

USING TEXT ADVENTURE GAMES TO ENTICE LEARNERS TO PRACTICE ARITHMETIC SKILLS OVER MXIT

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The matrices of 2009 (those learners turning 18 in 2009) are younger than the internet, younger than cell phones, younger than computer games. Every primary school learner and secondary school learner in school this year has lived his or her entire life in the presence of computers, wireless connectivity, television, the world wide web, cell phones, and computer games. They are a hooked up, wired, connected, multi-tasking, parallel processing generation of learners. Isn't it time the education process catered for these characteristics? This paper describes a facility where learners are enticed or encouraged to practice basic arithmetic skills by playing text adventure games over Mxit on their cell phones. The text adventure game is a traditional "dungeon" type game with rooms and hallways. Unlike traditional "dungeon" games where the weapons of choice are keys, axes, and magic wands, the weapons of choice in our text adventure games are cell phones, calculators, remote digital keys and mathematics textbooks. Whereas in traditional "dungeon" games, magic words would be written on walls, in our text adventure game, numerical calculations are sms'd to the virtual cell phone of the player. The result of these numerical calculations are the secret codes to get through digital safe doors, use keypads and to turn on digital keys.

INTRODUCTION

The learners in primary and secondary school today are a "switched-on" generation. Traditional educational tools such as paper, pencils, and white boards are competing with cell phones, MP3 players, IPODs, PDAs, Wiis and play stations. This paper examines a project where text adventure games with a mathematical twist are deployed over Mxit which participants can play on their cell phones. In order to complete the puzzles laid out in the game, participants must do various arithmetic calculations.

A BRIEF HISTORY OF TECHNOLOGY

By standing on the shoulders of giants, Sir Issac Newton saw farther and could build on what his predecessors had already discovered.

It is difficult for an author to give a brief history of technology because the author never knows how far back that history must go. But let's start in 1969 when four host computers were connected together creating the initial ARPANET configuration [1]. That initial network of four computers grew to be the world wide web. In 1974 one

of the first computer games, *Pong*, was introduced [2]. In 1983 Motorola and AT&T introduced an advanced mobile phone system which grew to over two million subscribers by 1988 [3]. In 1988 Creative Labs also hit the market with their Sound Blaster card for PCs bringing sound to PC gaming [4].

In South Africa, Vodacom (a major cell phone network) was launched in 1993 [5] and MTN (another major cell phone network) was launched in 1994 [6].

And the majority of the matrices for 2009 will be turning 18 in 2009 and were born in 1991. During their entire life there has been internet, cell phones, and noisy computer games.

Marc Prensky [7] maintains that digital technologies have dramatically changed these learners: “Today's students have not just changed *incrementally* from those of the past, nor simply changed their slang, clothes, body adornments, or styles, as has happened between generations previously. A really big *discontinuity* has taken place. One might even call it a 'singularity' – an event which changes things so fundamentally that there is absolutely no going back. This so-called 'singularity' is the arrival and rapid dissemination of digital technology in the last decades of the 20th century.”

This paper will explore a project where computer games with a mathematical twist are accessible to learners on their cell phones using the popular Mxit instant messaging system.

A BRIEF DESCRIPTION OF MXIT

Mxit is an instant messaging system (also known as a “chat” system) which runs on cell phones. People who wish to use Mxit must download a small application (known as a “mxit client”) onto their cell phones. This application is then used to send and receive messages and chat with other people. In many ways it is similar to an sms message or a text message. The two major differences between sms messages and Mxit messages are

1. In order to communicate with another person using Mxit *both* people must be using Mxit *at the same time*. This is quite different from sms messages or text messages which can be sent at any time regardless of whether the intended recipient has his or her phone switched on.
2. Mxit messages are a fraction of the cost of sms or text messages. Depending on cell phone contracts, sms and text messages may cost up to ZAR1.00 (one South African Rand) per message whereas Mxit messages cost one or two (South African) cents each.

In addition to these features, the designers of Mxit (Mxit Lifestyle (Pty) Ltd based in Stellenbosch, South Africa) keep the Mxit cell phone application vibrant and “kewl” (“kewl” is a common term used in Mxit and other instant messaging systems and is a derivation of the old slang term “cool” meaning fun, funky, exciting, nice, etc) with

frequent updates. The cell phone application is colourful, makes noises, and is easy to use. It is a virtual meeting place for young people.

Mxit currently boasts over 9 million users of their system [8].

A BRIEF DESCRIPTION OF DR MATH

Dr Math is a project which was implemented by Meraka Institute in January, 2007 [9]. Dr Math provides help with mathematics homework using Mxit as a medium. Primary and secondary school learners can use Mxit on their cell phones and reach a tutor in the afternoons after school to help with their math homework problems. The tutors are engineering students from the University of Pretoria. The engineering department has a requirement that students must do 40 hours of community service in order to get their degree. Between twenty and thirty of the engineering students spend their 40 hours as Dr Math tutors. During the first two years of operation (2007 and 2008) over 4000 learners received help from the tutors.

During the second year of operation (2008), Dr Math implemented a number of competitions in which learners could compete against other learners in basic arithmetic and algebra skills during the periods of time when human tutors were not available [10]. The competitions included simple skills such as addition and multiplication and more complicated skills such as factoring a polynomial and finding the intersection point of two straight lines.

These competitions are extremely popular and learners often do hundreds of calculations in order to remain the “top score” of the competition.

However, in reviewing the log files of the competitions, it became obvious that some competitions (such as addition and multiplication) were extremely popular and other competitions (such as division) were not very popular.

Another mechanism was needed to really entice learners to practice skills such as division. The mechanism investigated was the implementation of text adventure games (often also called “interactive fiction”) which can be played over Mxit on cell phones.

A BRIEF DESCRIPTION OF TEXT ADVENTURE GAMES

Text adventure games were some of the first games available on personal computers with *Zork* being one of the oldest documented text adventure games [11]. Players navigate a world of rooms (or caves as the case may be) by typing commands such as “go east” or “enter door”. Objects in the world can be manipulated with simple commands such as “take ax” or “read book” or more complicated commands such as “throw ax at tree.”

Although this genre of computer games may seem old-fashioned, even “quaint”, in view of the current trend of high end graphics, multi-player, first person shooters, text adventure games are still being developed and deployed. Inform 7 [12] is an open source text adventure game development environment which is freely downloadable. Inform 7 generates a binary file of the adventure game in a format which is an industry standard. The binary file can be played by various other software applications including software on some mobile players.

DR MATH'S MISSING LAPTOP

Dr Math's Missing Laptop is a text adventure game developed using Inform 7 to be specifically playable on the Dr Math's Mxit contact on cell phones. The game consists of a “world” or “map” of 4 rooms with an interconnecting hallway between them. All of the doors of the rooms are locked with either a digital key pad or are controlled using a digital remote key. In the various rooms, players will find handy objects such as a cell phone, a calculator, an LCD torch, a battery charger, a digital remote key, a mathematics text book, and a rucksack which can be used to carry all of these objects.

Clues on how to get through the digital locks are often written on the walls, on white boards or are “virtually” sms'd to the player. In view of the fact that *Dr Math's Missing Laptop* was written to encourage learners to practice division, all of the clues are division calculations. Here are a few samples of the clues:

On the desk top, dirty finger prints have written “Sliding door code is $32/4$ ”

The sms says “The key code for the digital key is $132/12$ ”

The player can then later execute the command

Key sliding door to 8

and the game will respond with

The sliding door is now unlocked

and the player will be able to open the door and get through.

In the following sequence of commands, the player needs to get a “virtual” cell phone working. (In the following transcript, the bold print are responses from the game and the normal print are user inputs)

Look in desk

In the modern gleaming metal desk are a torch, a cell phone and a digital key

take cell phone

[your score has just gone up by one point]

examine cell phone

The cell phone is currently switched off

Turn on cell phone

[your score has just gone up by one point]

Examine cell phone

It is a high-end cell phone with a 5 mega pixel camera, FM radio, HSDPA.

You must really key the cell phone to a pin number.

Key cell phone to 10

Invalid pin for cell phone

look

You can see a sliding door, a modern gleaming metal desk, a broken executive chair and a white board here.

Examine white board

On the white board in large black writing are the words "cell phone pin is 24/12"

key cell phone to 2

the cell phone is now useable

[your score has just gone up by one point]

Players must navigate through the four rooms collecting all the objects in order to eventually find *Dr Math's Missing Laptop*. Through out the game, depending on the routes taken by the players, approximately 5 or 6 division calculations must be correctly done by the player. In this particular case, the game ensures that the division calculations are integer calculations with no remainders or fractions. These calculations are generated by random number generators so that the calculations are different every time the game is played.

Because the game is rather involved, there is a mechanism for the player to save the game status and come back to the game at a later time

RESULTS

By looking at the data from the log files, we find that participants often play the text adventure game for a short period of time, go away, and come back later. In this particular log, Rapper (not his or her real Mxit nick name) started playing for the first time on January 7, 2009, around mid day.

2009-01-07 11:35:14,121 Rapper:

2009-01-07 11:35:14,151 Bot -> Rapper: Today's TopScore is Gumm be@r with 0. It may be easier to play if you turn the dictionary on. Commands must be spelled out. For example .g help or .g look or .g go or .g take.

He played on and off all day until the early hours of January 8, 2009

2009-01-08 03:04:28,126 Rapper: take

2009-01-08 03:04:28,135 Bot -> Rapper: Today's TopScore is Man wida plan with 3. What do you want to take?

He continues playing on and off for days

2009-01-15 18:33:37,365 Rapper: desk

2009-01-15 18:33:37,369 Bot -> Rapper: Today's TopScore is *THE CHAMP OK URL NERDZ(G)* with 20. That's already open.

Until finally on January 18, 2009 (over a week later), he successfully finds *Dr Math's Missing Laptop*

2009-01-18 03:42:10,949 Rapper:

2009-01-18 03:42:10,953 Bot -> Rapper: You are still the top score.

*** You have found Dr Math's laptop. Congratulations. Now it's time to hit your math homework. Bye bye. ***

In that game you scored 21 out of a possible 22, in 163 turns.

We have found that participants often play this adventure game over a period of days. Currently, at the time of writing this paper, there are 70 saved games stored on our system. These are games which are in progress. The participants will come back and continue the game at a later time.

ETHICS AND SAFETY OF MINOR CHILDREN

Because this project deals with minor children, the entire Dr Math tutoring project has received ethics approval from the Tshwane University of Technology ethics committee. All conversations are logged for research purposes. All participants are informed when they subscribe to the service that their conversations are logged for research purposes. No personal details of participants and no actual telephone numbers are stored in any of the log files.

CONCLUSION

It is clear that children and teenagers can concentrate for long periods of time when it comes to playing computer games. We would like to take advantage of that fact and encourage them to concentrate on items of educational benefit. This initial game *Dr Math's Missing Laptop* was just an attempt to see if it would be technologically possible to deploy text adventure games over Mxit and if children and teenagers would, in fact, play them.

In that respect, the project has succeeded.

From a gaming point of view, however, the introduction of mathematical formulae into the game was a bit “forced” and did not allow the game to flow smoothly. By this we mean that it is a completely unrealistic scenario that a formula for a pin for a cell phone is written on a white board. However, when looking at commercial games, that scenario is no more unrealistic than soldiers having more than one “life” in a first-person-shooter war game.

THE WAY FORWARD

We plan to develop a few more games and deploy them over Mxit. We would also be very interested in venturing into writing science games. Any science or math teacher who has interesting ideas on this is urged to contact the writer of this paper.

In addition, it would be an interesting research project to see if deploying a MUD (multi-user dungeon) game where participants actually played against or with other participants could succeed.

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