SMS story:
Early results of an innovative education trial

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Abstract

The spread of mobile phone service into rural areas of Papua New Guinea (PNG) in recent years has created a new means of supporting workers based in such locations. The innovative SMS Story project is a controlled trial in which teachers at elementary schools receive resources through mobile phone text messages. These resources include daily short stories and complementary lesson plans designed to enhance the teaching of reading to students. This paper provides initial findings from the earliest stages of the project, including a baseline reading assessment of 2,478 students and visits to schools. As well as the early results, the paper shares lessons learnt about the implementation of SMS Story. It also posits possible additional uses of mobile phones which may be beneficial in the education sector in PNG.

Key words

Aid project evaluation, Australian aid, communication, education, elementary, Madang Province, mobile communication network, mobile phone, Papua New Guinea, phone, phonics, Simbu Province, telephone, text message.

Introduction

This paper will discuss the innovative SMS Story research project as a case study for the use of mobile phone technology in the Papua New Guinea (PNG) education system. Short message (or messaging) service (SMS) is a system that enables cellular phone users to send and receive text messages. The paper will firstly provide the context of the rapid expansion of mobile phone access in PNG, explore current uses of mobile technology in PNG schools and highlight the successful use of mobile phones in other education contexts. Secondly, the paper will introduce the SMS Story project: a controlled research trial into the effectiveness of daily text message stories and lesson plans in improving elementary children's reading. The third section of the paper will discuss early findings and lessons learnt during the early stages of the research. In the final section, further ideas are proposed for the use of mobile technology as an educational tool, along with concluding remarks.

Mobile technology in education in Papua New Guinea

The telecommunication sector in PNG has experienced rapid change in recent years (see Suwamaru and Anderson 2012, pp. 2-3). Since foreign-owned

Digicel commenced operations in 2007 (breaking a monopoly on mobile phone provision), mobile phone coverage has expanded over the majority of the population, including many remote and rural locations (Watson 2011, pp. 47-49).

Many teachers now own or use mobile phones. Baseline data for this study revealed that 91.9% of the teachers in the study own mobile phones (n=114). The technology has also been used by many teachers for some time: the mean length of time that teachers had owned a phone was 2.7 years. Increased access to communication and data services led to the Department of Education quickly establishing a large closed user group including school inspectors and provincial education managers (Commonwealth of Australia 2010, p. 9). A closed user group allows registered users to call and text each other member of the group for free. The organisation or company (in this case, the Department of Education) pays a monthly fee to the service provider (in this case, Digicel) for each user on the network.

Responding to concerns about the impact of mobile phones on student learning (see Watson 2011, pp. 247-249), a mobile phone policy was developed and launched to give guidance to schools (Department of Education 2009). In recent years, several education and health development projects have started to explore other mobile strategies such as bulk text messaging and free phone advice lines (for example, Watson and Sabumei 2013).

Mobile technology in education in developing countries

The number of mobile phones in use has increased dramatically around the world in recent years, particularly in developing countries (International Telecommunication Union 2011). Their popularity has prompted many to consider whether mobile phones could be used in education (for example, Suwamaru and Anderson 2012, p. 1; Watson 2012). This emerging field is known as mEducation. Michael Trucano, senior ICT and education policy specialist at the World Bank, suggests mEducation may well offer benefits, and that the area merits investigation.

> 'Broadband will come, but it will not come quickly enough. Computers, as we think of them sitting on someone's lap or on a desktop, will come, but not quickly enough. Phones are already there ... We think there's a real opportunity there to explore' (Trucano in UNESCO 2013, no page)

There are also some promising mEducation projects in other countries. A program in Bangladesh has offered inexpensive English language lessons through mobile phones (Prosser 2010, pp. 31-33). Some schemes have utilised mobile phones in teacher training (Selinger 2009). Other education projects which use mobile phones in education are outlined by the African Development Bank et al. (2011, p. 33) and include:

- Bridge IT Tanzania, which is using mobile phones to distribute educational videos in Tanzania so that these can be played on classroom television sets;
- Dr. Math in South Africa which started as an online tutoring service (in which students contacted tutors for help with mathematics) and has expanded to include mathematics competitions and games; and
- Yoza, which started in South Africa, but is now also available in Kenya, and which supports reading and writing by enabling students to interact with a novel as it unfolds.

A note of caution is warranted as "there aren't a lot of mobile education initiatives in developing countries that have reached scale. But there are several promising projects" (Trucano in UNESCO 2013, no page). In addition, little quality mEducation research has been conducted thus far, with most endeavours lacking in research rigour or tending to be limited to small, pilot projects (Watson 2012, p. 48). Therefore, there is a need for projects such as SMS Story to be conducted with a rigorous research methodology and for the results and lessons learnt to be widely shared.

Elementary education in Papua New Guinea

Elementary education in PNG refers to the first three years of formal schooling: Elementary Preparatory Grade and Grades 1 and 2. The first elementary schools were introduced in PNG during the mid-1990s. Historically, teaching at these grades has been undertaken in local vernacular. The language of instruction to be used in class was chosen by the local community (Department of Education 2004, p. 27). Reforms by the current government are changing this, and the language of instruction in future will be English (Department of Education 2013, p. 1).

Literacy levels in PNG are low (Ambang 2012, p. 90; ASPBAE Australia Ltd and PNG Education Advocacy Network 2011; Department of National Planning and Monitoring 2010, p. 54; RTI International 2011).

Learning to read and write is critical during elementary education. One of the core areas of focus for elementary schooling is to "develop the basis for sound literacy" (National Executive Council 2009, p. ii). Children who fall behind with literacy early in their lives tend to remain behind all of the way through school (Hopkins et al. 2005, p. 94). Good literacy skills also support a child's broader learning. English literacy in particular will be important for children earlier than ever now that all elementary teaching will be in English. Currently levels of reading in English at elementary level are very low. Early Grade Reading Assessments (Machuca-Sierra et al, 2011) have confirmed low reading levels amongst elementary and lower primary students.

However it is important to stress that these results were not unexpected. Elementary teachers receive limited training and many work in inaccessible areas. Reading books are in short supply (National Executive Council 2009, p.

14). Teachers struggle to create new texts and make books. With limited resources, they rely on a chalkboard and a limited range of teaching strategies to deliver language lessons. SMS Story was designed to provide a novel solution to these challenges.

The story of SMS Story

SMS Story is a controlled trial which aims to understand whether mobile telephones can be used to improve children's reading by providing daily stories and lesson plans by text message to teachers in remote elementary schools. This is the first instance in which text messaging has been used to provide resources to teachers in PNG in this way, and it appears to be the first instance of this kind of project anywhere in the world. It is hoped that the programme can provide benefits which mitigate some of the need for very high-cost programmes such as in-service teacher training and delivery of books to schools in remote locations (see Commonwealth of Australia 2010, pp. 40-41 regarding the major challenges associated with delivering books to schools across PNG).

In SMS Story, two text messages were sent to elementary teachers in grade 1 and 2 every day for two terms. One text message is a short story based on a structured and progressive phonics and high frequency word scheme. Phonics has been found to be useful in previous studies in PNG (Cawley et al. 2011, p. 16) and elsewhere (UK Department of Education 2011, p. 2) and therefore the text messages follow a structured, phonics-based approach. The stories are potentially a very valuable resource for teachers and students in locations where there are no books. The stories were initially decodable, where a child can "sound out" unfamiliar words. Later stories were more complex and include common "tricky" words and have a number of chapters over several days. The second daily text message is a simple lesson plan based on that day's story. The lesson plan included various activities, such as reading comprehension questions, key sound practice, word practice and writing activities.

There was no face-to-face teacher training component to the trial. Teachers have received a short (less than one hour long) demonstration of the daily texts and received a laminated A3 poster with cartoons (Figure 1) showing the steps teachers need to follow each day. Each message is less than 160 characters in length, in order to fit into the length of a standard SMS message. SMS, 'Short Message Service' or text messaging, is a facility which allows mobile phone users to transmit text between phones. Examples of the content are given in Figure 2.
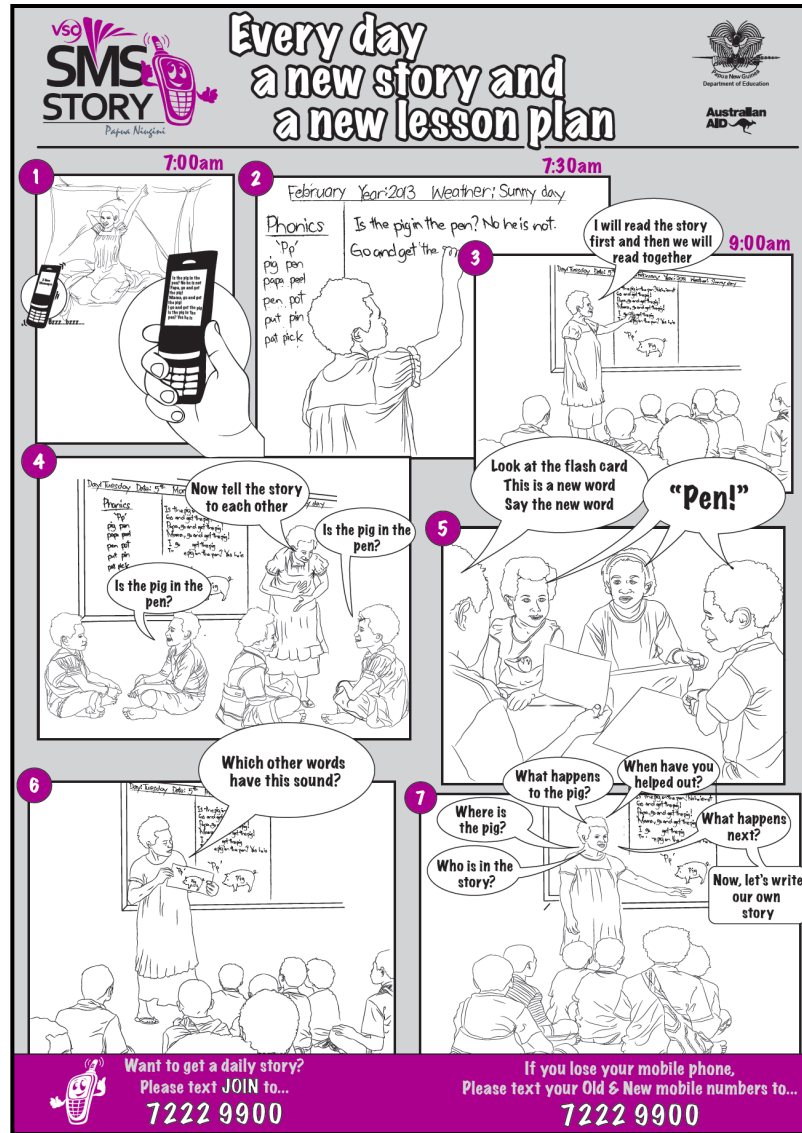
Figure 1: SMS Story poster

The Story	The lesson plan
Ben is a big man. He has a big dog. The dog is dirty Don. Don likes bananas. Ben picks bananas for Don the dirty dog. But bananas make Don sick. Oh Don!	Teach new sound: 'b' (Ben, big). New words: big, man, bananas, sick, but. Practise blending words on board with class using fingers to count sounds in the words.
152 characters (1 text message)	160 characters (1 text message)

Figure 2: Example text messages (as sent to teachers on May 24, 2013)

The project is designed as a research trial, the results of which will be available by the end of 2013. The hypothesis of the project is that by providing new stories and lesson plans every day, the quality of pupils' English reading will improve. In order to test this hypothesis, a test group of 57 teachers is receiving text messages every day over the course of 20 weeks, during terms 2 and 3, 2013. A second group of teachers from equivalent control schools do not receive the intervention (instead they receive an unrelated mathematics pack). Pupils in all classes were assessed in a range of reading skills at the beginning and at the end of the trial. Reading comprehension is assessed using a modified version of the Early Grade Reading Assessment (EGRA) used in PNG. Students are tested on common decodable words, common high frequency words, nonsense decodable words, reading fluency and reading comprehension. The reading performance of the children whose teachers receive the text messages will be compared with pupils in classes which did not receive the resources, in order to understand what impact the daily stories have had, if any.

A statistically significant difference in reading aptitude scores between the two groups would mean that the text messaging could be said to have an influence on the reading ability of students (Salters-Pedneault 2009). In addition, the research will examine the costs of the intervention and evaluate the technology. Teacher interviews and classroom observations explore how the stories are used and whether the intervention has an impact on teacher practice. Data included in this paper includes: baseline reading assessment data from testing conducted with students in term 1, 2013 (n=2,478); data from structured interviews with teachers conducted during visits in term 1, 2013; findings from phone interviews with teachers conducted after two weeks of text message distribution (n=37); and observations from field visits to 20 schools conducted during term 2, 2013, in a period spanning four weeks of text message distribution.

Rural and remote schools were selected, rather than urban schools, because the latter as a general rule would have more access to books, as well as other communication technologies and media products, such as newspapers. The two provinces, Madang and Simbu, hosting the trial are quite different in nature and context: Madang is a coastal province whereas Simbu is situated in the Highlands. Therefore, the findings will be valuable for educators throughout PNG who may wish to consider this methodology for use in other settings. If the outcomes are positive, the scheme may be considered for further trials or national expansion.

SMS Story baseline results

Baseline reading assessment was conducted in term 1 in grade 1 and 2 to measure the current reading ability of children and observe teachers' practice. The findings provide a clear picture of the pre-intervention children's reading ability in elementary classrooms in Madang and Simbu against which SMS Story's intervention will be measured – by comparing reading ability of pupils in control and active schools in term four. Children's reading scores were

disaggregated by gender, class level and by school selection (active or control); and tested for statistical significance.

A total of 2,478 students were tested on four sub-tests (familiar decodable words, familiar sight words, invented decodable words, and oral reading fluency and comprehension). The results showed that many children had limited or no reading ability (a result which mirrors similar studies such as EGRA). Of particular note are the very low numbers of children able to decode unfamiliar words (Figure 3).
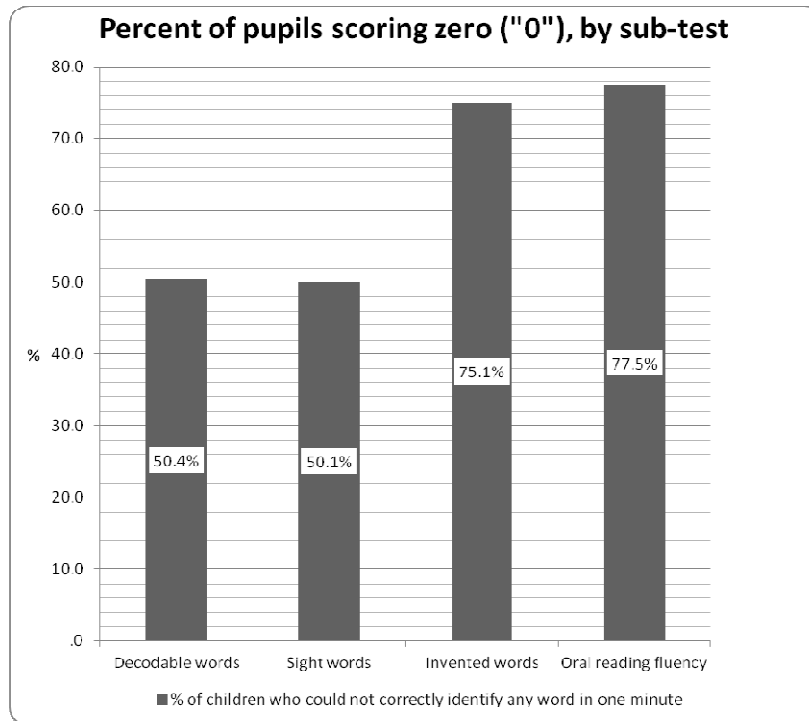

Percent of pupils scoring zero ("0"), by sub-test

- Decodable words: 50.4%
- Sight words: 50.1%
- Invented words: 75.1%
- Oral reading fluency: 77.5%

% of children who could not correctly identify any word in one minute

Figure 3: Graph showing the percentage of children in the whole study who scored zero in four sub-tests

The baseline also established that the active and control populations were statistically similar. For example, the proportion of non-readers (zero scores) by treatment was the same (Figure 4).
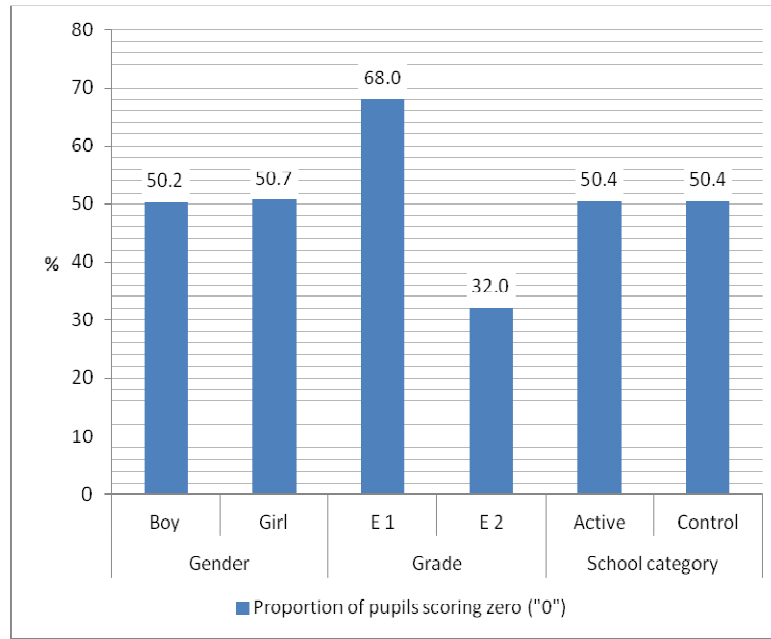
Figure 4: Graph showing the percentage of children scoring zero across all sub-tests compared by gender, grade level and treatment

A large proportion of pupils in all categories could not read a single word of connected text. The mean oral reading fluency scores are correspondingly very low: just three words in the sample paragraph read correctly in both active and control schools. Only one child, out of the 2,478 pupils sampled was able to read 60 words correct per minute. The baseline found statistically significant progression from grade 1 to grade 2 in all sub-tests (Figure 4).

In addition to the comprehension reading assessments, the researchers conducted structured interviews with teachers about how they teach reading (Figure 5). Observations were taken of the teachers' classrooms and student workbooks during the initial visit.

Classroom Activities	Never	on 1 or 2 days	on 2 or 3 days
You wrote a short story on the chalkboard for the children to read.	14.7%	33.0%	23.9%
You read a short story to the class.	12.8%	28.4%	28.4%
The whole class read aloud a short story from the chalkboard.	15.6%	18.3%	28.4%
Pupils read aloud individually to you.	26.6%	35.8%	23.9%
Pupils read aloud individually to other pupils.	25.7%	35.8%	22.0%
Pupils orally answered questions you asked about a story they had read.	14.7%	28.4%	33.0%
You taught the pupils a new English sound.	12.8%	25.7%	31.2%
You taught pupils new English words.	4.6%	24.8%	27.5%
You taught pupils a new spelling pattern.	22.0%	26.6%	24.8%
You taught pupils the meaning of new words.	4.6%	34.9%	26.6%
Pupils read silently to themselves.	30.3%	31.2%	14.7%
Pupils copied down writing from the chalkboard.	11.9%	13.8%	6.4%
Pupils wrote a story or poem.	39.4%	36.7%	12.8%

Figure 5: Frequency of classroom activities undertaken

Once the baseline data was collected the trial intervention began with a total of fifty stories and fifty lesson plans being sent to teachers in the active schools during term 1. A short telephone interview was conducted in week 2 of the trial to ensure that text messages were being received. 100% of the teachers interviewed (n=37) said they were receiving the lesson plans and stories in time and with no difficulties.

SMS Story mid-point evaluation

During term 2 the research team visited a sample of active and control schools to conduct lesson observations and track the progress of the implementation. Visits to active schools found that the technology is effective in delivering stories and lesson plans to teachers. 100% of the teachers (n=42) at schools visited (20 schools) asserted that they were receiving the lesson plans and stories in time and with no difficulties, affirming the findings of the earlier telephone interviews.

Content analysis conducted in randomly selected children's books revealed evidence of teaching SMS stories and in many of the classrooms visited SMS stories were displayed for children to read. There are no incidences detected of

sharing SMS stories and lesson plans between teachers in intervention schools and teachers in control schools.

Learning from the process

During the early stages of establishing the SMS Story trial, the authors have learnt about implementing a mobile technology programme with teachers in PNG.

Teacher uptake has been very positive
Initial feedback from teachers in the active group has indicated that they are using the resources regularly, and perceive educational benefits from them. All active teachers spoken to at the time of writing reported receiving and using the stories in their teaching.

Using software to send messages to a mass audience
VSO is making use of a software programme called FrontlineSMS in order to send text messages. This software has been successful in helping ensure that 100% of active schools had received all messages at the point of the term 2 mid-point survey (40 days into the programme). FrontlineSMS is open source software and uses a modem to send text messages from a laptop to predetermined groups of users. It is software designed for use by non-government organisations and is free-of-charge (the software is free, although users must still bear the cost of sending text messages). FrontlineSMS offers advantages in its ability to synchronise with Excel contact databases and store and access past sent and received messages. The cost of sending the messages is determined by the SMS provider. The same SIM card is used to send the messages so that teachers can recognise the number of the sender and send responses by text message. The cost-benefit analysis of the trial is one of its more innovative features.

The cost to the teachers
The only expense which has been mentioned by teachers involved in the project is in relation to making sure that their phone batteries remain charged. Previous research found that recharging mobile phone handset batteries can be difficult in rural PNG (Watson 2011, p. 275). Around half of teachers surveyed said that they charge their mobile phones using generators (50.5%). Some teachers reported paying those with a generator to charge their mobile phone handset batteries (at an average of two kina). This was the only cost attached to using the service, and had no impact on the levels of participation among teachers in the active group.

Messages should be sent in advance, to give teachers preparation time
Messages were initially delivered to teachers each morning for use in teaching the same day. However, telephone interviews early in the trial suggested that teachers preferred to have more preparation time with the materials. It was therefore suggested that messages be sent the afternoon before the day on which they were to be taught. This change has been implemented, with messages for use on Mondays now being sent on Friday afternoons.

Innovation and further uses of mobile phone technology for education

The authors hope that the case study of SMS Story illustrates the potential of mobile phone technology to play a part in meeting the challenges of the PNG education system in the coming years. SMS Story seeks to determine whether mobile phones could have a measurable positive effect on the learning outcomes for students.

There is an opportunity for mobile phones to support teaching and learning in the classroom in various ways, such as:

- Loading content (such as stories, sounds or songs) onto teachers' phones
- Using 'free' phone numbers to allow teachers (and students) to hear stories, songs, new words and sounds
- Collecting and reporting basic education data and student assessment results
- Enabling teachers to share stories, lesson plans and good practice
- Using software applications running in smart phones for student diagnostics or assessment of special educational needs
- Student reporting of teacher absenteeism.

SMS Story is a research project with a rigorous and sound research methodology centred on a controlled trial. As such, the findings will have relevance not only for educators in PNG, but also globally in both the mobile communication and education fields. This paper has presented early results including valuable baseline data about student reading ability, research interviews with teachers and observations made during field visits. A second round of reading assessments will be conducted with students in both control and active schools in term 4, 2013. The authors anticipate that analysis of all data will be concluded by the end of 2013, with publication to follow soon thereafter.

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