

3.   There needs to be some motivation for students who respond and it can be in the form of a simple certificate of participation.

4. The study was successful due to support of school administration and students were motivated due to the personal visits made by the researcher therefore these factors need to be considered when replicating the study in other public schools.

5. Studies must be designed to provide assessments with scaffolding to students, giving direct feedback and linking learning with the environment of students to truly engage them in the learning process and to reap the maximum benefit of m-learning.

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