

Mobile information communication and technology use in secondary schools: A feasibility study

by

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List of abbreviations and acronyms

Abbreviations and Acronyms Descriptions

CSIR	Council for Scientific and Industrial Research
ICT	Information Communication and Technology
M-Learning	Mobile learning
OBE	Outcomes Based Education
SMS	Short message service
MMS	Multimedia Message Service
TTS	Text-to-speech
IVR	Interactive voice response
AGI	Application Gateway Interface
Wiki	Cooperative learning space available through the internet
PBX	Private Branch Exchange
Parser	Article reader
URL	Uniform Resource Locator. Naming method used to identify the addresses of web sites

Summary

Mobile technology has allowed the traditional boundaries that exist between formal learning and informal learning to blend. The purpose of this research is to understand and describe the use of established and new “support networks” and the process of knowledge acquisition and knowledge creation in a formal learning environment. Factors affecting the design, testing and ultimate feasibility of using mobile devices such as cell phones to enhance teaching and learning in well-resourced developed, and under-resourced developing schools are identified. Findings in this study point to the general acceptance of using mobile technology as a readily available vehicle, to provide access to contents and allow learners to contribute to the collective body of knowledge from their own perspective.

Keywords

Mobile learning
Prototype project environment
Developed and developing schools
MobilED system
Collaborative learning
Project based learning
Design research
Mobile communities
Open source
AudioWiki

Chapter 1

Introduction and Background

Introduction

This essay reports on the design, development and testing of a mobile learning event in two very different schools in South Africa located within walking distance of each other. The first school is a well-developed, privately-owned school located on a luxury estate. The second school is found just down the road, struggling to outgrow its farm-school status.

It is widely anticipated that mobile devices will, in the future, narrow the existing digital divide experienced in developing countries (ITU, 2006). Mobile learning seems a viable solution, with networked and ubiquitous instruments allowing the playing fields between the “haves” and the “have-nots” to be levelled.

The current principle partners of the MobilED initiative are the **Meraka Institute** of the Council for Scientific and Industrial Research (CSIR), South Africa and **Media Lab** of the University of Art and Design, Helsinki, Finland.

One of the main objectives of the Meraka Institute is to facilitate needs-based research and innovation to develop products and services based on information and communication technology (ICT). This is in an effort to address the “Digital Divide”-related problems that exist in South Africa and other developing countries.

Research Project

The following is taken from the MobilED research documents.(MobilED, 2005)

The research is conducted under the auspices of the MobilED initiative. The current principle partners of the MobilED initiative are:

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- Media Lab of the University of Art and Design, Helsinki, (Fi)
- Centre for Research on Networked Learning and Knowledge Building, University of Helsinki (Fi)
- Tshwane University of Technology (SA)
- University of Pretoria (SA)
- Escola do Futuro Universidade de São Paulo (BR)
- Wikimedia Foundation, (US)
- Center for Knowledge Societies (IN)

The initiative is funded by the Principle Partners, the Department of Science and Technology, South Africa, and the Embassy of Finland in Pretoria. Handsets were sponsored by Nokia.

MobilED, a set of flexible mobile learning services, is geared towards finding solutions to narrow this ever-widening divide. The MobilED Server was designed and developed by the research team of the MobilED initiative. The main thrust of the initiative is to enable the usage of a public information source, such as the Wikipedia on-line encyclopaedia, via an audio-based mobile device, such as a mobile phone. Mediawiki is a media-rich wiki engine and is currently used by the MobilED technology platform as the content management system of Audio Wiki, an audio information system. Users of the system will be able to access existing content by sending an SMS message to the MobilED server, which will return reply with a return call reading the relevant article by means of a speech synthesizer. Users can navigate in the article by selecting their touch tone keys and can even modify it by contributing audio clips via their mobile phones.

This essay consists of a series of three articles. The first article focuses on the issues guiding the design of the MobilED technology platform and services. The second article reports on the implementation of mobile learning in a developed school. The third and last article reports on the testing of the

same lesson material and technology platform in a developing school scenario.

Background

Education is becoming increasingly multicultural, global and widely accessed. Same page learning (accessing the same content no matter the locality in the world) is being actively advocated, raising concerns about maintaining the uniqueness of different cultures. The amount of research being done in the fairly new field of mobile technology in teaching is derived from a relatively narrow social, cultural and geographical base. “Reported findings originating mainly out of Europe, North America and Australasia . . . is not representative of developing countries and their scenarios” (Kukulska-Hulme & Traxler, 2005). The contextualization of mobile learning in an African country is yet to be done at school level.

For the purposes of this research the terms “developed school” and “developing school” need clarification:

Developed school: This tends to be a formally structured school, situated in an affluent environment. Parents contribute to school fees in order to boost staff numbers so that learner to teacher ratio is below 30:1. Strict rules apply to the dress code and general pupil conduct. Facilities usually include an adequate number of classrooms, a resource centre, computer centre, tuck shop, and hall as well as sport fields for sporting and recreational activities. Security includes burglar bars and alarm systems, armed response as well as controlled access. Very few of the learners at such schools make use of public transport to commute to school.

Developing school: This type of school is usually situated in a rural area. Government pays the salaries of teaching staff and school fees cover additional costs and are not used to employ extra staff. Learner to teacher ratio tends to be around 45:1, which results in teachers teaching up to 60 learners per lesson. Facilities are limited to a few classrooms, with no resource centre on the premises and few or no computers, therefore no connectivity. If there is a computer in the school, it is generally shared by all

the staff and is not available for learner use. Few security measures to safeguard equipment are visible. Most learners make use of public transport to commute to school.

The use of mobile phones in a formally structured learning event in secondary schools in South Africa has not been reported on before, and this essay, serves the purpose of informing future developments.

Research objectives

The objective of the investigation undertaken as reported in this thesis is to answer a range of questions concerning the design of a technology platform to support mobile learning and the experience of the learners in using the mobile technology in a formal learning scenario. This is in an effort to determine the feasibility of implementing and adopting the use of mobile technology to support learning in senior secondary schools.

The first research question focuses on aspects that guided the design of the MobilED technology platform. The second research question looks at the experience of the learners in using the mobile technology in a classroom setting.

The main research questions and subsidiary research questions are presented in Tables 1 and 2. The research questions in Table 1 are arranged according to the principles that guide the analysis, design and development of the MobilED technology platform.

Table 1: Outline of the first research question.

<i>Which criteria guide the design of feasible mobile technology solutions for secondary schools in South Africa?</i>		
Research theme	Research question	Topic of interest
Research partners and project focus	What are the expectations and contributions of the research partners?	Analysis
The nature of the existing technology	What is the lowest common denominator in used handsets in the country? What is the current scope of available mobile technology?	Analysis
Research Model to guide research outputs	What should be considered for inclusion in the research model?	Design
MobilED Kit	What should a mobile kit consist of in order to enhance the learning process?	Design
Incorporate new capabilities into current designs	How can Text-to-Speech combine and SMS technology be combined with Wikipedia?	Development
Testing of MobilED solution	Which classroom factors impact on the testing of the MobilED kit?	Implementation
Feasibility	Can MobilED services offer feasible solutions to enhance teaching and learning?	Evaluation

In Table 2, the secondary research question is extrapolated.

Table 2: Outline of the second research question

<i>How do the learners experience the Mobiled technology platform during a collaborative learning event?</i>		
Research theme	Research question	Topic of interest
Collaborative group interaction	How was the system used?	Group interaction – own interaction, support, listen vs reading.
Accessing information	How did the system perform?	How the system worked / accessing information – navigation and menu options.
Reaction of the service	What was the reaction of the server/service?	Reaction to the service - response time, prompt time and allocated lesson time.
Text-to-speech voice	How was the voice perceived?	Assessing the voice – aspects such as clarity, comfort with voice and future use.
Service settings	What are the preferred settings of the service offered?	Service preferences – settings relate to aspects such as language, gender and age of the voice used.
Audiocastings	What was the response to the audiocastings?	Quality, content and accessibility.

In Table 2, the subsidiary research questions posed are grouped together in themes and include those related to the collaborative group interaction, accessing information, text-to-speech voice, and reaction of the service, service settings and audiocastings.

Rationale

Mobile learning is seen to be rapidly moving from small-scale pilots, where applications are still very new and exemplars of best practice are still emerging, into institution-wide implementation with consideration for structured levels of sophistication. (Stone, 2004) This may be the case in the developed world, but does not reflect the current situation in South Africa as a developing nation.

“Culture is concerned with establishing ideas. Education is concerned with communicating those established ideas. Both are concerned with improving ideas by bringing them up to date. The problem arises when new information is only being evaluated through an old idea. Instead of being changed the old idea is strengthened and made ever more rigid.”
(De Bono, 1970)

According to this quote, education is forever seeking to keep pace with established ideas which are already accepted and adopted in culture / society. The challenge is to use the mobile phone in a new and more formal environment and to change the learning perspective of learners of classroom-bound learning to one of lifelong learning. (Oblinger & Oblinger, 2005)

A proliferation of new ideas in the arena of mobile technologies and their possible application in formal and informal learning environments has raised some serious questions regarding good pedagogic practice vs. technology research.

Mobile learning is a very young science embarking on the next phase of its growth. In the developed world, it is past the pilot phase, but in the developing world, guidelines still need to be scripted and contextualized.

A word of caution is given by the organisers of the 2006 Conference on mobile learning about future research.

“... developing and implementing learning application for mobile devices that are not truly anchored in sound principles of learning is something a researcher in the area of mobile learning must be mindful of. There is a call for research on collaborative, contextual, constructivist approaches. ” (mLearn, 2006)

This international call to greater responsibility in applying sound learning principles to the design and development of mobile learning events serves to highlight the complexities of piloting mobile learning. The complexities that we face in our education system contribute to a contextually rich research environment.

Limitations of the research

The MobilED pilot study involved two groups of learners, one from a developed school and one from a developing school. Both are located in South Africa and will not necessarily reflect results obtained from other developing countries.

This report identifies the following research limitations:

- It involved a small sample in a peri-urban area in South Africa.
- The developed school received no training in the use of the devices, whereas the developing school received training in the use of mobile phones.
- The text-to-speech language is set at English, which is not necessarily the mother tongue of the learners.
- Research concentrated on the experience of the learners with the MobilED platform and access to Audio encyclopaedia.
- Only 5 MobilED kits were available to the developed school, while the developing school had 8.

Main Objectives

The following have been identified as the MobilED objectives during the pilot phase:

- To uncover unique ways in which learners use mobile phones and to use these innovative ideas to develop learning events in collaboration with learners in order to access the beliefs and social practices embedded in their indigenous knowledge systems.
- To choose themes/topics that explore and investigate our rich “African Philosophical Thinking” in order to promote the preservation of indigenous knowledge and encourage sensitivity across a range of social contexts.
- To encourage learners delve into their own life experience and relate their own personal stories in their efforts to actively participate and contribute to the existing body of knowledge.
- To articulate guidelines for the design of learning events that can be used in developed and developing scenarios to explore and comprehend the cultural, social and organizational context of learners in secondary schools.

Significance of the study

The significance of the study could be far reaching for all the stakeholders but particularly those involved from South Africa:

- CSIR – as they obtain new knowledge from the research, they can tweak their products and develop complementary technology to enhance good pedagogic practice.
- Education system - developing sustainable models to inform further development.
- Schooling in the South African context – this product can be contextualized and tailor-made to address conditions specific to

our country and can be adapted to inform similar situations in other developing countries

- To shed light on the feasibility of adopting mobile learning to enhance teaching and learning.

Thesis outline

An outline of the remaining chapters of this thesis follows.

Chapter 2 offers a literature review of the research design process, the current projects in mobile learning, and the main theories of use as applied in practice with specific focus on the conversation theory of Pask (1976).

Chapter 3 is the first in a series of three articles, and considers the principles that govern the design of a technology platform to enhance and support mobile learning.

Chapter 4 is the second in a series of three articles and is titled: “Piloting mobile learning in a developed school.” It reports on the design and implementation of a collaborative learning event using the MobilED service designed by the Meraka Institute (CSIR) as the first initiative.

Chapter 5 is the last in the three-part series and comprises the article: “Piloting mobile learning in a developing school.” It reports on the testing of the MobilED technology, using the materials developed in the previous pilot, in an under-resourced scenario in a developing secondary school.

Chapter 1

Introduction and Background

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- To uncover unique ways in which learners use mobile phones and to use these innovative ideas to develop learning events in collaboration with learners in order to access the beliefs and social practices embedded in their indigenous knowledge systems.
- To choose themes/topics that explore and investigate our rich “African Philosophical Thinking” in order to promote the preservation of indigenous knowledge and encourage sensitivity across a range of social contexts.
- To encourage learners delve into their own life experience and relate their own personal stories in their efforts to actively participate and contribute to the existing body of knowledge.
- To articulate guidelines for the design of learning events that can be used in developed and developing scenarios to explore and comprehend the cultural, social and organizational context of learners in secondary schools.

Significance of the study

The significance of the study could be far reaching for all the stakeholders but particularly those involved from South Africa:

- CSIR – as they obtain new knowledge from the research, they can tweak their products and develop complementary technology to enhance good pedagogic practice.
- Education system - developing sustainable models to inform further development.
- Schooling in the South African context – this product can be contextualized and tailor-made to address conditions specific to

our country and can be adapted to inform similar situations in other developing countries

- To shed light on the feasibility of adopting mobile learning to enhance teaching and learning.

Thesis outline

An outline of the remaining chapters of this thesis follows.

Chapter 2 offers a literature review of the research design process, the current projects in mobile learning, and the main theories of use as applied in practice with specific focus on the conversation theory of Pask (1976).

Chapter 3 is the first in a series of three articles, and considers the principles that govern the design of a technology platform to enhance and support mobile learning.

Chapter 4 is the second in a series of three articles and is titled: “Piloting mobile learning in a developed school.” It reports on the design and implementation of a collaborative learning event using the MobilED service designed by the Meraka Institute (CSIR) as the first initiative.

Chapter 5 is the last in the three-part series and comprises the article: “Piloting mobile learning in a developing school.” It reports on the testing of the MobilED technology, using the materials developed in the previous pilot, in an under-resourced scenario in a developing secondary school.

Chapter 2

Design-based research, mobile learning and underpinning conversational theory

Introduction

This chapter reviews the current literature with regard to

- criteria for conducting design research in a project-based environment.
- a survey of similar research in the field of mobile learning, internationally as well as in South Africa.
- the conversation theory as applied to mobile learning.

Criteria for conducting design research in a mobile learning environment

Reigeluth & Frick (1999) noted that

“Design-based research has the potential to generate theories that both meet the researchers’ needs and support educational reform”

and Wang & Hannafin, (2005), in turn, identified nine principles central to the planning and implementation of design-based research. They are as follows:

- Design should be supported with research from the outset.
- Practical goals should be set for theory development and an initial plan should be developed.
- Research should be conducted in representative real-world settings.
- Close collaboration with participants is essential.

- Research methods should be implemented systematically and purposefully.
- Data should be analyzed immediately, continuously and retrospectively.
- Designs should be refined continuously through thorough reflection.
- Contextual influences should be documented with design principles.
- The generalising ability of the design should be validated.

An iterative process and constant reflection are needed to reveal design principles and inform future developments. However, it remains imperative to emphasise pedagogy rather than technology, especially in a school setting where the accountability of completing an existing curriculum is a priority for the teacher.

One of the distinctive characteristics of design research is that it deepens the understanding of the phenomenon under investigation while the experiment is in progress.

“The overall goal of design research is to solve real problems while at the same time constructing design principles that can inform future decisions.” (Reeves, 2000)

In this research, the use of mobile technology in formal learning environments is under scrutiny. In future, it is predicted that the focus will shift from formal structured learning, to informal learning, where learning is a life-long experience. (MobilED, 2005)

Research results need to be connected to both the design process through which the results are generated as well as the setting in which the research is conducted. (Wang & Hannafin, 2005) This type of process must be thoroughly documented with a visible data trail, so that later research can

trace the emergence of new ideas, relating them to the contextual factors that could have led to the particular observed effect.

Where research agendas might differ between the practitioners and the researchers, the needs of all parties must be negotiated with the principal research partners in advance. (Cobb *et al.*, 2003) noted the importance of developing a deeper understanding of learning ecology in a research setting, as this understanding is to form the theoretical target for research.

Similar Research

MOBlearn, one of the main research programs consisting of a conglomeration of 24 partners from Europe, Israel, USA and Australia, is currently limiting its research to tertiary institutions, business training and health care scenarios. Issues identified by researchers from the MOBlearn project include: context, mobility, learning over time, informality and ownership.

They see learning moving more into the learners' personal environment, both real and virtual, and becoming more collaborative and lifelong. (O'Malley *et al.*, 2003)

M-Learning, a pan-European project, addresses three social/educational problems relating to youths 16-24 years of age: poor literacy/numeracy, non-participation in conventional education and lack of access, creating ICT "haves" and "have-nots". (Attewell, 2005)

The MobilED project plan states:

"There has been a concerted attempt to introduce computer technology to schools in the developing world, with mixed results. There have been several initiatives to attempt to include technology in a more active manner in the educational arena. However these have been PC-specific, sporadic and often adopt unsustainable models. Hence scalability is a major consideration." (MobilED, 2005)

This MobilED project has identified prevalent issues in a developing scenario:

- Lack of ICT-literacy at a general level amongst teachers.
- Stringent and structured forms of teaching with little or no scope for lateral thinking.
- Realization of the importance of technology, but inability to incorporate this due to lack of training, adequate infrastructure and integration with the current curriculum. This is more apparent as we move from the urban to the rural areas.

Currently, mobile phones do not play an active role in formal education. If at all, they are for personal use alone. In many schools, existing policy forbids the use of mobile phones in class, and such use is viewed by school management as a security risk and a distraction. In an informal learning context, however, mobile phones are used extensively.

Barker *et al.*, (2005) proposed theoretical models for the adoption and implementation of mobile learning in developing countries. They see mobile learning as a vehicle to cross the digital divide as technology penetration is very low in African countries, particularly in comparison to other developing countries. The concern has been raised about whether learners without previous experience of e-learning will be able to reap the full benefits that m-learning can offer. (Syvänen *et al.*, 2004).

Brown, (2005) differentiates between two classes of mobile learner in an African setting. The one class consists of first world learners with access to the latest in mobile technology, who have been exposed to e-learning in the past. The other class is the third world or remote-areas learner, with limited access to mobile phones and network coverage and with little experience in e-learning. The difference becomes more marked, with learners from the developed scenario often owning their own technology and seeing it as a

personal commodity, whereas learners from a developing perspective have access, but do not own their own phones. In 2003, Brown also developed a model for support in distance education at tertiary level.

Statistics

The following is taken from the International Telecommunications Union’s website.

“Africa’s mobile cellular growth rate has been the highest of any region over the past 5 years, averaging close to 60% year on year. The total number of mobile subscribers continent-wide at end 2004 was 76 million.” (ITU, 2006).

Figure 1 illustrates the relationship between the fixed line vs. the uptake of mobile technology.

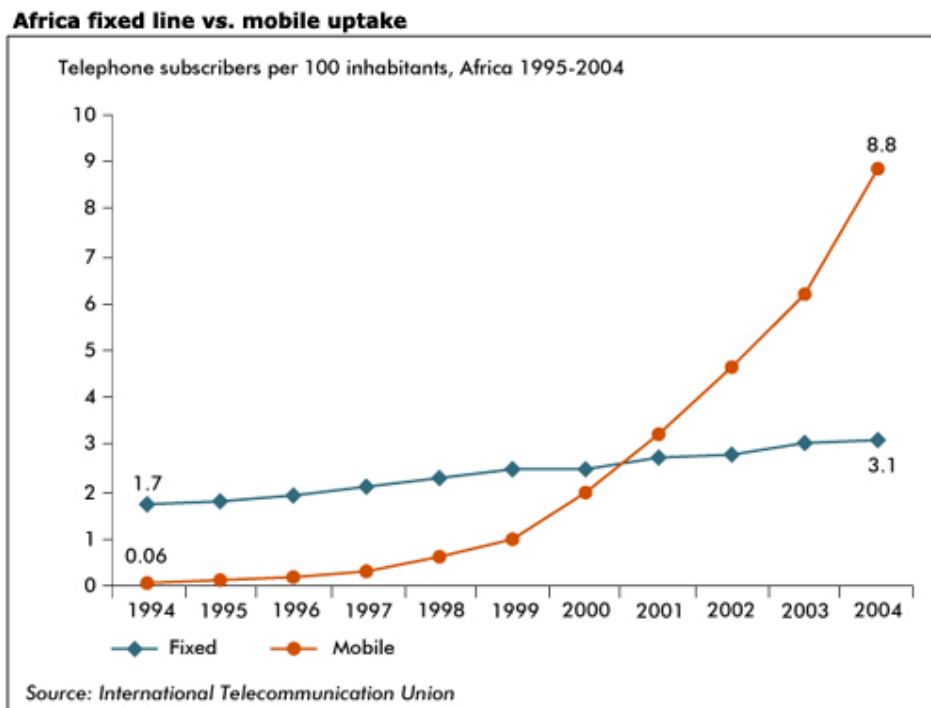


Figure 1: Africa fixed line vs. mobile uptake

In 2004 Africa had close to 100 million telephone subscribers in total, 76 million of which were mobile subscribers. Africa has the highest ratio of mobile to total telephone subscribers of any world region, and has been dubbed

"...the least wired region in the world. Over the last 10 years, the digital divide has been shrinking in terms of numbers of fixed phone lines, mobile subscribers, and Internet users. Nonetheless, there remains a crucial gap." (ITU, 2006)

The latest General Household Survey released by Statistics South Africa (STATS-SA, 2005) reveals that almost 60% in 2004 compared to 35% in 2002 of households in South Africa have a mobile phone available for the regular use of the household. Furthermore, that 15.8 million people - ranging from preschool pupils to university students - were attending educational institutions.

Over the last 10 years, the digital divide has been shrinking in terms of numbers of fixed phone lines, mobile subscribers, and Internet users.

To fill this gap, research needs to be conducted in the context of a developing world, as products developed for the first world context often lacks sustainability. (Ahonen *et al.*, 2003)

We also see a body of work focussed on setting up guidelines for the design of the mobile learning activities and materials. Amongst these are contributions from Pehkonen & Turunen, (2003), proposing mComponents – originating from their “Digital Learning 2” project.

Aspects they focus on are:

- continuity and adaptability
- learning as a personal process
- context in learning
- accessibility
- support for time
- learning management
- flexible interaction

Theoretical underpinnings

Trends are being identified and suitable theories underlying pedagogical aspects are being formulated to guide future research paradigms. Two learning theories in relation to mobile learning are being widely discussed currently. The first of these is the Activity theory. This is where the mobile technology is seen as a tool or artefact. (Engeström, 2001; Taylor, 2004) The second theory under scrutiny is the Conversational theory. Learning is seen in terms of conversations between different systems of knowledge and was originally developed by Pask in 1976 and adapted by Laurillard in 2002.

Conversational Theory

The other theory being investigated is Conversational theory. It describes learning in terms of conversations between different systems of knowledge. Gordon Pask (1928 – 1996) was a UK scientist and inventor and one of the founding fathers of cybernetics. His ideas about learning and teaching were articulated as Conversation theory.

In formalising his theory, Pask did not distinguish between people and interactive systems. He saw this theory as a useful framework for

“adumbrating a wide range of other work on human communication and human systems and on the design of man-machine systems and interactive environments” (Scott, 2001a).

It can therefore be extended to include interactions between humans and humans, as well as humans and computers.

“Rather than seeing the conversation/communication as the exchange of messages through an inert and transparent medium, Pask reconceived it as the sharing of understanding within a pervasive computational medium. Media are thus to be understood as active and responsive systems within which mind-endowed individuals converse.”
(Taylor et al., 2006)

Minds, by expressing language and instantiating different systems of belief, provide the impetus for conversation.

The underlying assumptions of conversation theory are that the brain/body is a dynamic self-organising, “variety eating”, adaptive and habituating system, subject to boredom and fatigue. Pask viewed man as a “system that needs to learn”. The motivation therefore is not “that we learn” but rather **what** is learned and **why**. (Scott, 2001b)

This theory accommodates a constant reflection and adaptation, articulation and re-articulation, action and feedback that take place between the participants, leading to an oscillating conversation in pursuit of the common goal of knowledge acquisition and knowledge sharing. The prerequisite for learning in any person or system is that:

“... *it must be able to converse with itself about what it knows.*” (Taylor et al., 2006)

This is aided by people being able to converse with each other, by interrogating and sharing their descriptions of the world.

According to (Jonassen, 1999), “Learning environments should emphasize the following characteristics: *Active, constructive, collaborative, conversational, complex, contextualised*, reflective, intentional, and technology should be used to complete these qualities.” (Italics added) He also advocates the approach of problem-solving to engage the learner in meaningful learning, as it provides the purpose for learning.

Laurillard extended Pask’s theory to the realm of academic knowledge. The ‘conversational framework’ she puts forward as illustrated in Figure 3, accommodates the multiple roles technology can play in the conversational space. Technology can provide the environment in which conversation takes place that enables conversations between human learners and between human learners and technology. Mobile technology can therefore extend the space provided and support multiple synchronous and asynchronous conversations.

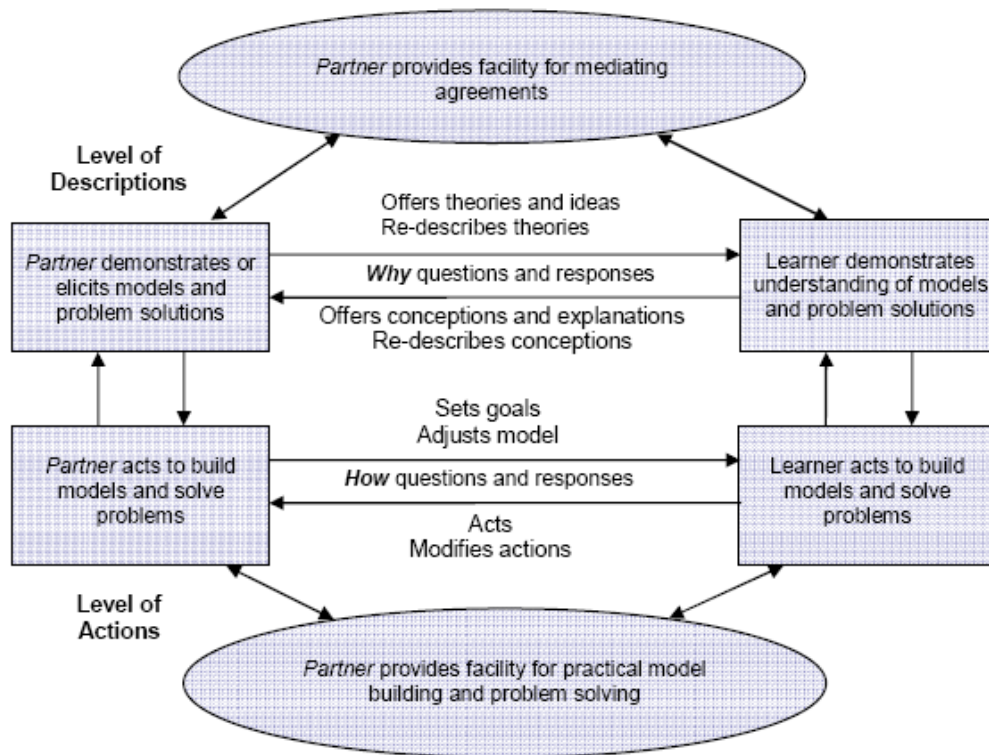


Figure 2: Role of technology in supporting conversational learning (Laurillard *et al.*, 2000).

Conversations can take place at two levels as indicated by figure 3. At the Level of Actions, a learner or partner may converse about the performance of some educational activity, formulate goals to refine and build models to test these goals and understandings. At the Level of Descriptions, the learner and partner discuss the implications of the actions, negotiating their way by proposing and re-describing theories, offering and adjusting explanations. Technology may provide or enrich the environment in which conversations take place and it can provide the tools for collecting data for building and testing models.

Learning needs

- a shared language (amongst learners, and between learners and computational systems);
- a means to capture and share phenomena, and

- a method of expressing and conversing about abstract representations of the phenomena.

Learning is thus seen as continual conversations with the external world and its artefacts, with oneself, and also with learners and educators. The most successful learning comes when a learner is in control of the activity, able to test ideas by performing experiments, to ask questions, collaborate with other people, seek out new knowledge, and plan new actions (Ravenscroft, 2000 cited by (Sharples *et al.*, 2005)).

In the Conversation theory the main factors as identified by Sharples in contextual lifelong learning “*can be summarised by the “3C’s” of effective learning: **Construction, conversation, and control.***” (Sharples, 2001)

These can be clarified as follows:

Construction – Acting in an environment and reacting to it. Actions can include problem-solving, engaging in dialogues of enquiry, and acquiring new knowledge. Sharples, (2000) explains construction as being a continual interaction and adjustment between a person’s thoughts and actions.

Conversation/ Communication - The exchange of information internally during reflection or externally between organisationally closed systems as in human to human or human to machine or in computational systems.

Control – This can rest with one person or be distributed amongst many and must be negotiated within groups of participants. This can extend to interaction between systems in the access of existing knowledge and the creation of new knowledge.

Considering these factors in analysing mobile learning, gives us insight into the process of “*coming to know, as a continual conversation with oneself, with other people and with interactive technology.*” (Taylor, 2004)

In Summary

This review explored aspects that serve to inform the design process in researching mobile learning in secondary schools.

They were as follows:

- Criteria for conducting design research in a project-based environment.
- A survey of similar research in the field of mobile learning internationally, as well as in South Africa.
- The Conversation theory of Gordon Pask as applied to mobile learning.

Mobile learning is a very young science embarking on the next phase of its growth. Internationally it is past the pilot phase; however, at local level it is being explored in a different context – that of a developing world.

The following chapter will focus on aspects that guide the design of mobile information and communication technologies to enable users to converse with each other in technology-enhanced shared spaces. This will allow them to access existing content and to deliberate, modify and make their own contributions to the body of knowledge. Subsequent chapters will report on the testing of the developed services in real life contexts.

Chapter 3

Designing information and communication technology to enhance and support mobile learning - a MobilED initiative

Abstract

This article reports on the analysis, design and development of a MobilED technology platform in support of mobile learning in South Africa. This initiative was conceived, developed and implemented by the Meraka Institute of the Council for Scientific and Industrial Research (CSIR). They adapted existing technology to explore the field of mobile learning and developed a prototype to make AudioWiki available to mobile phone users. As part of the research design, the process followed an iterative cycle and strategies were developed to guide the use of mobile information communications technology (ICT) in a school environment. This part of the project aims to gain a better understanding of the performance, acceptability and viability of mobile learning in schools. It was found that mapping appropriate outcomes for the various role players, before and during the design phase, contributed significantly to isolating the key factors influencing feasibility.

Keywords

Mobile learning

Mobile ICT

Technology platforms

AudioWiki

Prototype project

Design research

HIV/AIDS

1 Introduction

This article describes the concept of mobile learning and the criteria that guide design and development of mobile information and communication technology. The MobilED prototype and service aim to significantly enhance and support teaching and learning in the South African context. This is the first in a series of three articles. Article two will report on testing the designed MobilED prototype in a wealthy, well-resourced “*developed*” school, and the third article reports on using the same technology and learning event in a sparsely-resourced “*developing*” school.

2 Background

The MobilED initiative has at its heart a range of services aimed at enhancing teaching and learning in developing countries. MobilED have developed a set of scenarios and are testing them in real world contexts. The driving force behind the South African side of MobilED is the Meraka Institute of the Council for Scientific and Industrial Research (CSIR). This council is one of the leading science and technology research, development and implementation organisations in Africa.

“The Meraka Institute takes its name from a term common to Sesotho, Sesotho sa Leboa and Setswana, used to describe communal grazing land. People may use this land productively, either privately or communally, but the land itself is kept for the common good. One of the objectives of the Institute is to contribute to the “digital Meraka”, sharing resources which enhance Africa’s participation and potential in the global knowledge society.” (<http://www.meraka.org.za>)

This ideal of sharing resources either communally or privately in giving a voice to the African Continent is encapsulated in the MobilED project. MobilED (mobile education), as an initiative, explores how mobile technologies can be used to enhance teaching and learning in developing countries. MobilED’s aim

is to develop scenarios and guidelines in collaboration with practitioners to aid them in the development of technological platforms and research-based pedagogical models in the empowerment of users in formal and informal learning situations. They want to meaningfully enhance teaching and learning experiences through the use of mobile technology.

Mobile learning is seen as learning, facilitated by the use of mobile devices. It is also concerned with learner mobility (Kukulska-Hulme & Traxler, 2005). It is not location-specific and is increasingly seen as an affordable means to bridge the digital divide (Brown, 2005).

3 Design research

The importance of a design research methodology is to search for instructional strategies and tasks that work rather than place all the research focus on determining the effectiveness of the delivery medium (Reeves *et al.*, 2005). One of the main strategies of MobilED is to find ways of using or slightly modify existing technology in innovative ways to enhance the learning process.

The importance of developing a deeper understanding of learning ecology in a research setting must be stressed in order to keep all parties grounded in the research objectives (Cobb *et al.*, 2003). The context in which the mobile technologies are deployed form the theoretical targets for research and serve to inform future research.

The principles of design research as formulated by (Wang & Hannafin, 2005) serve as guidelines for good research practice. It is especially relevant when working with untested prototypes. The most applicable of these principles is to “conduct research in real-world settings” and to “document contextual

influences with design principles”. The contextualization of research, in turn, influences the analysis of the findings.

The value of using design research methodology is in the ability to improve educational practice. Other than creating novel teaching and learning environments, it aids the development of theories that are contextually based and increases the capacity for educational innovation (Kelly, 2003).

4 Project Plan

The project plan was conceived by the principle research partners. They are the Meraka Institute (CSIR), South Africa and Media Lab of the University of Art and Design, Helsinki, Finland. Figure 4 sets out the project plan from October 2005 to November 2006.

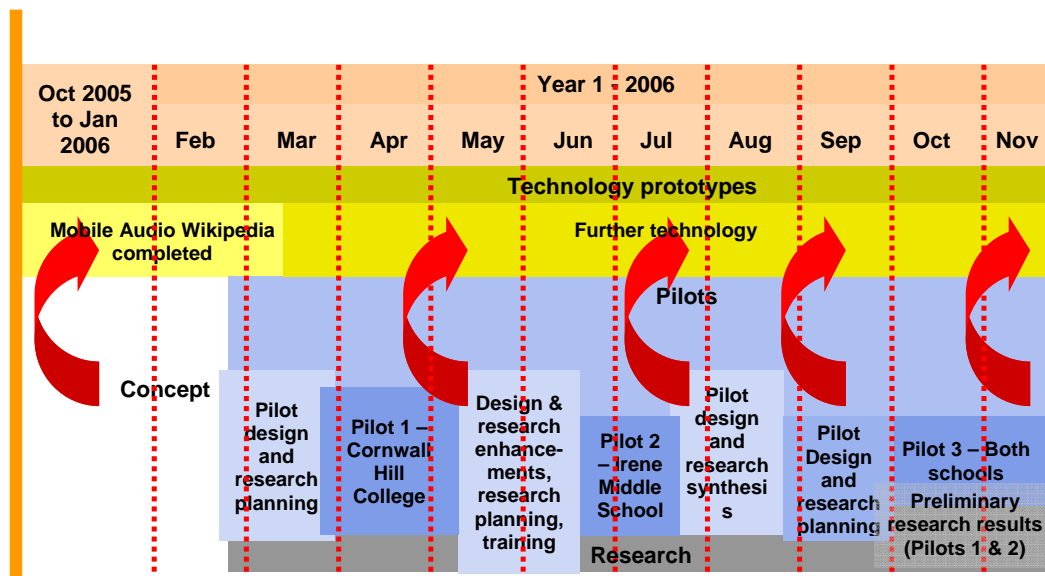


Figure 3: MobilED project plan for 2006

This time line documents the main events scheduled from October 2005 to November 2006. It only indicates the operation aspects during the first year of research. The MobilED project is set to run over a period of three years and

hopes to make a significant contribution towards understanding factors influencing the adoption of mobile learning from a developing country's perspective.

As indicated in the project plan in Figure 4, each intervention will inform the next pilot. This gives ample time to adapt or implement lessons learned in previous pilots in subsequent interventions and allow designs to be refined continuously through thorough reflection.

The large arrows have their origins in the design of the learning event and serve to inform the development of technology. The research is therefore pedagogically driven, thus increasing the acceptability of the project in a school environment. Reigeluth & Frick (1999) noted that this type of research has the potential to generate theories and facilitate educational reform as well as meet the needs of the researchers.

This cycle of iteration provides an opportunity for the teachers to create a scenario as conceived in discussion with learners and present it to the research team. It is then left up to the technologist to come up with a suitable means to make it happen.

5 Research framework

The initial proposed MobilED project relies on making use of development research practice in the design of the project plan. An overview of the research framework is given in Figure 5.

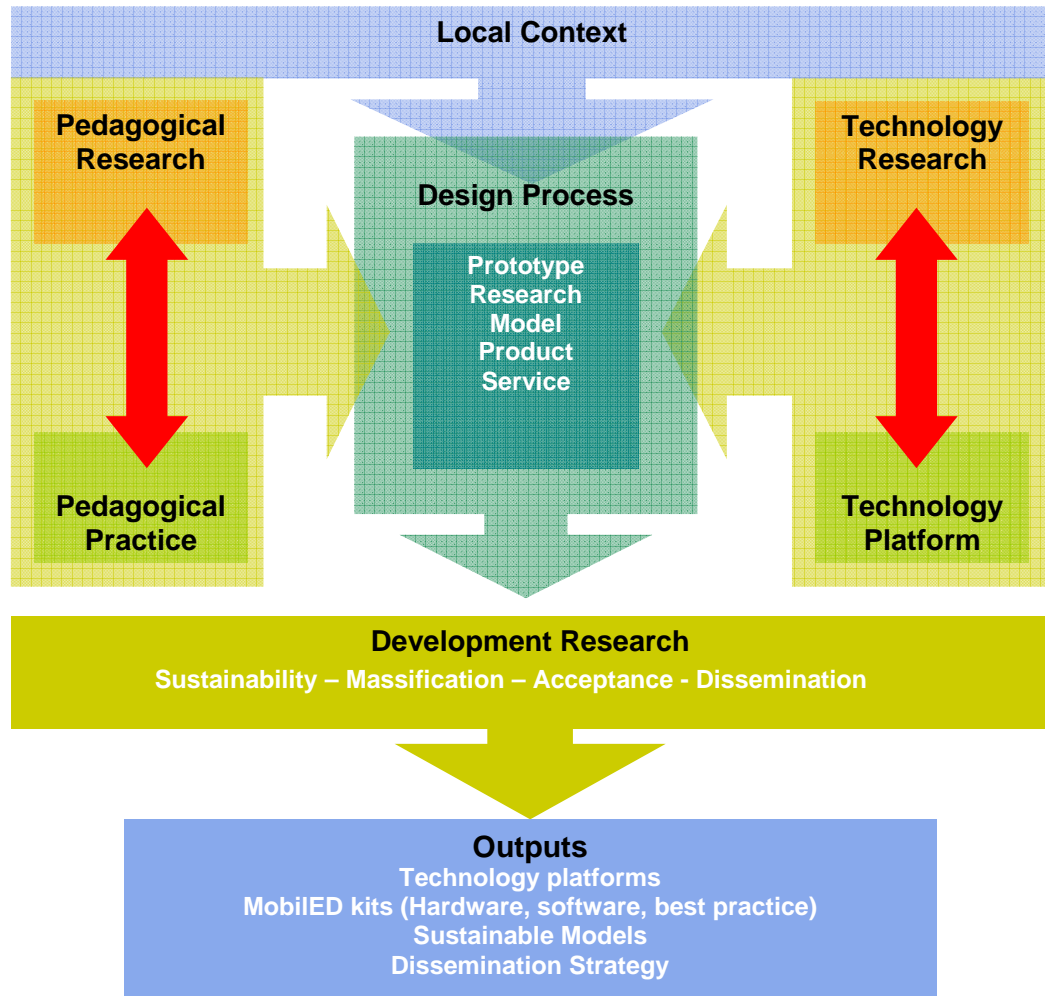


Figure 4: Overview of research outputs (Ford, 2006).

In the proposed model, the technology platform stands opposite pedagogical practice and straddles the design process. This model must be seen in the context of development research/design research and is expected to generate

guidelines in the development of mobile learning scenarios, products and services which can lead to sustainable models of implementation.

In Pedagogy, the focus is on student and group-centred learning, project-based learning, problem solving and, inquiry learning.

Technology focuses on:

- mobile devices: GSM phones, multimedia/smart phones, Internet tablets;
- wireless networks: GSM, 3G, WLAN;
- voice, speech and language technologies: speech interfaces and audio information systems;
- social software: Mediawiki, blogs and knowledge building tools;
- Wikipedia: The Free Encyclopaedia.

In the study, Pedagogy and Technology should complement each other, informing each other and serving as reflective partners as part of a larger iterative process.

In the design of the learning event, it is always imperative to place the needs of the learners first. Skills need to be mastered and the prescribed curriculum completed in a set period of time. Testing a new technology platform in a school environment requires close co-operation from all parties involved. Educators must be well-informed about the implications of testing a prototype platform and mechanisms needs to be put in place to circumvent possible technology failure. This requires extensive planning, as the event must be completed in time, independently of functioning technology.

One important aspect to take into account in the conceptualization of a project is to stipulate the expectations of the various stakeholders in the project. Accordingly, outcomes of expected behaviour changes are mapped in an effort to monitor the impact of the project.

“The intended impact of the program is the guiding light and directional beacon, not the yardstick against which it is measured. Feedback on performance concentrates on improving rather than proving, on

understanding rather than reporting, on creating knowledge rather than on taking credit.” (Smutylo, 2001)

At the heart of outcomes mapping is the documentation of behavioural change.

“Outcomes are defined as changes in behaviour, relationships, activities and/or actions of people, groups, and organisations with whom a program works. (Smutylo, 2001)

Mapping these changes provides researchers with techniques and tools with which to monitor the research design process, and forms part of reports generated to maximise learning and improvement on the project. It also serves to justify spending patterns and inform budgetary considerations of sponsors.

6 Technology Platform

A more detailed use case diagram, focussing more on the systems and processes employed by the MobilED platform itself, is given in Figure 6.

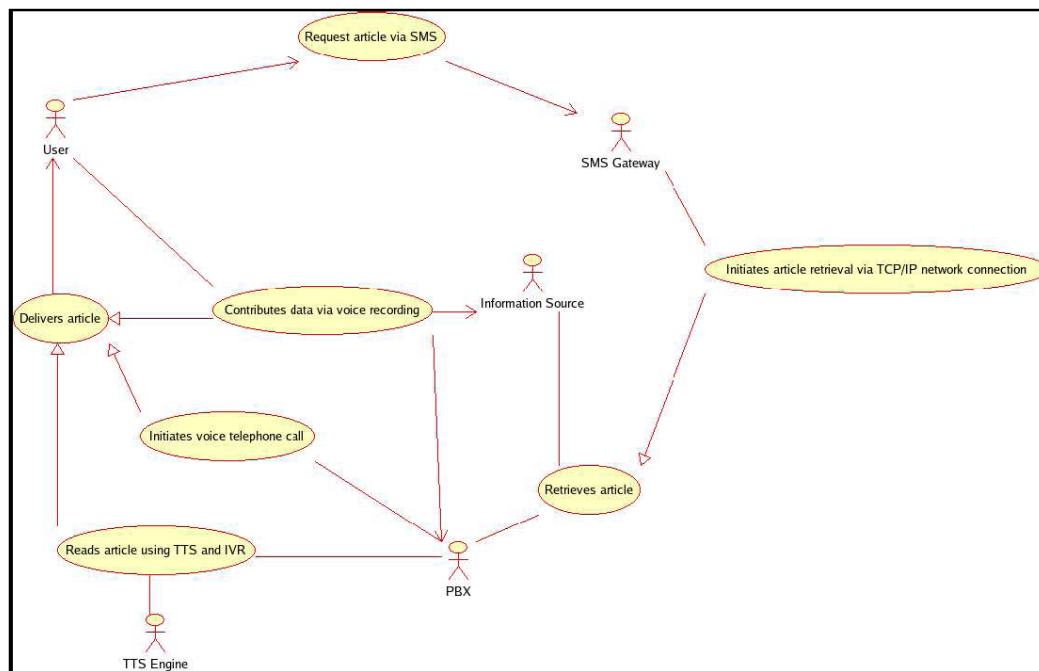


Figure 5: Use case diagram (platform specific) provided by Mobiled 2006. <http://mobiled.uiah.fi>

The design and functionality of the system as seen in figure 6 is described as follows:

“The user of the system uses the standard text messaging capability of his/her Mobile phone (SMS) to request an article from the Mobiled platform, by entering the title of the requested article, and sending the message to the phone number assigned to the Mobiled platform implementation (this is installation-specific). The Mobiled platform responds by calling the user and delivering the requested article via an audio telephone call. This is accomplished using a platform for interactive voice response applications, and human language technology components such as a text-to-speech engine. It reads the article to the user using a computer-generated voice in combination with pre-recorded voice prompts, and accepts input from the user via DTMF/Touchtone key presses” (Aucamp, 2006).

7 Mobiled kit

The Mobiled kit in Image 1, was designed for use during the first pilot to make it easy to distribute and monitor during a formal lesson time. It consisted of a box containing:

- one mobile phone
- a set of speakers to amplify the audio received via phone
- optional earphones
- electrical sockets for charging the phone
- instructions in using the Mobiled technology platform



Image 1: Prototype MobilED kit.



Image 2: A set of MobilED kits

All objects were colour-coded with stickers, and placed into a corresponding container to make distribution and control easier. These containers could be stacked easily for safekeeping, as seen in Image 2.

The reasoning behind the compilation of the kit was that in an under-resourced environment, in a class of 30+ learners, the kit could be used with ease during collaborative learning events, being easily assembled, charged and stored in a lock-up facility for safekeeping. The reusable sheets could be used to plan, take notes, aid discussion and record ideas during collaborative events.

8 Learning event

8.1 Introduction

The lessons were structured thematically around the issue of AIDS (Acquired Immune Deficiency Syndrome). Various social aspects around AIDS were explored and investigated, and were selected in an effort to explore and add to our rich “African Philosophical Thinking”, and to promote sensitivity across a range of social contexts. Our diverse society comprises different cultures and communities, each with its own unique perspective on HIV. This Human

Immunodeficiency Virus progresses during the late phase of infection, damaging the body's immune system, increasing the risk of serious opportunistic infections and of dying (Conway & White, 2004).

This viral disease infects and affects the lives of millions of people every year. Young people have become very jaded and fatigued in their dealings with this disease (Page, 2005). This intervention partly serves the purpose of using modern technology to rejuvenate their interest and to access their belief systems and to make them available to other communities in the form of audiocastings.

The lessons were designed to be part of a two-week learning event and were classroom-situated. Two double and a single lesson were used for the intervention, which involved 4 hours of contact time. Learning was mainly group-centred and inquiry-based.

The objective was to generate discussions amongst group members and to access the beliefs and social practices embedded in their own indigenous knowledge systems as well as to encourage them to share these with others. In this way, socially responsible attitudes and values can be nurtured, leading to new knowledge creation and contribution, thereby enriching the experience of the learners (DoE, 2005).

The design of any learning event must remain socially responsible, especially in a project-based environment where the ultimate objective is to test the functionality of the prototype technology in a real life situation. (Reeves *et al.*, 2005) The pedagogical responsibility of the event rests solely with the facilitator. It is up to the facilitator to look after the interests of the learners and to negotiate with the project team aspects such as the timeframe, content and structure of the event. It remained imperative to guard against the

invasive nature of conducting research in a school environment, and to ensure that the right of the learners to an education was not infringed in any way.

8.2 Limitations and delimitations

Because of the unreliability of the untested technology platform, additional resource materials had to be prepared so that the learning event could still proceed in the event of failure of the technology platform. Only four lines were available for use during the learning event, making collaborative group work necessary.

Other limiting factors that played a significant role in determining the design of the learning event included:

- learner numbers
- the size of the venue
- available lines and MobilED kits
- speaker and handset volume
- synthesized voice quality
- lack of a quiet recording space.

These factors contributed greatly in the decision to make use of the jigsaw, co-operative learning technique (Aronson, 2000).

8.3 Different groups

Three different groups were used: an intimate whole-class gathering; a smaller working group, and a knowledge-contributing group. This implies that every learner was a member of three different groups and had a clearly-defined role in each group.

Intimate group

Learners gathered in an informal semi-circle in close proximity to one another close to the whiteboard, as seen in Images 3 and 4. The learning event and all role players were introduced. Subsequently, learners received reusable laminated colour-coded cards which were numbered. They were then given markers to write their names on the tags and then pinned their nametags to their lapels. This ensured that observers and researchers interacting with the learners could address them appropriately, smoothing the way for effective communication.



Image 3: An intimate group



Image 4: Another intimate group

Audiocasting group

Learners had to gather according to a tag number. Only four numbers were selected, as there were only four lines available at the time, ensuring no waiting period or delays in recording. They had a short time to familiarize themselves with the other group members and had to select a group name. This name was to be used at a later stage during audiocasting, and was registered on the server in the meantime. The scripting of their contribution and its recording took place in this group context.

Expert group

Participants gathered according to their tag colours. In this group, the specific assigned theme was explored using the AudioWiki and other provided resources.

8.4 Lesson Phases

The learning event had four main phases:

Introduction: Set the scene and stipulate expected lesson outcomes. Create a learning environment as well as introducing the MobilED technology.

Group work: The main task was to gather information using the MobilED tools and discuss their findings, and construct a mind-map. They had access to additional resources other than the AudioWiki. Their findings was then used to identify search-words to be sent to the MobilED server. They were encouraged to delve into their own life experience and relate their own personal stories.

Reporting: Learners report their findings to the “Audiocasting Group”. They had an opportunity to negotiate content and decide on the nature of their audiocasting show. They wrote a script of all they wanted to say and contribute and then the recording commenced.

Show time: Listen to the audiocastings of other groups. They could offer critique and decide on how to market their audiocasting recordings to the larger school community.

8.5 Logistics

Retort stands with either a colour (Image 5) or a number (Image 6) were placed throughout the venue indicating the various group locations. This ensured that learners returned to the same location on every occasion, making roll-call easy.



Image 5: Expert group according to colour



Image 6: Audiocasting groups according to number

Each group was provided with a sponsored “NOKIA Smart phone” which they were expected to use during the lesson time. The phones were all loaded with a network simcard and airtime to the value of R60. They were only allowed to use the provided during classtime.

In addition to the single “NOKIA Smart phone” provided in group context, they also all had their own phones. Their own phones were registered on the server, allowing them access to the service after lesson time to continue in their knowledge pursuit if the need arose. They were prohibited to use their own personal phone during lesson time. Cost of the SMS from their personal phone was for their own pocket.

8.6 Sequence of events

The learners worked in co-operative working groups with access to the mobile kit. The learning task was introduced and outlined by the facilitator. Learners were then given the opportunity to deliberate, following which they could

access the MobilED platform set in place by CSIR to search for information with a single SMS. This query was placed in a queue, as only four lines were available.

The service returned their SMS query with a phone call which was relayed through a set of speakers, ensuring that everyone in the group could hear, with the option of using the earpiece. The information in Wikipedia was then transcribed from text to audio, with English as the language of choice. The learners could then continue their search, following a set of printed instructions or, alternatively, simply follow the audio prompts.

As a group, they could then formulate their own response in their mother tongue or language of choice and contribute this by recording it via the mobile phone to Wikipedia. This could then be accessed by others interested in the same topic.

9 *Initial findings*

During the initial stages of the design and development of the learning event, the separate roles of the researchers, technologists and practitioners became blurred. The learning intervention needed to be planned in parallel to the design and development of the MobilED server capabilities, thus increasing the feasibility of offering a solution to real-life problems in schools.

The value of mapping the outcomes of expected behaviour changes contributed to isolating the key factors influencing the feasibility of the MobilED initiative. Key factors that were identified ranged from: design aspects such as system performance; reaction to the service; preferred settings such as voice clarity, audibility and navigation, as well as social aspects such as collaboration, sustainability, gender issues and ownership.

The solution was enthusiastically received by the learners. They noted that even though they knew the technology of cell phones in general, they still needed extra time to familiarize themselves with the particular cell phone model being used. Gender played a significant role, as boys tended to monopolise the instruments in a group setting, resulting in learners wanting individual access to their own mobile phones. They even used the service outside of formal lesson time, using their own instruments.

There were a few technology “hiccups” during the scheduled event, which lead to efforts to improve the system. Poor sound quality from the speakers attached to the phones limited amplification, and the particular text-to-speech engine selected resulted in reduced audibility.

The initial pilot intervention in the school unexpectedly served as a catalyst, enthusing learners and educators alike to pursue other ways of implementing mobile phones into the more formal classroom environment.

10 Further plans

The MobilED initiative will use the designed scenario to test the feasibility of the use of mobile devices in enhancing teaching and learning in a South African context. This will inform developments in other countries involved in the MobilED project.

The MobilED kit can be improved by considering the following aspects:

- an electrical lead and multi-plugs extending the reach
- an introductory DVD to explain the MobilED concepts
- a guidebook with descriptions of the technology platform
- mobile phone operating manual
- examples of previously used learning events, and
- lesson templates.

The current capabilities of the technology platform can be extended to accommodate more media-rich materials. Interfaces to accommodate other features of smart phones, such as the capturing of images and video will be explored.

The average phone user in a developing country does not own the latest mobile technology and therefore the MobilED solutions will initially focus on ways of exploiting the lowest common denominator of simple mobile phone – that of voice and text input.

MobilED service offers the potential to a large portion of the South African population already connected via mobile phones, to share information and become part of a larger information society.

Chapter 4

Piloting mobile ICT in a developed school in South Africa

Abstract

This article reports on the design and implementation of a mobile learning event in a privileged school in a developing country. The main objective was to test the technology platform designed by the Meraka Institute of the Council for Scientific and Industrial Research (CSIR), and to gain a better understanding of its performance, acceptability and viability. The conversation theory of Pask is used to address pedagogic as well as non-pedagogic issues as raised during this pilot. It was found that the developed MobilED services add specific elements to enhance teaching and learning by creating access to existing content and allowing for new knowledge contributions to be made. Constrains such as navigation and voice quality, however, needs clarification before being considered as feasible.

Keywords

Mobile learning

Mobile ICT

MobilED

Co-operative learning

Design research

1 Introduction and Background

This article is the second in a series of three articles focusing on the feasibility of using mobile learning in secondary schools. It was preceded by the first article titled: *“Designing information and communication technology to enhance and support mobile learning - a MobilED Initiative”*. The third article in this series documents the testing of the MobilED technology platform developed by the Meraka Institute (CSIR) in a developing secondary school in

South Africa. MobilED is a set of services consisting of the technology platform, a kit containing instruments, some resources and instruction manuals and a set of guidelines as tested in practice.

The potential of cutting down on costs by implementing m-learning in favour of e-learning in a school scenario is very attractive and can be explored from all angles. The effective use of existing e-learning resources can be maximised and applied in mobile environments, allowing greater ICT penetration in learning, and creating real opportunity for anytime, anywhere learning.

This article considers the relevance of viewing mobile phones as part of a larger network of connected information communication technology. It reports on the significance of using the conversation learning theory of Gordon Pask in the analysis of the findings. The case study considers accepted design research principles, and reports on the design, implementation and dissemination of results of piloting a prototype MobilED service. Recommendations are made for consideration in future interventions in mobile learning.

2 Theoretical underpinnings

Educational technology is a complex area and the conversation theory originally developed by Pask in 1976 gives structure to the deployment of new technology in an educational environment to meet particular educational objectives. It is particularly suited to the understanding of how to support effective learner-centered learning when using these new developments, as well as to appreciate and address the non-pedagogic issues such as the administrative, political and cultural implications of new technologies.

Conversation theory can be defined as a theory of learning in which one participant wishes to expound a body of knowledge to a second participant. In this theory, narratives are constructed and exchanged, and the memorable can be “taught back” (Laurillard *et al.*, 2000)

“Remembering is understood as a dynamic process of reconstruction that is always contextualized and social”. We should recognise that memories are stored in our brains and bodies as well as *“in our environments including the brains and bodies of other people”*(Scott, 2001a). The act of remembering allows for an individual to access these repositories, whether they are biological or technological in nature. These memories can therefore be stored and accessed internally as well as externally.

The individual participants in a conversation are defined as stable, organisationally closed, self-reproducing systems of memories and concepts. In formulating the conversation theory, Gordon Pask (1976) did not distinguish between man and machine, and they enjoy equal status.

Conversation with self and others in the exchange of information takes place between participating individuals. This information is stored in the cognition of the self and of others, as well as in repositories such as computers. This information forms a linked network of ideas and can be traced across an entailment mesh.

These memories form a complex “entailment mesh”. Figure 7 illustrates how existing memories are unzipped and new ones are embedded.

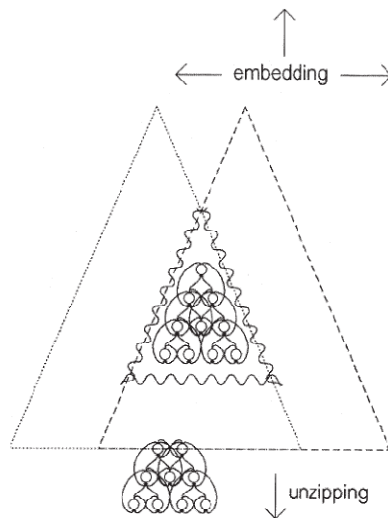


Figure 7: Extensions to an entailment structure by unzipping and embedding: local cycles have been added to form an entailment mesh (Taken from:(Scott, 2001a))

This entailment mesh is a fluid and dynamic structure and consists of multiple interconnected lesser items and must be seen as a labyrinth of topics with extendable edges. This allows the boundaries between man and machine to shrink as conversations take place between participating individuals beyond the confines of the physical environment and can be extended to include virtual spaces made available by technology.

To be able to engage in a productive conversation during collaboration, all parties need access to a common, external representation of subject matter that allows them to identify and discuss topics. (Sharples, 2003)

This can be labelled with the phrase: ‘*Same page learning*’, with the Wikipedia as a good example. Learners can learn from the same virtual page and access content in their language of choice, if available. Opportunities are created to access, share, contribute and amend knowledge, independent of locality.

Learners across the globe have access to the same content, although the environment they find themselves in can be used to contextualize this knowledge by adding the colour of their own indigenous knowledge to this growing body of shared knowledge.

Making the audio encyclopaedia available in the learners’ own language, allows them to access, share and make new contributions in their own language.

3 *Project description*

A key issue in designing and implementing mobile learning in secondary schools is to make it acceptable and viable to all stakeholders. These stakeholders can include principle research partners as well as the local school ecology, consisting of learners and their parents, teachers, administrators and management.

This first pilot, set in a privileged school, reports on the experiences of the learners of the MobilED technology platform during a collaborative learning event. This gave learners access to the audio encyclopaedia. Research

questions were grouped together in themes and included those related to the group interaction, access of information, text-to-speech voice, reaction of the service, service settings and audiocastings.

4 Research Method

The research followed a mixed methods approach, making use of both quantitative as well as qualitative methods in the collection and dissemination of the generated data. In order to enhance the process of conducting design research, it became imperative, at an early stage, to identify aspects needing clarification (Reeves et al., 2005). Timelines, technology enablement, number of instruments, roles of the research team, access to learners, topics covered and assessment strategies all had to be negotiated amongst the research team and subsequently managed by a project leader.

Design research processes tend to be flexible as collaborators strive to improve an initial design, and methods can also vary as new needs and issues emerge and the focus of the research evolves (Wang & Hannafin, 2005).

The research team decided, initially, to focus on the experiences of the learners during the learning event as they used the mobile devices to gain access as well as contribute new knowledge which could be made available to a larger audience. A secondary but equally important aspect was to focus on the technical performance of the mobile platform.

Learners were observed, photographed, videotaped and interviewed during the intervention, and they completed a questionnaire the day after completing the audiocastings. Parents had to give informed consent for their children to participate in the project. Research documentation included the call logs and transcribed interviews. The quantitative data was triangulated with responses from learner interviews as well as observations. Interviews were transcribed, coded and analysed with *Atlas/ti* to identify patterns and emergent themes.

Their final deliverable, the audiocasting contribution, was assessed according to a given rubric compiled by the facilitator.

Observations focussed on group interactions, displayed behaviour, interaction with the MobilED kit and other group members, facial expressions, body language and gender roles. During the interviews, the focus was on how the learners interacted with the phones, as well as on their MobilED experience.

The research team consisted of 5 team members. They played the roles of participant observers, non-participant observers, interviewers, facilitators and technologists. My role was that of co-designer and facilitator of the event. Playing the dual role of facilitator as well as participant observer could affect my personal bias but this in turn allowed me to interpret the responses of the learners more accurately limiting the Hawthorne effect where the mere presence of an observer could alter the responses of participants (Cohen *et al.*, 2000).

5 Selected school and Target Group

The learning event took place in the private school Cornwall Hill College, Pretoria, South Africa. The school is owned by the parents and will celebrate its 10th birthday in 2007. It falls within the boundaries of a luxury security estate and has approximately 1600 learners. It is divided into five different phases, with more or less 250 learners in the senior secondary phase. Learner-to-teacher ratio is around 20:1. Information technology, with access to the internet, is available to every learner. Most of the senior learners own their own mobile phones. The general teaching trend is to incorporate traditional information technology into the existing curricula, and not to run it as a separate subject.

The target group consisted of all the Grade 11 Biology learners. The target group was selected based on the exit level offered at this school. Learner ages ranged from 15 – 17 and they were accommodated in three different classes. They numbered 51 in total, with 45 completing all phases of the learning event. They were gender and racially heterogeneous and five different ethnic groups were represented. Language of instruction at the

school was English although up to half of the learners used other languages as home language.

There was no inducement offered to participate, other than to be part of a research project, with an opportunity to create and contribute knowledge which could be made available to a wider audience. Participation was completely voluntary and learners could withdraw at any stage from the project.

6 *Learning event*

The topic was HIV/AIDS – as part of the subject Biology as prescribed by the National Senior Certification Curriculum. Sections not covered during the planned learning event were covered during regular class time. This event offered an opportunity to capture the unique perspectives of teenagers, specifically from their own cultural background. The various themes covered aspects such as myths and legends, heroes and villains, responsibilities, support as well as , ethics in action.

Learners were grouped and provided with a MobilED kit. They could use the kit to send an SMS with a search term to the MobilED server. The server responded with a return call and used a text-to-speech engine to read the article. A set of speakers attached to the phone served to amplify the voice, making it audible to the rest of the group. Learners could interact with the service by using the touch tone keys on their mobile phones to navigate in the article. After deliberating on the accessed information, they then scripted their own contributions and recorded them to the MobilED server. These “audiocastings” were then made available to others subscribing to the same service.

7 *Research Findings*

The findings are presented in a narrative format in an endeavour to provide the reader with a reflective account of the research findings with regard to the MobilED pilot in the developed school.

Reporting will focus on:

- How the system was used / interaction
- How the system worked / accessing information
- Reaction to the service
- Assessing the voice (TTS)
- Service preferences
- Audiocastings

7.1 General

The MobilED server number was the only number recorded in the phone book options. The learners activated this number instinctively by trying to call or send a message via SMS, with mixed results. Most managed to succeed and others received coaching from their successful peers.

Because all of the participants owned their own phones and were mobile literate, only a short period of familiarizing was needed for them to become proficient in the use of the new phone, and more specifically, its SMS capability. They were allowed to explore the facilities and applications offered by the phone, which resulted in spontaneous behaviour, such as taking one another's photographs, recording short videos, and changing the preferred settings such as screensavers and ring tones.

They took ownership of the phones by personalising the technology to reflect their possession. After personalising the phones, other groups assembled the speakers, found the MobilED kit and tuned in to the radio. Some of them felt that this period of informal learning or play was too short and were quoted as saying:

"I just need a few more minutes with this phone."

7.2 Accessing information –The technology

7.2.1 Technical aspects

The set of speakers attached to the phone had a very short antenna. Some groups tried to enhance some of the applications as seen in Image 7.



Image 7: Learner trying to enhance radio reception of the mobile phone

In Image 7, this particular learner, on instruction from the group, tried to enhance the reception signal of the radio by extending the range of the signal and thus became a linking part of the technology.

The phone had to be connected to the speakers at all times so that the batteries could be charged and audio could work. The moment the connection was broken, the audio reverted to normal handset settings. The cable connecting the phone to the speakers was very short, 10 cm, which made handling the set rather difficult and uncomfortable.

7.2.2 Interaction with and reaction to the service

The ringing of the phone on the first call-back from the server resulted in great excitement, with learners answering the phone with a very cheerful and friendly “Hello”. The server responded with a human female voice saying: “Welcome to the MobilED” and proceeded with various menu options. As the learner selected a choice, the service continued with a speech-synthesized male voice.

It was observed that the initial greeting was met with some surprise from the learners. They did not know how to respond as they were speaking to a computer server. Observing conventional conversation protocol did not seem to apply after the initial “hello” from the learner, and subsequent queries resulted in the “hello” greeting eventually petering out to no greeting whatsoever from the learner in answering the return call from the server. Interaction with the service comprised the use of the touch tone keys of the phone to navigate once in the menu of the article.

Only a small number of learners did not use the opportunity to interact with the service themselves. It is unclear whether those that did not use it were motivated by lack of access to the instrument or because of disinterest and disengagement. Only 3% of those that interacted with the service indicated that they would not be able to use the service in future, even with additional assistance, while the rest were confident in their ability to master the technology.

7.2.3 System response

Response time varied. With five groups working simultaneously and only four lines available, one group was always placed in the queue, resulting in an extended response time. These waiting periods varied from a few seconds to a few minutes, necessitating the use of the extra resources. The longest response time was approximately 3 minutes.

It was reported by 29 out of 40 that the service called them back promptly, while 15 students disagreed with this statement. Results regarding the system

response during a listening session (navigating etc. included) showed that 25 believed that the system reacted promptly enough, while 18 felt it was too slow.

7.2.4 Navigation

Menu navigation was not perceived to be intuitive. Once access was gained to the menu, the navigation was problematic. Detailed instructions as well as an illustration of the functional keys were printed on matching coloured A4 sheets. These were not used by the learners as they tried to rely fully on their intuition to guide them through navigation. Learners found it difficult to follow the sections read by the female voice and got lost in the navigation. The sections often numbered more than 10 options and there were too many to remember.

The following two images illustrate the coping strategy of the different groups in their navigation of the service. Initially 9 of the 14 groups received support in their accessing and navigation of the service.



Image 8: Learners being assisted



Image 9: Learners studying the menu options

In image 8, learners receive assistance in clarifying the menu instructions whilst in image 9 the learners manage to interpret them independently. This supports the observation that the menu options could not necessarily be followed intuitively.

Learners found that their calls terminated prematurely in some cases. Call logs did not indicate the length of the connections, but the frequency of calls

could indicate that the calls were initially terminated prematurely. The break in service can be ascribed to incorrect instrument use or longer periods of collaboration between learners without the use of the service. Once the SMS was sent, the phone setting had to be returned to the main menu to allow a return call from the service. Groups that did not follow this procedure waited for long periods of time for a response and became frustrated.

Formulating appropriate queries to give learners access to the content they wanted proved difficult. It was explained that only single search terms could be used. Being more familiar with the multiple search-word options offered by electronic search-engines, learners experience some problems with the selection of appropriate search terms. Multiple search words, as singular concepts, were used successfully e.g. “Sexually transmitted disease” and “Nelson Mandela”.

Queries were sent after lesson time. On being questioned about it, one learner commented on the novelty and is quoted as saying:

“ I wanted to show some friends this weird voice that we heard.”

7.3 Accessing information – The Voice

7.3.1 Quality

The MobilED service used a female pre-recorded voice that read from the main menu and a male synthesized voice that read from the article content. Learners were not very familiar with the “text to speech” (TTS) technology and found the male voice very strange. They found the phrasing, pace and quality of the voice to be lacking. They personalized it by giving it names and tried to describe it by using familiar concepts such as *“that guy from the horror movies”* or *“real creepy-crawly”* (Creepy-Crawley is the name of a popular mechanical swimming pool cleaner in South Africa) and even *“sounds like he is speaking under water”*.

7.3.2 Volume

The speakers provided in the MobilED kit and attached to the phones to amplify the sound had a volume setting and this was turned up to its highest setting, but even then it was inaudible at times. The noise levels emitted from the other speakers, as well as those generated from other group discussions, made it nearly impossible to hear, even in a fairly large venue. The learners used their own initiative, and used materials to amplify the sound by shielding the speakers with the boxes provided as part of the kit as seen in Images 10 and 11.



Image 10: Enhancing voice with box



Image 11: Copy behaviour of voice box

Some were more adept at comprehending the voice and were subsequently tasked with listening to the service. The roles became very flexible at this time, and documented photographs indicate that this task generally fell more to the male members of the group, as it involved the handling of the instruments.



Image 12: Male learner using earphones



Image 13: Two males sharing earphones

Because of the inadequate sound quality, groups reverted to using the earpiece. This resulted in other group members being excluded from this service, as only one, or maximum two, could use the earpieces at a time. Images 12 and 13 show the boys monopolizing the earpieces and sharing them amongst themselves. The rest of the responsibilities were shared amongst the other members, as they had been excluded from interacting. They explored the other resources provided and started on the mind-maps and the paperwork. This caused some of the learners to become actively disengaged from the service.

7.33 Clarity

The voice clarity was insufficient. The majority of the learners could not hear the voice clearly and could explain why there was such a big discomfort with the particular voice. It does not, however, mean that the majority of students were not comfortable with a synthesized voice; it is more likely that the combination of the inferior voice quality and inability to carry such a voice effectively over the GSM channels may be the main reason for the negative experience.

The majority of students could not hear the text-to-speech (TTS) voice clearly, and 34 out of 45 of them did not feel comfortable listening to this particular synthesized voice. Only 2 out of these 34 would be willing to use such a voice in future, as opposed to 8 out of the 11 that did feel comfortable listening to the voice.

The majority of students do not have a specific preference for a male or a female voice. Only 17.8% of the learners preferred a young voice to an adult voice while the rest either preferred an adult voice (35,6%) or didn't have any preference at all (46,7%). It would seem that the voice of choice was gender and age non-specific. Appendix 11 contains full data set.

7.3.4 Gender

Gender equity in the use of technology in a learning environment must be carefully monitored, as Cleveland (1998), advises us to be aware of subtle gender bias or discrimination evident in the most subtle ways. Events should be thoughtfully planned in advance of receiving the class to ensure that they are similar and consistent, despite the gender of the learner.

Acker & Oatley, (1993) drew upon the work of others in their description of the following generalised traits of girl learners: low self-confidence and lacking confidence in own ability, fear of unfamiliar tasks and risk-taking. This is reflected in the results, as 94,7% of the boys, as opposed to 84,6% of the girls, interacted with the service. Only 21, 1% of the boys found the navigation difficult, whereas 50% of the girls found it difficult. Boys seemed to be more at ease with the technology.

Group composition could have had an effect, as homogenous girl groups seemed to progress better than the mixed boy-girl groups. That does not, however explain why more girls struggled with the technology than their counterparts did.

The following was noted by an observer:

“Care should be taken that students don’t take complete ownership of the equipment and don’t allow others to use it as well. It will be worthwhile to establish why the girls seemed to struggle more with using the technology than the boys. Ideally, every student should have access to his/her own mobile.” (Van den Berg, 2006)

7.4 Service preferences

It does seem that listening to information might not be that effective. On the question whether they believed listening was effective, or whether ONLY reading was effective for this type of information, an overwhelming 40 out of the 45 students indicated that they believed only reading was effective.

The students were asked whether the time available to listen to an article was long enough and whether more time would have made a difference; 66%

indicated that the time was inadequate. Even though 34% of the participants felt that the time was adequate, 10 of these students believed that more time would have made a difference. In total, only 13(29%) did not believe more time would have made a difference.

From the results, it became clear that time was a factor to consider. It could not be established conclusively whether the main problem experienced was the speed at which the article was read, or the actual time allocated in class. If it was the speed at which the article was read, the technology needs to be adjusted. If it was the lesson time factor, the lesson plans and time allocated to activities should be amended.

7.5 Recording audiocasting

Planning the script for the audiocasting was a very serious undertaking. Doing the audiocasting was a roller coaster ride. Energy levels were very high at this stage and everyone was in a state of anticipation and excitement. Learners were highly motivated and well prepared although apprehensive, as their previous exposure to this particular platform technology had not been altogether favourable. They had to manage their time and needed to have made a successful audiocasting by the end of the lesson. Learners perceived that the stakes were high, as the final deliverable was to be formally assessed, and this only added to the already-tense atmosphere.

The first obstacle was to find a quiet venue, as previous events had been a bit noisy. They split into their “audiocasting groups” and went off into different directions.



Image 14: Writing the script



Image 15: Audiocasting in the glass store

Some closed themselves off in the science laboratory glass storeroom (Image 15); others found an empty classroom or an unused office (Image 14). It became a secretive affair, making facilitation difficult. It was only when problems arose in the audiocasting process that they came for help.

The second obstacle was the navigation. Groups tried to follow the instructions with little success. At the beginning of the audiocasting, a list of options were given, amongst them “press 3 to save” but, after doing their recording, they had forgotten what the instructions were and there was no way of finding the instructions or repeating them. This resulted in 2, 3 and even 4 failed attempts, and learners were fast becoming fatigued and bored with the service.

As a backup, a few cassette recorders were made available to record their script which could then be uploaded to the server at a later stage. It became clear that these learners were not familiar with the technology of tapes and recorders, so they had to receive brief instruction which was made more difficult by the fact that they were spread in different venues at that stage.

As a rule, learners carry their recordings in their phones, on MP3 players and iPods. These are truly digital natives as described by Prensky, (2001). They did not know how to operate a cassette recorder and had great difficulty in pressing the *play* and *record* buttons at the same time. They also did not use the *pause* button to interrupt their recordings when things got out of hand, and preferred to redo the entire audiocasting rather than rewind to the appropriate spot in order to continue after interruption. Each group received a new tape and did not wind it on to the “brown bit”, thereby losing the start and introduction section. They failed to adjust the recording volume, resulting in barely audible recordings. They found the sound of their own voices to be strange, and a lot of giggling ensued; however they were very impressed with the good sound quality of the device.

From the tape recorder it was transferred to the server by one of the CSIR technicians, using one of the phones. He had to repeat the process a few times before finding the correct recording distance between the cassette recorder and the phone (Image 16).



Image 16: Monitoring audiocasting after platform failure

Those that tried to do the audiocasting directly to the server found the greatest obstacle to be the recording ability of the phone microphone itself. They found that their initial recording volume was too low as they kept the phone centrally located between all group members. It was observed that they then redid the casting by passing the phone to each member, resulting in different voice volumes.

The learners said that they were not impressed with the recording quality on the server and ascribed it to the limited functionality of the phones' microphones. However, they were very eager to show off their contributions to visiting staff members, as seen in Image 17, in spite of the poor sound quality.



Image 17: Demonstrating the technology

8 General

Communication between learners is extensive and not limited to personal or social use. In a traditional classroom situation, communication is generally directed by the teacher. In this environment, the use of mobile phones is forbidden as a rule, unless stated otherwise.

During the interviews, learners reported that in restrictive environments, they continued to engage with each other using their mobile phones. It would seem that the prohibition of mobile phones in a classroom situation only succeed in making learners become more crafty in their communication with each other. Today, communication via mobile phone in a classroom scenario has become a largely covert activity.

Learners rely on friends for entertainment, to strengthen friendships and to establish new channels of communication. They seek information and reciprocally help their social circle in their knowledge acquisition and problem-solving situations. Technology enables them to communicate with each other openly or secretly, both in formal and informal gatherings. They make use of virtual identities and communicate mainly via “blue-toothing” capabilities. This type of communication is not charged, whereas more traditional formats like voice calling, MMS and SMS carry a fee.

Learners reported that most of their informal communication occurred spontaneously before school started in the morning amongst gathered groups of friends. Between classmates it generally occurred during the first lesson of the day, where the virtual identities were known to some, and, in the wider school context and on a more anonymous level, during large gatherings such as a school assembly.

They became very attached to these virtual identities, and the loss of a phone could impact heavily on the dynamics of a social circle, as a member could find himself/herself cut off from any communication within the existing group. Their ability to contribute to the larger communal knowledge base became severely hampered.

When the formal boundaries between “teacher” and “learner” fade (Botha, 2006) it creates an opportunity to tap into these formal and informal established communications networks that exist in a school environment.

9 Conclusions

Collaboration is increasingly becoming part of teaching and learning. Owing to the proliferation of new technologies, the ways in which learners can

communicate with each other increase, and this leads to spontaneous collaboration.

Mobile phones are becoming very powerful computing devices, with built-in advanced multimedia facilities. In addition, if we have a closer look at the whole mobile phone infrastructure, we realize that the actual device can be seen as a terminal for using several computers in a network. When making a simple call or sending a SMS message, we use the “computer” of the mobile phone, server computers of the operators and the “computer” of the receiver’s mobile phone. When mobile phones are perceived as terminals for using computers, we open up a new perspective for the design and development of practices on how mobile phones could be used in different human operations and processes, including formal and informal learning. (MobilED, 2006)

Knowledge becomes less of a bargaining tool and more of a community property. New knowledge is created in a social-constructivist learning environment and is validated by peer review. This contribution is then released to a wider audience, and feedback can be processed, starting an iterative cycle of reviewing and contribution.

Teenagers in general know exactly what they want. They are hard to please and they are used to owning and having access to the latest technology in this more privileged environment. Learners prefer to use their own mobile phones, especially when the stakes are high and there is a deliverable at the end of a lesson which will contribute to their overall academic standing. The novelty factor wears off very quickly, and the serious pursuit of knowledge becomes a priority.

10 Recommendations for further work

The concept of mobile learning with the use of the mobile phone and the TTS technology has demonstrated the viability of this type of communication. The first pilot of the MobilED project has raised many questions and issues for further research, including:

- Fluidity. For the service to be seen as a full participant, worthy of being a participating individual, it must become more fluid in its service.
- More control should be made available to the user, so that the speed of the voice and navigation once in the menu can be controlled.
- Access to information must be immediate; if the waiting time becomes too long, learners disengage from the service and pursue other means of access.
- The number of lines available to the service must be increased to at least match the number of groups participating in the event.
- TTS voice. A better quality of voice and proper amplification when the phone is used in a group should be ensured.
- The design of learning events should be standardised in order to optimise use and control of instruments, as well as improve the management of group dynamics.
- New knowledge should be verified and the audiocastings should be monitored for audibility.
- The extent to which mobile learning can support collaborative learning.
- Teachers and learners need sufficient time to familiarize themselves with the technology, and a short education process needs to precede the use of the service.
- Scalability in a formal school environment.

11 Finally

The MobilED server has become an active participant in the cycle of conversation, and is seen as a living entity, initiating conversations with return phone calls and responses to prompts. It serves as a repository of existing and newly-created knowledge, and extends the opportunity to all to participate in the activity of entering into conversation with other participating individuals, whether man or machine.

Learners clearly enjoyed the ability to add their own voices to the growing body of knowledge, and in doing so, become part of the wider entailment mesh of global conversation.

This research has indicated that mobile learning is one more option available in the pursuit of knowledge and the contribution of new knowledge by simply using one of the most pervasive communication technology tools commonly available to man.

Chapter 5

Piloting mobile ICT in a developing school in South Africa

Abstract

This article reports on the 2nd MobilED intervention set in a under-resourced school. This follows the first iteration in the design research testing text-to-speech technology and the creation and contribution of new knowledge in the language of choice. The same lesson plan designed and developed for the resourced school in the 1st pilot was used, and the technology platform settings were adjusted slightly to accommodate the pitfalls as identified in the first pilot at a developed school. All resource materials were provided, as the research focussed primarily on the experience of the learners in a mobile supported collaborative learning event. Issues such as ownership, time management, accessibility and possible uses are discussed.

Keywords

Mobile learning

Computer supported collaborative learning (CSCL)

Knowledge creation

Developing school

Research design

1 Introduction

This is the last of a series of three articles. The first of these articles documents the principles that guided the design of the MobilED technology platform and learning event supported by mobile technology. The second article reports on the experiences of learners in using this MobilED platform in a privileged environment. This article focuses on using the same technology and learning event as was used in the initial pilot (with the well-resourced,

developed school) in an under-resourced, developing secondary school in South Africa.

2 Background

In 2004, Africa had close to 100 million total telephone subscribers, 76 million of which were mobile subscribers. Africa has the highest ratio of mobile to total telephone subscribers of any world region, and has been dubbed "the least wired region in the world"(ITU, 2006). These statistics do not distinguish between smart phones with networked capability or older phones with limited capabilities.

The following is taken from the International Telecommunications Union's website. <http://www.itu.int/home/contact/index.html>

"Africa's mobile cellular growth rate has been the highest of any region over the past 5 years, averaging close to 60% year on year. The total number of mobile subscribers continent-wide at the end of 2004 was 76 million." (online)

As the penetration of these very powerful mobile communication tools increases in the African continent, so does the opportunity to connect more and more people to the growing body of knowledge through shared access. Currently, mobile phones do not play an active role in formal education. If at all, they are for personal use alone. In many schools, existing policy forbids the use of mobile phones in class, and their use is viewed by school management as a security risk and a distraction. In an informal learning context, however, mobile phones are used extensively.

The distinction between the use of computers with and without connectivity is particularly important in a developing country such as South Africa (Hodgkinson-Williams, 2006). Without connectivity, learners and their teachers cannot gain access to or contribute to the information society. (Barker et al., 2005), see mobile learning as a vehicle to cross the digital divide, as the more traditional computer technology penetration is very low in African countries, particularly in comparison to other developing countries.

(Syvänen et al., 2004), raise the concern about whether learners with little previous experience to e-learning would be able to reap the full benefits that m-learning can offer (Brown, 2005). on the other hand, makes the prediction that in a developing continent such as Africa, users will be able to leapfrog over e-learning and go straight to m-learning.

3 *Theoretical underpinnings*

The conversation theory of Gordon Pask has been used extensively to unpack all the requirements for effective learning. This theory was developed in cybernetics and is used to evaluate learning through a process of making enquiries about some shared phenomenon. Central to this learning theory is a common language or a shared space in which learning can take place.

“Language frequently creates the illusion that ideas, concepts and even whole chunks of knowledge are transported from speaker to a listener . . . rather each must abstract meanings, concepts and knowledge from his or her own experience” (Von Glaserfeld, 1991 as cited by (Scott, 2001b)

The use of existing repositories of knowledge such as Audio Encyclopaedias, allow any place, anywhere, anytime access to the same stored knowledge information on the page, in a common language. The concept of “same page learning” must be viewed from the context in which the learner finds himself (Batchelor, 2006). Even if they find themselves on the same virtual page, the content therein will become coloured by their own experience and knowledge concepts. Because of these differing perspectives it creates a fertile ground for agile *“minds, by expressing, language and instantiating different systems of belief [and provide] the impetus for conversation.”* (Sharples, 2001)

In Figure 8, the empty space was originally occupied by the reflecting teacher, and the learner and teacher were able to “converse” with each other in the process of becoming informed.

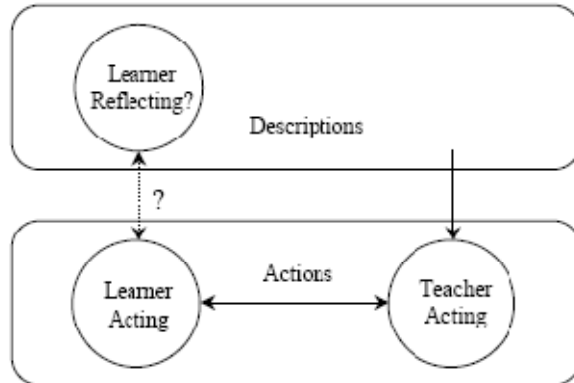


Figure 8: A framework for conversational learning (Sharples *et al.*, 2002)

This framework, divides conversation into levels of actions and levels of descriptions. In the open space, an alternative environment can be created to accommodate conversations and enable learners to converse with each other, directly or indirectly, by extending the range of human conversations. The technology provides this conversational learning space (Sharples, 2003).

The learning objects, as produced by an individual or a knowledge-building community, are then held in a space provided by technology to be used as needed by the participants in “conversation”, in the effort to access or create new knowledge. *“Representing what we have learnt becomes an instrument of communication and co-operation”* (Peters, 2006).

4 Research Method

The digital gulf that exists between the well-resourced school used in the first pilot and under-resourced school used in the 2nd is so huge that even though they are neighbours geographically, they might as well have been in different countries. Besides providing data on usability and usefulness of the prototype service, the conducted research addresses more fundamental issues, such as ownership, accessibility and the use of language in these two very different scenarios.

In order to document this research, a combined method/mixed methods approach was undertaken. Research focussed mainly on the experience of the learners with the MobilED service. Learners were observed, photographed, videotaped and interviewed during the intervention, and completed a questionnaire after doing the audiocastings.

To compile a data trail for reflective research, documentation includes the call logs and transcribed interviews and reflective diaries of the participant observer and non-participant observers. The transcriptions were coded, using *Atlas/ti5* and were used to triangulate quantitative data and emerging themes.

During the interviews, the focus was on exploring what they did with the phones, what they used them for, as well as their perceptions of the learning event.

The questionnaire, however, focussed on five different aspects of the MobilED service:

- *How was the system used?*
Group interaction – own interaction, support, listen vs. reading
- *How did the system perform?*
How the system worked - accessing information – navigation and menu options.
- *What was the reaction of the server/service?*
Reaction to the service - response time, prompt time, allocated lesson time.
- *How was the voice perceived?*
Assessing the voice – aspects such as clarity, comprehensible, comfortable with voice and future use.
- *What are the preferred settings of the service offered?*
Service preferences – settings relate to aspects such as language, gender and age of the voice used.

5 School Background

This under-resourced, developing school is in close proximity to the developed school used in the first pilot. They are within 500m of each other. It is located on the outskirts of a little village which historically used to be a farming community. It was previously known as a farm school which bordered on a municipal refuse dumping site. The dumping site was rehabilitated 10 years ago, and a private school was built on the site as part of a larger luxury security estate.

The school is government-owned and relies heavily on local and foreign donations. School fees are extremely reasonable, at US\$ 60 per year. Constant upgrading and building are taking place. A new staffroom was built recently, and new sport fields and an administrative building are under construction. Staff consists of volunteers and permanent employees.

A whole computer centre, with 26 new computers, was donated by Telkom – a South African Telecommunications company. It was run by a parent from the developed school, in a private capacity, as a volunteer who taught basic computer skills. They had no internet connectivity and few software applications for use. The computer centre was up and running for a period of four months. Over the holiday period after installation, all the computers were stolen. To date, no progress in the recovery of the computers has been made,, and the school is without computers yet again. There is no library on the property and learners have to rely on public libraries in their own communities for research purposes.

6 Project description

MobilED technology platform was designed to allow users using a mobile phone to send a SMS with a search term to the MobilED service. The service would then respond with a return phone call. A Text-To-Speech engine then read the selected article to the user. The user could amplify the audio by connecting the mobile phone to a set of speakers making it audible to other members in a group. To navigate in the article, the users used the touch tone keys of the phone to jump across sections, return to the main menu or to

simply pause. Contributions to the MobilED server could be made by recording their own voices, thus adding to the growing knowledge base. The learning event designed and tested in the resourced school, as reported earlier, relies solely on sending an SMS and receiving a call.

7 Target group

The second target group consisted of approximately 90 Grade 9 Life Orientation learners at the Irene Middle School located in Centurion, South Africa. They were divided into two groups with approximately the same number of learners in each group.

The learners were racially homogeneous and gender heterogeneous. Their ages ranged from 14 – 17 years of age. Most of them travelled to school with public transport such as taxis, buses and trains, which could take up to 2 hours of commuting in a one-way direction. Their instructional medium was mostly Sepedi, but from Grade 6 on upwards, this switches to English, with support available in Sepedi. The target group was selected based on the exit level offered at the school. Irene Middle School only offers schooling up to Grade 9.

8 Lesson plan

The same lesson plan as designed for the first pilot was used, as reported in the first article of this series. The lessons were structured thematically around the issue of AIDS (Acquired Immune Deficiency Syndrome). Various social aspects around AIDS were explored and investigated, and were selected in an effort to explore and add to our rich “African Philosophical Thinking”, and to promote sensitivity across a range of social contexts. Learning was mainly group-centred and inquiry-based and made use of the jig-saw methodology (Aronson, 2000).

The objective was to generate discussions amongst group members and to access the beliefs and social practices embedded in their own indigenous knowledge systems as well as to encourage them to share these with others. In this way, socially responsible attitudes and values can be nurtured, leading

to new knowledge creation and contribution, thereby enriching the experience of the learners (DoE, 2005).

The themes/topics explored and investigated were chosen in an effort to explore and add to our rich “African Philosophical Thinking” so as to promote the preservation of indigenous knowledge and encourage sensitivity across a range of social contexts. Learners were encouraged to delve into their own life experience and relate their own personal stories in their efforts to actively participate and contribute to the existing body of knowledge.

The same lesson was repeated in the two different groups with the original lesson structure, designed for the first pilot, being maintained. The lesson also followed the jigsaw method, and the groups included the intimate, expert and audiocasting groups. The intimate group is seen in Image 18.



Image 18: Intimate group

In Image 18, the learners faced the front of the class and received instruction from their teacher. Subsequent to this, learners divided into their audiocasting groups.

9 *The first pilot in the well-resourced school*

Several issues were identified in testing the prototype platform during the first pilot intervention in the developed school. From a pedagogic perspective,

changes were mainly made because of the increased learner numbers. The themes of the learning event were adapted at the suggestion of the educators at the developing school. They felt the learners would be more comfortable with less abstract concepts, as they were much younger than the learners from the pilot at the developed school. The following recommendations of a technical nature were made, and subsequent changes were made to the MobilED service:

- More lines were made available to shorten the call-back period.
- There would be a response from the server to indicate a failed query.
- The call would terminate when no response was received by the user after a predetermined time.
- More handsets were to be made available for use.
- More speakers were provided, with better amplification of the TTS voice.
- Training was provided to the learners in the use of the handsets and the service before the intervention.
- Teachers received phones 3 days prior to the event to allow themselves enough time to get to know the instrument before transferring this knowledge to the learners.

10 Findings

This section reports on the experiences of the learners in their interactions with the MobilED technology, and is classified into general and technical sections. For many of the learners, enjoying access to the internet using a phone was a novel concept.

10.1 General

The developing school was very keen to be part of the research project, and the principal made the learners available to the researchers. The sentiment was that they would learn something useful, even if it strayed outside the boundaries of the prescribed syllabus. The implication of this was that learners were withdrawn from their normal lesson time. All materials needed

during the intervention were provided by the CSIR. They printed all materials on a laser colour printer, resulting in very colourful resource materials.

10.2 Pre-training

During the first pilot, the learners felt that the time allocated to familiarising themselves with the MobilED kit phones was too short. This resulted in the scheduling of a training session in the second pilot. The desired outcome of this session was that every learner would have had the opportunity to handle the phone and gain access to the MobilED server.

During training, the learners were trained in the use of this particular phone. The two groups each followed a different approach. The first group was left to explore on their own, and the second group received more guidance and instruction. The differences were not that marked, as there were learners familiar with this kind of technology in each of the groups, and transference of knowledge took place spontaneously.

During this period, it was observed that many little hands held the phone simultaneously, as in Image 19. It became a shared object, and the coaching that took place was done with much verbal input. They did not demonstrate to each other, but preferred guiding each other by giving verbal instructions and pointing, using a finger, to the correct options.



Image 19: Handling of the phone

10.3 Learning to send a SMS

An exploration of the phone memory log showed the following sent messages: 4, 435, mo, a, mobi, 7, 7md, aids. This would indicate that learning to send a SMS needs some practice.

Learners did not use predictive text and did not switch between numerical and alphanumerical settings, and reported that most of their messages were sent in English, as their home language, such as Sepedi or Zulu, contained too many characters, and therefore took longer to compose.

10.4 Search terms

Learners were given an opportunity to explore Audio Encyclopaedia by sending a search word in the form of a SMS. These can be categorized in 5 main areas as seen in Table 3:

Area of interest	Search word
Entertainment	Beyonce, gospel, kwaito, hiphop, music, rnb, Ramaru,
Hobbies	Subaru
Academic (linked to their current syllabus)	Cold war, world war 1, world war 2, plants,
Local knowledge	Weather, Pretoria, Gauteng, Irene, SABC
Others	Guns, google, R,

Table 3: Search word during pre-training

Table 3 would indicate that they understood the nature of the internet as a source for information and used it to access information relevant to their group

situation. At this stage, they did not struggle with the concept of single search words.

The HIV/AIDS task-orientated searching is shown in Table 4.

Area of interest	Search word
Topical	Rape, sex, Poverty, ARV, rights, pregnant
Thematic	Aids, hiv, person, family, strategies, economy, community,
Unsuccessful SMS - more than one word (most of them grouped together in one long word)	WhatarethefamilystrategiesbasedonAIDS, Strategiesonhiv, personeffects, immunesystem,

Table 4: Task orientated search words

Once in the MobilED menu, navigation was tedious, and learners tried various options to access the specific information they needed. They started stringing words together in an effort to stick to the one search word rule as seen in Table 4. They did not read instructions, but relied on intuition to see them through the exercise, mainly through following a trial and error methodology.

10.5 Collaborative group work.

Each learner was a member of two different groups. Early on in the lesson, it became clear, that learners were not comfortable with the jigsaw methodology. Even with roles assigned, they moved around from group to group.

The teachers prefer a classroom with little noise – this is not conducive to collaboration where conversation is encouraged between learners.

The following suggestion was given by one of the teachers as a recommendation for future adaptations to the MobilED kit.

“Different ports could be used for earphones. Each learner can use an earphone that has a volume control, which can be adjusted according to his own needs. By so doing, the whole class will be quiet, no one will be talking. Even the other groups will be quiet when they are sending information to the system.” (Teacher)

10.6 Time management

Learners had to sit and wait for long periods of time whilst the facilitators got themselves organized. This included the packing out of materials and moving the desks and chairs. Little was done in preparation, and learners started fidgeting and became rowdy.

Pre-training for the teachers was provided by the CSIR researcher in advance of the intervention. Teachers, however, took their time, and were unsure of the next step. They had to be guided throughout the process, and disappeared for long periods during the intervention. At a later stage, it was explained that they had other lesson commitments for other grades, to which they had to attend. Facilitation therefore became the sole responsibility of the Meraka Institute technologist.

10.7 Technical aspects

10.7.1 Text-to-speech (TTS) Voice

Most learners struggled to hear the voice clearly and could not understand what it was saying. Learners picked up the speakers and leaned in closer, as seen in Image 20, in order to improve their chances of hearing.



Image 20: Lifting the speaker to the ear

The most profound comment came from a learner who verbalized her frustration about the TTS voice:

*“The **person** who speaks. We cannot hear the **person** clearly and we can’t hear what he is trying to say to us, so we can’t give answers to the **person** if we wish to. So I wish, the speaker must - the **person** must change and the voices and the tone must be a little bit smooth and not to be rough like that **person’s** voice because we couldn’t hear what **he** wanted to say and it was so difficult for us to listen if we can’t hear **somebody** trying to talk.. So it was difficult.” (learner)*

It became clear that this learner personalized this synthesized computer-generated voice, referring to it as a “person”, a “he” and a “somebody”. For this particular learner, the illusion of a computer-generated voice, being human, was complete.

10.7.2 Language

Learners were encouraged to contribute to the Audio encyclopaedia in their own language. Of all the artefacts, only 20% used English as medium, while 10% used Sepedi, and the rest used a blend of English and Sepedi. This reflects the method of instruction, as learners receive formal instruction in Sepedi up to Grade 4 level (10-12 years of age) and from then onwards, the language of instruction switches to English, with support available in Sepedi. A focus group consisting of five boys was adamant that they preferred to access and contribute knowledge in English. One of them motivated it as follows:

“Nobody speaks Sepedi. I want people to hear what I am saying. If I speak Sepedi they will not know.” (learner)

They clearly wanted to communicate to a wider audience and not be restricted by their own language.

10.7.3 *Audiocastings*

Learners were very excited about the ability to contribute to the body of knowledge and be heard by many others. They were confident in their abilities, having familiarized themselves thoroughly with the functionality of their particular mobile phone and the MobilED server.

However, learners struggled to navigate and follow the instructions of the audiocastings, and records show a few unsuccessful attempts. They could not grasp the difference between recording on the MobilED server and on the handset, and ended up recording on the memory cards of the phone, only to discover that when they tried to access their recording, the MobilED server did not contain their castings. This did not dampen their enthusiasm and only resulted in better-rehearsed and correctly recorded audiocastings. Image 21 and 22 show one such audiocasting in progress.



Image 21: Many phones in a group

Image 22: Learner Audiocasting

Learners initially held the phones too far away from the speaker as seen in Image 21 and this led to quite a few re-recordings. They were generally not happy with the quality of their audiocastings. The limitations of a phone microphone with regard to range and amplification created artefacts that were almost unusable.

The limitations of the mobile phone's speaker/s detracted from the audibility of the replayed casting, and their voices were badly distorted, especially when more than one person spoke, as in a chorus or in a song.

In scripting and practising their audiocastings, a lot of indigenous song was used to contextualize their script. Their castings contained a lot of excitement, and some were very emotional in their recordings. The heightened emotions can be relayed to the topic of HIV/AIDS and their own personal experience of this disease.

11 Ownership

Learners anticipated problems in the handling of the equipment and made suggested solutions.

“There are a lot of problems with phones. If these phones come to school, they should not hand them out every day. There should be a day for phone or either you go the computer centre. But if you hand them out, then all the phones can disappear or something like that, but then you know they have trackers and stuff. . . “(laughter) (Learner)

Their immediate need for ownership was expressed by a girl who made the desperate assumption that ownership of the instruments was immanent.

“I want this phone. When can I have this phone?” (learner)

This does raise concerns about teacher and learner expectations, and possible reward for participating in the pilot study. This will have to be clearly stipulated and communicated in future interventions.

12 Access to resources

In a rural area, access to resources is limited to the libraries in their areas of living. These are often far away from their homes and require travelling additional to their daily school commute. This is how they expressed their frustrations with the current situation:

“It is also important in the sense that now it gives the learners access to information immediately; they don’t have to leave the class or the classroom situation, go to the library to search and so forth. In that regard it would be very helpful.” (Principal)

The learners reported that most of these libraries were under-stocked and carried out-of-date literature. There is little or no access to computers in these

facilities. Simply gaining access to relevant information seems to be problematic. One particular learner found the MobilED service to offer hope and stated the following:

“When we need information there is a solution; we need information most of the time and we can find the information, all of it quickly.”
(Learner)

During the semi-constructed interviews, learners reported on family structures as well as mobile technology and how it was utilised in their family context.

Most learners reported having access to the “family phone”. This instrument was for the general use of the household. The members of the close family would each own their own simcard – they would then use the phone to access their personal messages, using their own number. Messages that were sent to the family phone were usually neutral, and limited to logistical arrangements.

The widespread use by parents and other adults of owning one phone but more than one Sim-card, (usually one from each network provider) was reported. The teacher remarked on this phenomenon by explaining it as follows:

“Because they share a phone amongst themselves, the close family members have one phone number, the work and business have another, and friends have the last one” (Teacher).

The multiple Sim-cards from different network providers also ensure constant connectivity, as they move from one area to the other, where network coverage is not always guaranteed, ensuring continuous connectivity.

13 Reflection

There exists a gulf between developed and developing schools that will be difficult to breach. Materials developed for a developed school will not necessarily be suitable to use in a developing school. Issues such as

language, intuitive use, extensive exposure to technology and support, all play a role.

The MobilED service offers a ray of hope to the under-resourced developing schools. Their main problem of gaining access to relevant content at an affordable rate can be overcome with the proposed MobilED solution. Learners did not mind sharing the instruments in group-based learning, although they would prefer owning and working with their own mobile phones. The proposed MobilED kit becomes a viable option in this context.

The feasibility of implementing the MobilED service in a well-resourced developed school is enhanced by the fact that these instruments are already owned by the learners. They prefer working with their own mobile phones, and collaborate with each other as the activity necessitates. The MobilED kit can be modified to contain all the specified materials except the mobile phones. This can then still accommodate group activities with access to the speaker systems.

The ability to access relevant content, and to have an opportunity to contribute to the growing body of knowledge, is a very powerful learning strategy to enhance future teaching and learning practices.

14 *Suggestions for further research*

Future research can focus on:

- Activities where the phone is not the object of the activity but rather supports learners in their acquisition of knowledge and to learn more about their own task-driven objectives.
- Collaboration in environments supported by mobile technology.
- Collaboration between two schools in virtual and physical spaces in the creation of shared reusable objects.

- Gender issues. The monopolisation of the technology by boys, who disallow girls access as well as, the inability of girls to fully utilise the technology.

15 Conclusions

It is clear that in any future events, substitute teachers will have to be employed to free up teachers participating in the research project, or alternatively, to adhere very strictly to the timetable roster and not go over allocated lesson time. The service was received positively, and many saw it as very useful and would use the service in future, although the Text-To-Speech voice needs adjusting.

A comprehensive withdrawal strategy needs to be formulated to increase the durability and sustainability of the service. This can only happen when the supporting partners withdraw once the associated social development is understood and incorporated into the offered solutions.

16 Recommendations

When designing and implementing mobile learning at a developing school, the following must be taken into account:

- Extra training for the teachers is needed so that they are comfortable with the technology
- Learners need time to adjust to the use of the new tool, and it may take some time for the novelty to wear off
- Collaborative groups must be managed with care. Issues such as gender issues as well as the monopolising of the instrument should be limited
- Misuse of the tool for personal gain, for example using all the airtime loaded on the phone to phone a parent or playing games whilst in the working environment must be prevented
- The disruptive nature of such an instrument
- Aspects such as venue size and acceptable noise levels

- What unique perspectives on mobile learning can our multicultural, multi-language and diverse society add to the growing body of knowledge?

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[Bllearn](#) project
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Appendixes

Appendix 1: Ethical Statement and Letters of consent

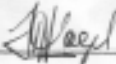
ANNEXURE D



UNIVERSITY OF PRETORIA
FACULTY OF EDUCATION
RESEARCH ETHICS COMMITTEE

CLEARANCE CERTIFICATE	CLEARANCE NUMBER : CS06/09/13
<u>DEGREE AND PROJECT</u>	MEd Computers in Education Mobile Learning
<u>INVESTIGATOR(S)</u>	Jacqueline Batchelor
<u>DEPARTMENT</u>	Curriculum Studies
<u>DATE CONSIDERED</u>	02 October 2006
<u>DECISION OF THE COMMITTEE</u>	APPROVED

This ethical clearance is valid for 2 years from the date of consideration and may be renewed upon application

CHAIRPERSON OF ETHICS COMMITTEE	Dr Salomé Human-Vogel	
DATE	2 October 2006	

CC

Prof J Cronje
Prof W J Fraser
Mrs Jeannie Beukes

This ethical clearance certificate is issued subject to the following conditions:

1. A signed personal declaration of responsibility
2. If the research question changes significantly so as to alter the nature of the study, a new application for ethical clearance must be submitted
3. It remains the students' responsibility to ensure that all the necessary forms for informed consent are kept for future queries.

Please quote the clearance number in all enquiries.

MobilED

PO Box 456
Irene
0062

28 January 2006

The Director and Board
Cornwall Hill College
Irene

Dear Sir

REQUEST TO DO RESEARCH

I am a final year Master's Degree Student in Computer Assisted Education at the University of Pretoria. My research is directly related to the MobilED initiative.

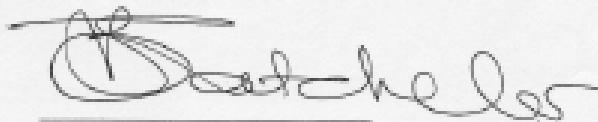
The current principle partners of the MobilED initiative are:

- Meraka Institute of the Council for Scientific and Industrial Research (CSIR), South Africa
- Media Lab of the University of Art and Design Helsinki (UJAH), Finland.
- The network of Associated Partners and Advisers includes Centre for Research on Networked Learning and Knowledge Building
- University of Helsinki (FI)
- Tshwane University of Technology (SA)
- University of Pretoria (SA)

My research work is on Mobile Learning. My research would involve interviewing learners and educator, observing, photographing, videotaping and recording lessons.

I would be much obliged if you could kindly permit me to get access to your educators and learners for research purposes.

With Regards



Jacqueline Batchelor

Cornwall Hill College

Association Incorporated Under Section 21
Reg. No.: 1999/087241/08

Cornwall Hill Estate, Mafikeng Drive, Irene - PO Box 421, Irene, 0542
Tel: (012) 667-1360 • Fax: (012) 667-1367 • Email: info@cornwall.co.za • www.cornwall.co.za



Faith in Education

3 February 2006

Mrs Jacqueline Batchelor

REQUEST TO DO RESEARCH AT CORNWALL HILL COLLEGE.

Receipt is acknowledged of your request to do research at Cornwall Hill College.

Kindly note that your request is approved subject to the following conditions:

- All participants will be offered the opportunity to remain anonymous.
- Participation will be voluntary.
- All information will be treated in the strictest confidence.
- The school will receive a copy of the final research document.

Yours sincerely

L. Kanneke
College Director.



UMnyango Wezemfundo
Department of Education

Lefapha la Thuto
Departement van Onderwys

Date:	23 May 2006
Name of Researcher:	Ford Merryl
Address of Researcher:	CSIR Campus Meiring Naudé Road Brummeria Pretoria
Telephone Number:	(012) 8414601
Fax Number:	(012) 8414720
Research Topic:	Using mobile phones for formal and informal learning opportunities
Number and type of schools:	1 Primary School
District/s/HO	Tshwane South

Re: Approval in Respect of Request to Conduct Research

This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved to conduct the research. A separate copy of this letter must be presented in both the School (both Principal and SGB) and the District/Head Office Senior Manager confirming that permission has been granted for the research to be conducted.

Permission has been granted to proceed with the above study subject to the conditions listed below being met, and may be withdrawn should any of these conditions be flouted:

1. *The District/Head Office Senior Manager/s concerned must be presented with a copy of this letter that would indicate that the said researcher/s has/have been granted permission from the Gauteng Department of Education to conduct the research study.*
2. *The District/Head Office Senior Manager/s must be approached separately, and in writing, for permission to involve District/Head Office Officials in the project.*
3. *A copy of this letter must be forwarded to the school principal and the chairperson of the School Governing Body (SGB) that would indicate that the researcher/s have been granted permission from the Gauteng Department of Education to conduct the research study.*

Office of the Senior Manager – Strategic Policy Research & Development
 Room 526, 111 Commissioner Street, Johannesburg, 2001 P.O.Box 7710 Johannesburg, 2000
 Tel: (011) 355-0488 Fax: (011) 355-0286

4. A letter / document that outlines the purpose of the research and the anticipated outcomes of such research must be made available to the principals, SGBs and District/Head Office Senior Managers of the schools and districts/offices concerned, respectively.
5. The Researcher will make every effort obtain the goodwill and co-operation of all the GDE officials, principals, chairpersons of the SGBs, teachers and learners involved. Persons who offer their co-operation will not receive additional remuneration from the Department while those that opt not to participate will not be penalised in any way.
6. Research may only be conducted after school hours so that the normal school programme is not interrupted. The Principal (if at a school) and/or Senior Manager (if at a district/head office) must be consulted about an appropriate time when the researcher/s may carry out their research at the sites that they manage.
7. Research may only commence from the second week of February and must be concluded before the beginning of the last quarter of the academic year.
8. Items 6 and 7 will not apply to any research effort being undertaken on behalf of the GDE. Such research will have been commissioned and be paid for by the Gauteng Department of Education.
9. It is the researcher's responsibility to obtain written parental consent of all learners that are expected to participate in the study.
10. The researcher is responsible for supplying and utilising his/her own research resources, such as stationery, photocopies, transport, faxes and telephones and should not depend on the goodwill of the institutions and/or the offices visited for supplying such resources.
11. The names of the GDE officials, schools, principals, parents, teachers and learners that participate in the study may not appear in the research report without the written consent of each of those individuals and/or organisations.
12. On completion of the study the researcher must supply the Senior Manager: Strategic Policy Development, Management & Research Coordination with one Hard Cover bound and one Ring bound copy of the final, approved research report. The researcher would also provide the said manager with an electronic copy of the research abstract/summary and/or annotation.
13. The researcher may be expected to provide short presentations on the purpose, findings and recommendations of his/her research to both GDE officials and the schools concerned.
14. Should the researcher have been involved with research at a school and/or a district/head office level, the Senior Manager concerned must also be supplied with a brief summary of the purpose, findings and recommendations of the research study.

The Gauteng Department of Education wishes you well in this important undertaking and looks forward to examining the findings of your research study.

Kind regards



ALBERT CHANEE
 ACTING DIVISIONAL MANAGER: OFSTED

The contents of this letter has been read and understood by the researcher.	
Signature of Researcher:	
Date:	

Appendix 2: Platform Documentation



MOBILED Platform Documentation

Version 1.0

Prepared by: Francois Aucamp
Meraka Institute
CSIR

Date: 31 March 2006

MERAKA INSTITUTE
31 March 2006

VERSION 1.0

PAGE 1 OF 13

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1. Introduction

This document describes the architecture, layout and implementation of the current MobilEd platform. It further provides information on the usage of the platform as well as information on possible future developments.

The MobilEd platform employs three main technology platforms to achieve its goal:

- SMS communication interface/gateway (such as Kannel/Alamin) to send and receive SMS's,
- the Asterisk Open Source PBX for audio telephony communications, and
- a MediaWiki server with suitable content, such as en.wikipedia.org.

This report mainly focuses on the software that was developed to combine these technologies.

2. Goals

The goal of this platform is to enable the usage of a public information source, such as the Wikipedia on-line encyclopedia, via a audio-based mobile device, such as a cellular telephone. This is accomplished by making use of speech-based technologies such as text-to-speech (TTS) engines and interactive voice response (IVR) applications. Users of the system will be able to contribute data to the information source, by recording and uploading audio clips via their telephones.

This will enable communities with little or no conventional access to the Internet to interact with and gain knowledge from state-of-the-art information sources.

3. Design and Architecture

3.1 Use cases

A typical high-level use case of the system is provided in Figure 1, below.

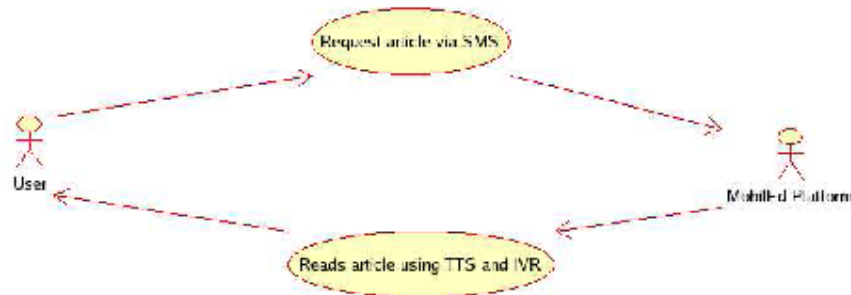


Figure 1: Simple high-level usage scenario (user's perspective).

The user of the system uses the standard text messaging capability of his/her cellphone (SMS) to request an article from the MobilEd platform, by entering the title of the requested article, and sending the message to the phone number assigned to the the MobilEd platform implementation (this is installation-specific).

The MobilEd platform responds by calling the user and delivering the requested article via an audio telephone call. This is accomplished using a platform for interactive voice response applications, and human language technology components such as a text-to-speech engine. It reads the article to the user using a computer-generated voice in combination with pre-recorded voice prompts, and accepts input from the user via DTMF/Touchtone key presses. The user is also allowed to contribute to the information source (local MediaWiki server) by recording his/her voice over the telephone.

A more detailed use case diagram, focussing more on the systems and processes employed by the MobilEd platform itself, is given in Figure 2.

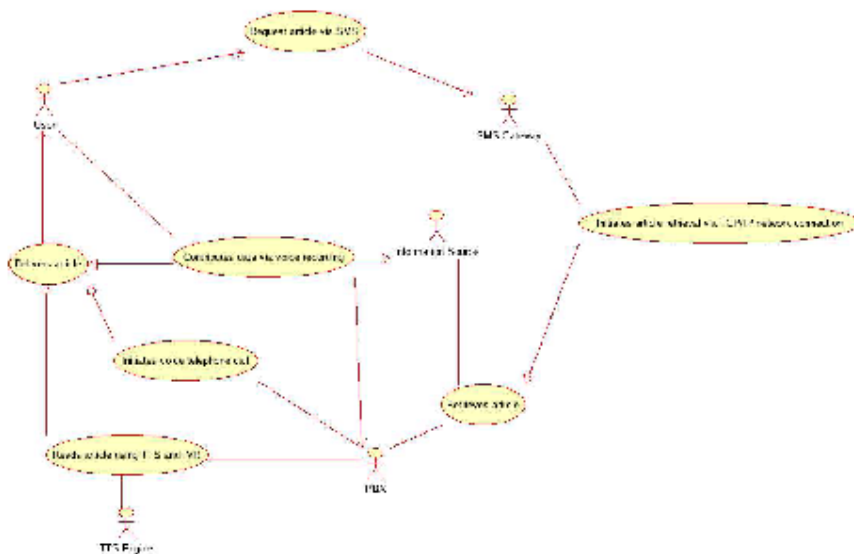


Figure 2: Use case diagram (platform perspective).

3.2 Implementation

The core of the MobilEd platform is the Asterisk Software PBX (<http://www.asterisk.org>). It is responsible for all telephone call-management, and the speech-based article reader presented to the user over the audio telephone call is an application that runs on top of the PBX. All other communication, such as HTTP requests/posts to the MediaWiki server and SMS communication, is described relative to the Asterisk PBX.

All of the required source code for this project was developed in Python, except where otherwise indicated. The nature of the requirements of the developed code implicated that a scripting language, such as Python, is most suited for the solution, due to the required interconnectivity between different technology platforms and ease of debugging and maintenance of the code.

3.2.1 SMS communication

A GSM modem (or similar device, such as a cellphone connected to a PC), as well as an SMS gateway application capable of executing external scripts/programs is required for SMS communication. The gateway is solely responsible for all external communication with the GSM network; internally, it must simply execute a Python script, providing it with the number of the user's cellular phone, and the contents of the SMS, i.e. the name of the requested article. For the MobilEd prototype, the Alamin SMS gateway was used, due to the simplicity of its setup.

The script that is executed by the SMS gateway formats the cellphone number provided by the gateway, so that it is a valid local number (i.e. it removes the +27 international dialing code for South Africa), and it adds a leading 0 to the number - this was done because the (physical) PBX systems in use at the CSIR require a leading 0 to any number to request an outgoing line. In a different deployment scenario, this will have to be modified.

After formatting the user's telephone number, the script initiates a TCP/IP socket connection to Asterisk, which may be running on a different computer. It uses the Asterisk Manager API to originate a "virtual call" on the Asterisk Console Channel, which informs Asterisk to run a specific dialplan, and thus execute the main component of the MobilEd platform. This is discussed in section 3.2.2

3.2.2 Asterisk dialplan and the MobilEd AGI interface

The main component of the MobilEd platform, which is responsible for all communication with the MediaWiki server as well as presenting the user with the necessary IVR menus for navigation, is implemented as an Asterisk Application Gateway Interface (AGI) program. It is executed by Asterisk, and communicates with Asterisk to provide the user with an interactive, voice-based version of the information it retrieves from the MediaWiki server.

Asterisk uses dialplans internally to direct its callflow; these dialplans are created using an Asterisk-specific configuration language, or can be created using one of several tools available, such as the CSIR's DialogPalette (<http://dialogpalette.sourceforge.net>).

The Asterisk dialplan developed for this project consists of two main parts:

- The initial "virtual call" dialplan: This dialplan instructs the MobilEd AGI application to download the requested article from the MediaWiki server. After the article is downloaded, the dialplan schedules an outgoing telephone call to the user.
- The outgoing dialplan: This is the dialplan that is executed when the user answers the Asterisk server's outgoing call (scheduled by the initial dialplan). It again launches the MobilEd AGI application, but this time instructs it to read the article, not download it. This is done in this 2-step fashion so that the user does not need to wait for the article to be downloaded after answering the phone call.

The file *extensions.conf* in the */etc/asterisk* directory (by default) of the Asterisk server contains the Asterisk dialplan(s) to be used. The dialplans used for the MobilEd pilot are optimized for the hardware that was used during the tests (a Digium Wildcard TDM400P/TD04B); they make use of analog telephone interface channels (e.g. incoming/outgoing telephone lines) via the *Zaptel* driver interface, and poll the telephony interface card for available channels as needed. If no channel is available (i.e. all the available channels are in use), it places the outgoing call request in a queue.

3.2.3 MobilEd application structure

The main MobilEd AGI application consists of four major components:

- An Asterisk AGI interface component,
- a Wikipedia article management component,
- an article parser and reader component, and
- the main functional section of the program, including IVR menu structures.

Figure 3 provides a high-level overview of the MobilEd application layout, and how it interconnects to the different technology platforms.

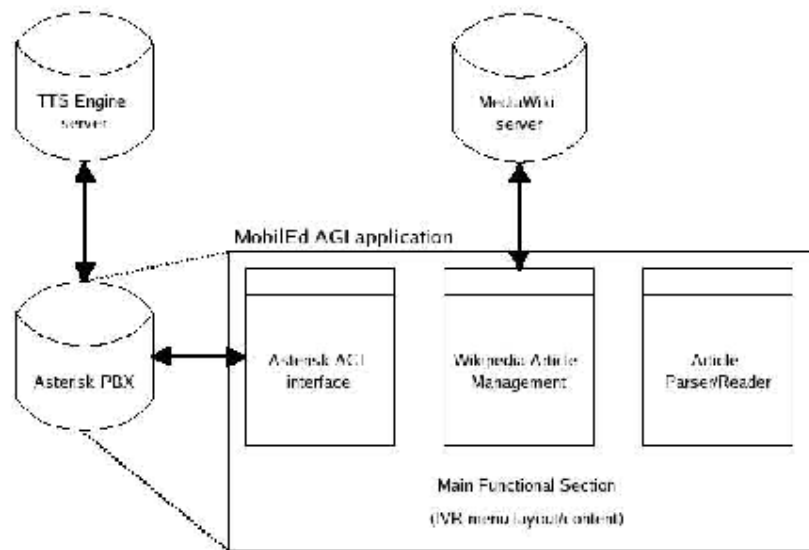


Figure 3: Component layout of MobilEd AGI application.

These components are discussed in detail in the following subsections.

3.2.3.1 Asterisk-MobilEd AGI interface

In order to communicate with Asterisk, the MobilEd AGI application wraps the basic Asterisk AGI functionality required for this project in an API contained in a single class called *agiWrapper*.

The *agiWrapper* class defines functions for executing generic Asterisk instructions, as well as reading and interpreting Asterisk's responses. Some often-used specific functionality is included in the API as well, such as methods allowing text to be spoken aloud as speech, via a text-to-speech engine, as well as getting DTMF input and playing audio files.

The *agiWrapper* class is solely responsible for all communication to and from the Asterisk server; without it, the application would have no contact to Asterisk, and thus no way of manipulating a telephone call. It specifies how operations in Asterisk are to be performed, but not what is to be performed - this is done by the main functional section, discussed in section 3.2.3.4.

The *articleReader* class provides, on demand, sentences from the current article (and article section); internally, it keeps track of the position in the article text that the user is currently "viewing" (i.e. listening to via TTS). It breaks the article up into sections (as specified by the *wikipediaManager* class's *_formatArticle()* method), and provides methods for retrieving article sentences one-by-one, in order, either backwards or forwards. Article sections are opened in order also as needed, but can be explicitly specified.

The *articleReader* class allows the appending of attachments to any section of the article - this is done by creating and maintaining an index of data elements added to the article through this interface; this data index is only present in the locally-cached wikipedia articles; the *articleReader* class is not responsible for the synchronization with the MediaWiki server - this is done by the Wikipedia article management component, as described in section 3.2.3.2. In other words, two uploads are done for every recording made; one to the article reader, which stores the audio as a waveform (as required by the Asterisk server for playback over the telephone), and one to the MediaWiki server as an Ogg Vorbis-encoded audio file (as required by the project specifications). Asterisk itself does not support the playback of Ogg Vorbis-encoded audio files.

3.2.3.4 Main functional section

The core of the MobilEd AGI application consists of several functions, each describing a different IVR menu (such as the *indexMenu()* and *endOfPageMenu()* functions), and some procedural code. This is what is executed when the application is launched, and is responsible for initializing all of the other three components and starting the main event loop via the *readArticle()* function.

It coordinates the call flow, by sending/receiving messages to/from Asterisk through the AGI interface component, and executes the correct instructions based on information received from the article reader and wikipedia manager components. This provides the IVR prompts, menus and interactivity that the user encounters while in a call.

3.2.4 Text-to-speech

The text-to-speech engine used in the project is the Flite text-to-speech engine. Flite is a smaller, faster, runtime version of Festival, but Festival may also be used; this is set in the in MobilEd AGI application, by setting the TTS_APPLICATION to "Festival".

In order to use Flite with Asterisk, an add-on expansion module needs to be installed; this module was developed at the CSIR, and can be downloaded from the DialogPalette website: <http://dialogpalette.sourceforge.net>

4. Installation overview

Currently, no formal installation process exists. Due to the nature and programming language of the developed software, packaging thereof in a standard format such as RPM or debian packages should not present too many problems.

What needs to be addressed, is the configuration and localization of the project; currently, all server information (such as the local MediaWiki server) are hard-coded, but since the program is written in Python, changing the actual script using a text editor is sufficient, and it is doubtful if an external configuration file is necessary.

Asterisk needs to be installed and configured to run on the telephony hardware that is installed - this is dependent on the actual hardware itself. The dialplan (*extensions.conf* file) developed for MobilEd will have to be configured to make use of the appropriate channels (and number of channels) also, and copied to the */etc/asterisk* directory. The Flite TTS module must be downloaded and installed.

A MediaWiki server must be set up, and configured to allow for the uploading of Ogg Vorbis audio files. The MobilEd AGI script (*wikipediareader.py*) must be modified to point to this server, by setting the WIKIPEDIA_EXPORT (for the global Wikipedia.org, if required) and LOCAL_WIKIPEDIA_EXPORT (for the local MediaWiki server).

An SMS gateway must be installed and set to run the Python *script mobil-ed-asterisk-client.py* with the correct parameters as discussed in section 3.2.1. Alamin is a good example of such a gateway, but another, such as Kannel, will also work.

Appendix 3: MobilED Research document

MobilED

Background

MobilED initiative is designing learning environments that are meaningfully enhanced with mobile technologies and services. We design scenarios and guidelines of how mobile technologies could be used for teaching, learning and empowerment of students within and outside the school context. We design concepts, prototypes and platforms that will facilitate and support the scenarios and guidelines developed. We test, evaluate and disseminate the scenarios, guidelines, concepts, prototypes and platforms in real contexts with real people.

In pedagogy we are focusing on:

- Student and group-centred learning
- Project-based learning
- Problem solving
- Inquiry learning
- In technology we are looking for:
- Mobile devices: GSM phones, multimedia/smart phones, Internet tablets
- Wireless networks: GSM, 3G, WLAN
- Voice, speech and language technologies: speech interfaces, audio information systems etc.
- Social software: Mediawiki, blogs, Knowledge Building tools.
- Wikipedia: The Free Encyclopaedia.

We are aiming to design and develop two products that are freely available for anyone to take in use.

The expected outputs are:

MobilED KIT

– a box with mobile tools, software and a guidebook that one can take in use in a classroom or youth club to carry out collaborative mobile learning projects.

MobilED SERVER

– a technology platform that makes it possible to take most out of the MobilED KIT. Governments, organizations or operators willing to support use of mobile phones in collaborative learning projects may install the technology platform.

The current principle partners of the MobilED initiative are [Meraka Institute](#) of the Council for Scientific and Industrial Research (CSIR), South Africa and [Media Lab](#) of the University of Art and Design Helsinki, Finland.

The network of Associated Partners and Advisers includes [Centre for Research on Networked Learning and Knowledge Building](#), University of Helsinki (FI); [Tshwane University of Technology](#) (SA); [University of Pretoria](#) (SA); [Escola do Futuro](#) Universidade de São Paulo (BR); [WikiMedia Foundation](#), (US) and [Center for Knowledge Societies](#) (IN).

The initiative is funded by the Principle Partners, Department of Science and Technology, South Africa and Embassy of Finland in Pretoria. The initiative is sponsored by Nokia.

Website

<http://mobiled.uiah.fi>

Audio Encyclopedia

The Audio Encyclopaedia is “online”. The number is:

+27 8 3299 7232

To use the service you must register your phone to the system.

Guidelines for the Service Navigation

Each article is broken up into sections (it uses the sections as they appear in the wikipedia article).

Initially the system greets the user with the message “Reading article name: ‘article name’”, after which it starts reading the first section of the article.

During the reading process, the following DTMF/Touchtone key commands are available:

- 6 - “Fast forward”; skip ahead one sentence in the same section
- 4 - “Rewind”; skips back one sentence in the same section
- 9 - “Next section”; skips to the next section of the article
- 7 - “Previous section”; skips to the previous article section
- 5 - “Pause”; pauses playback - if any other DTMF key is then pressed, playback continues from where it was paused
- 2 - Listen to the user-added audio entries of the current section (if any) (see below, “Listen to Audio Entries Menu”)
- 3 - Add an audio entry to the current section (see below, “Add Audio Entry Menu”)
- 8 - Restarts the current section (i.e. starts reading the current section again)
- 1 - Restarts the article (i.e. starts reading from the first section)
- 0 - Go to the article index menu (see below - “Article Index Menu”)

When the system reaches the end of a section, it presents an “End of section” menu; this basically pauses playback until the user informs it to continue, or to make an audio entry, etc.

Article Index Menu

If the user presses 0 during reading playback, he/she accesses the article index menu. This menu audibly lists all of the available sections in the article, spread across several pages if necessary, and is presented in the following form:

“For , press 1”

“For , press 2”

etc.

...until digit 9 is reached, where the menu will offer the following options:

0 - Go to next index page (if available)

* - Go to previous index page (if available)

- Exit the index menu, and resume reading playback from where it was previously

Add Audio Entry Menu

Pressing 3 during playback (or at the “end-of-section” menu) causes the system to enter the audio-entry menu; this instructs the user to begin recording after they hear a beep, with a message like:

“Please record your entry after the tone, and press ‘hash’ when done”

The entry currently has a maximum time limit of 5 minutes; this can be changed if desired. Pressing the # (hash/pound) key will end the recording, and present a “preview” submenu, with the following options (note that the audio recording is NOT YET SAVED at this stage):

1 - “Preview”; Listen to the recording that was just performed

2 - “Redo”; Re-record the recording

3 - “Save”; Save the recording and add it to the article

7 - “Cancel”; cancel the entry; this will delete the recorded audio clip, and return the user to the “end-of-section” menu

Listen to Audio Entries Menu

Pressing 2 during playback (or at the “end-of-section” menu) causes the system to enter this menu; from here the user can listen to the user-added audio entries for the current section of the article. The following controls are available:

6 - “Forward”; skips ahead to the next audio entry (if any)

4 - “Back”; skips back to the previous audio entry (if any)

5 - “Repeat”; replays the current audio entry (the entry that was just played/is playing)

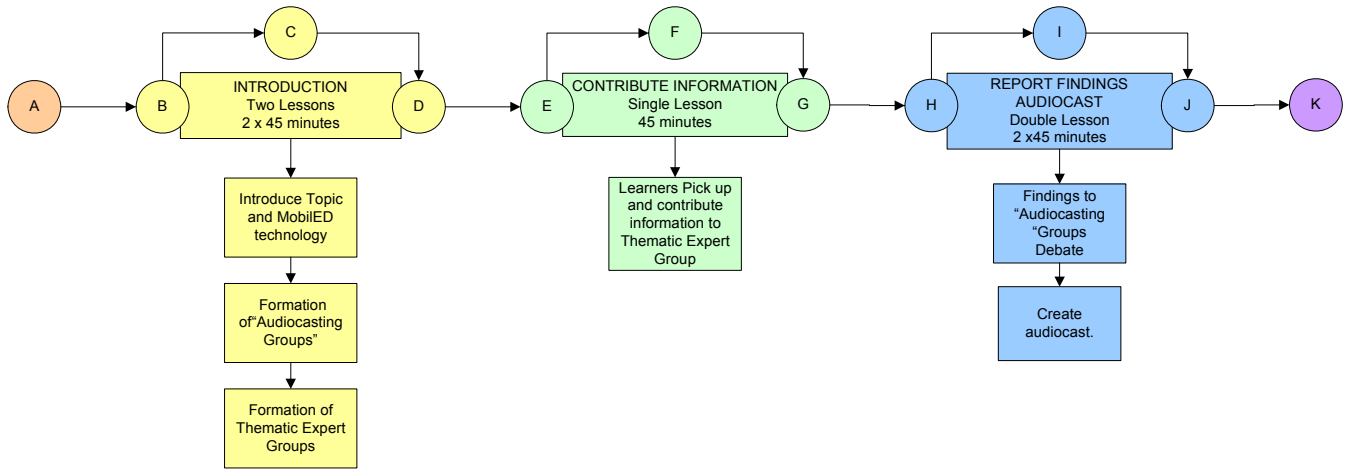
9 - “Next section”; Skip forward to the next article section, and start reading it

7 - “Previous section”; Skip backward to the previous article section, and start reading it

3 - Make and audio entry in the current section

* - Exit this menu (goes to the “end-of-page” menu of the current section)

Instruments



- A. Pre Learning Event
- School Permission
- Disclaimer from pupils

B. Pre Introduction

Data Collection	Pre-lesson interview
Collected from	Facilitator / Teacher
Collected as	Video Footage
Collected by	Teemu
Distributed to	n/a
Data Collection Compiled by	Adele, Teemu, Jacqueline
Informal Video Interview Pre Introduction: Semi-structured Goal: Determine the Agenda of the Facilitator. Questions / Discussion Topics: What is your plan for this lesson? What is the role of the mobile phone in this lesson?	

C. During Introduction

Data Collection	Observation and video footage
Collected from	Lesson
Collected as	Notes and video footage of the beginning of the lesson
Collected by	Adele
Distributed to	CSIR
Data Collection Compiled by	CSIR
<p>Observer Checklist</p> <p>Do the group members share the phone?</p> <p>Is there a leader in the group? Who is the leader? How does he behave (give everybody a chance, is he the only one using the system?)</p> <p>Do any of the users look frustrated? Do you think it is because they are bored, waiting too long, don't understand the voice, don't understand what to do? etc.</p> <p>Does the learners' and the leader's behaviour change as time goes by? How?</p> <p>Look at the learners' facial expressions while they use the system. Make notes of that in order to try and correlate their answers to the questionnaires to their behaviour.</p>	

Data Collection	Informal video interviews of groups in class
Collected from	Lesson
Collected as	Video footage
Collected by	Teemu
Distributed to	n/a
Data Collection Compiled by	Questions: Adele, Teemu, Liisa
<p>Informal Video Interviews of groups:</p> <p>Semi-structured</p> <p>Goal: Determine the Experience of the Learners.</p> <p>Questions / Discussion Topics:</p> <p>What did you do with the mobile phones?</p> <p>What did you use the phone for?</p> <p>How did it go?</p>	

D. Post Introduction

Data Collection	Post-lesson Interview
Collected from	Facilitator / Teacher
Collected as	Video footage
Collected by	Teemu
Distributed to	n/a
Data Collection Compiled by	Adele, Teemu, Liisa
<p>Informal video interviews of the facilitator / teacher after the introduction</p> <p>Semi-structured</p> <p>Goal: Determine the experience, evaluation of the lesson and the working sequences: Were goals achieved, what kind of obstacle or problems there existed.</p> <p>Questions / Discussion Topics:</p> <p>How did you think the lesson went today?</p> <p>How do you think the use of the mobile phone went today?</p> <p>What are you going to do for the next lesson?</p>	

E. Pre Contribute Information

Data Collection	Pre-lesson interview
Collected from	Facilitator / Teacher
Collected as	Video Footage
Collected by	Teemu
Distributed to	n/a
Data Collection Compiled by	Adele, Teemu, Jacqueline
<p>Informal Video Interview Pre Introduction:</p> <p>Semi-structured</p> <p>Goal: Determine the Agenda of the Facilitator.</p> <p>Questions / Discussion Topics:</p> <p>What is your plan for this lesson?</p> <p>What is the role of the mobile phone in this lesson?</p>	

F. During Contribute Information

Data Collection	Informal Video Interviews of groups in class
Collected from	Lesson
Collected as	Video footage
Collected by	Teemu
Distributed to	n/a
Data Collection Compiled by	Questions: Adele, Teemu, Jacqueline
<p>Informal Video Interviews of groups: Semi-structured Goal: Determine the Experience of the Learners.</p> <p>Questions / Discussion Topics: What did you do with the mobile phones? What did you use the phone for? How did it go?</p>	

Data Collection	Observation and video footage
Collected from	Learners
Collected as	Notes
Collected by	Adele
Distributed to	CSIR
Data Collection Compiled by	CSIR
<p>Observer Questions</p> <p>Do the group members share the phone? Is there a leader in the group? Who is the leader? How does he behave (give everybody a chance, is he the only one using the system?) Do any of the users look frustrated? Do you think it is because they are bored, waiting too long, don't understand the voice, don't understand what to do? etc. Does the learners' and the leader's behaviour change as time goes by? How? Look at the learners' facial expressions while they use the system. Make notes of that in order to try and correlate their answers to the questionnaires to their behaviour.</p>	

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G. Post Contribute Information

Data Collection	Post-lesson Interview
Collected from	Facilitator / Teacher
Collected as	Video footage
Collected by	Teemu
Distributed to	n/a
Data Collection Compiled by	Adele, Teemu, Jacqueline
<p>Informal video interviews of the facilitator / teacher after the introduction</p> <p>Semi-structured</p> <p>Goal: Determine the experience, evaluation of lesson and the working sequences: Were goals achieved, what kind of obstacle or problems there existed.</p> <p>Questions / Discussion Topics:</p> <p>How did you think the lesson went today?</p> <p>How do you think the use of the mobile phone went today?</p> <p>What are you going to do for the next lesson?</p>	

H. Pre Report Findings and Audiocast

Data Collection	Pre-lesson interview
Collected from	Facilitator / Teacher
Collected as	Video Footage
Collected by	Teemu
Distributed to	n/a
Data Collection Compiled by	Adele, Teemu, Jacqueline
<p>Informal Video Interview Pre Introduction:</p> <p>Semi-structured</p> <p>Goal: Determine the Agenda of the Facilitator.</p> <p>Questions / Discussion Topics:</p> <p>What is your plan for this lesson?</p> <p>What is the role of the mobile phone in this lesson?</p>	

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I. During Findings and Audiocast

Data Collection	Informal Interview with groups
Collected from	Learners in lesson
Collected as	Video Footage
Collected by	Teemu
Distributed to	
Data Collection Compiled by	Questions: Adele, Teemu, Jacqueline
<p>Informal Video Interviews of groups:</p> <p>Semi-structured</p> <p>Goal: Determine the Experience of the Learners.</p> <p>Questions / Discussion Topics:</p> <p>What did you do with the mobile phones?</p> <p>What did you use the phone for?</p> <p>How did it go?</p>	

Data Collection	Observation and video footage
Collected from	Learners
Collected as	Notes
Collected by	Adele
Distributed to	CSIR
Data Collection Compiled by	CSIR
<p>Observer Questions</p> <p>Do the group members share the phone?</p> <p>Is there a leader in the group?</p> <p>Who is the leader?</p> <p>How does he behave (give everybody a chance, is he the only one using the system?)</p> <p>Do any of the users look frustrated? Do you think it is because they are bored, waiting too long, don't understand the voice, don't understand what to do? etc.</p> <p>Does the learners' and the leader's behaviour change as time goes by? How?</p> <p>Look at the learners' facial expressions while they use the system. Make notes of that in</p>	

order to try and correlate their answers to the questionnaires to their behaviour.

J, Post Findings and Audiocast

Data Collection	Post-lesson Interview
Collected from	Facilitator / Teacher
Collected as	Video footage
Collected by	Teemu
Distributed to	n/a
Data Collection Compiled by	Adele, Teemu, Jacqueline
<p>Informal video interviews of the facilitator / teacher after the introduction</p> <p>Semi-structured</p> <p>Goal: Determine the experience, evaluation of the lesson and the working sequences: Were goals achieved, what kind of obstacle or problems there existed.</p> <p>Questions / Discussion Topics:</p> <p>How did you think the lesson went today?</p> <p>How do you think the use of the mobile phone went today?</p> <p>What are you going to do for the next lesson?</p>	

K. Post Learning Event

Data Collection	Rubrics
Collected from	Learners
Collected as	Paper Hard Copy
Collected by	CHC
Distributed to	n/a
Data Collection Compiled by	Teemu, Jacqueline

Data Collection	Questionnaires (CSIR)		
	Accessing the Information: The Technology		
	Accessing the Information: The Voice		
	Accessing the Information: Adding Information to the Wiki		
Collected from	Learners		
Collected as	Paper Hard Copy		
Collected by	CHC		
Distributed to	CSIR		
Data Collection Compiled by	CSIR		
Name			
Group Name			
MobilEd Mobile Number			
Personal Mobile Number			
Sex (M/F)			
Accessing the Information: The technology			
1	Did you interact with the service yourself?	Yes	No
2	Did you manage to use the service?	Yes	No
3	Did someone help you to use the service?	Yes	No
4	If somebody did help, would you be able to use it yourself in future?	Yes	No
5	Did you find it easy to listen to the information or did you feel that it is only effective to read it?	Yes, easy to listen	No, only reading is effective
6	Did you use the navigation during the article?	Yes	No
7	How did you find the navigation of the service?	Easy	Difficult
8	Did you find that the menu options were	right	Too many Too little

9	Any suggestions regarding the navigation?		
10	Can you think of other applications where one can use this technology?		
11	Did you find that the time you had to wait for the service to call you back was,	too long	prompt enough
12	Did the service respond promptly during the session/navigation?	Yes	No
13	Did you have adequate time during the lesson to listen to the relevant articles in order to complete your assignment?	Yes	No
14	If you had more time, would it make a difference?	Yes	No
Name			
Group Name			
MobilEd Mobile Number			
Personal Mobile Number			
Sex (M/F)			
Accessing the Information: The voice			
1	Could you <i>hear</i> the voice clearly?	Yes	No

2	Did you feel comfortable with the type of voice used to read the article?	Yes	No	
3	Would you use a service with this kind of voice in future?	Yes	No	
4	Would you prefer to have this service in any other language?	Yes	No	
5	If you do prefer another language, what language would it be?			
6	Does the synthesised voice sound close enough to a human voice to make it understandable?	Impossible to understand	Understood a bit	
		Understood most of the time	No problem with understanding	
7	Would you prefer listening to a male or a female voice?	Male	Female	Don't care
8	Would you prefer listening to a younger voice or and adult voice?	Young	Adult	Don't care

	Any other comments:

Guideline and Policy for the Using Mobile Phones and the Prepaid Cards in the School Tests

1. Ownership of the Mobile Phones and the Accessories

Media Lab, University of Art and Design Helsinki is responsible on the mobile phones and the accessories used in the school pilots. The mobile phones and the accessories should be returned for the representative of the Media Lab when the pilots are over.

2. Ownership of the Prepaid Cards

The prepaid cards are property of the Meraka Institute of the Council for Scientific and Industrial Research (CSIR). The cards should be returned for the representative of the Meraka Institute when the pilots are over.

3. Loss or Damage of the Mobile Phones or the Prepaid Cards

The teachers and students are expected to take good care of the mobile phones, the accessories and the prepaid cards. However, teachers or students are not responsible of any destruction, loss or damage caused for the mobile phones, the accessories or the prepaid cards.

In the case of loss or damage the representative of the Media Lab or the Meraka Institution should be informed about the accident as soon as possible.

4. Contact Information

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Institute

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Merryl Ford, Meraka

mford@csir.co.za

+ 27 12 841 4061

Student Numbers and Identity

Each student will have a research number that would be linked to their cell number and name. They will use the research number in all questionnaires to protect their identity.

Appendix 4: Learning Event – Developed school

Learning Event

HIV/AIDS Project for Grade 11 (16 – 17 years of age)

By Adele Botha*, Jacqueline Batchelor* and Teemu Leinonen**

* Cornwall Hill College, Pretoria, SA

** Media Lab, University of Art and Design Helsinki, Finland

1. Introduction

HIV/AIDS learning even is designed to be a three-week learning project with 5 lessons for 15-16 year old students. The objective of the learning project is to generate discussion on topics related to the HIV / AIDS.

The project will cover the main topics of the national curriculum through students own project work. Those topics that are not covered in the project work will be covered in other lessons.

The project is following the principles of a *Jigsaw* cooperative learning technique (Aronson 1971; <http://www.jigsaw.org/>) with home groups (in this case audiocasting groups) and thematic expert groups that are reporting back to their home groups. The results of the home groups are then communicated for the whole school community as an audiocasting of 2 minutes with information about HIV/AIDS. The audiocasting will deal on issues that the students have considered to be the most relevant for their own age group.

2. Main Phases

The learning project has four main phases:

Introduction: Forming the “Audiocasting Groups” and “Thematic Expert Groups” and introducing the MobilED technology;

Expert Group work: Gathering information with the MobilED tools (wiki) and discussion on the finding in the expert group.

Reporting: Report findings to the “Audiocasting Group”, Negotiate content and decide on the nature of audiocasting show. Write script and record.

Show time: Listen to the audiocastings of other groups and market them to the school community.

3. Resource and Facilities

Content

Aims and objectives of the Learning Event.

Titles of the thematic areas that are studied by the expert groups.

Mini-manual on how to use the MobilED tools and the MobilED wiki.

Tools

MobilED KIT

Pens and notebook

Study books

Reusable learning objects

Communication

Teacher's presentation of the project

Small group discussion and class-room discussions

Audiocasting show

Marketing the Audiocasting to the larger community

Basic sequence of the learning event

Introduction: Aims and objective of the learning project and the expected results.

Forming the Audiocasting Groups.

Presenting the themes of the Expert Groups.

Making the Expert Groups.

Gathering information in the Expert Groups.

Group discussions in the Expert Groups about the information found.

Debate and decide on what is important in the theme of our Expert Group.

Presenting the results of the Expert Group work in the Audiocasting Groups.

Debate and decide on the content of the Audiocasting.

Writing the script of the Audiocasting

Producing the Audiocasting.

Listening and assessing to the Audiocastings according to rubric.

“Marketing” the Audiocastings.

4. Learning Event

Background

This lesson is designed along themes. These are to be explored and investigated and have been selected in an effort to explore and add to our rich *African Philosophical Thinking* and to promote sensitivity across a range of social contexts. Our diverse society comprise of different cultures and communities, each with their own unique perspective on HIV. The main objective of this event is to access these belief systems and to make them available to other communities in the form of audiocastings.

Today HIV/AIDS has killed an estimated 25 million people, currently between 37 and 45 million are living with the disease and in the year 2005 more than 6 million were newly infected. The ramification of the disease is known to all and it is believed that education is key in the fight against this disease.

This learning event forms part of the curriculum and is used in an effort to increase the learner's understanding of the complexity of HIV/AIDS. This intervention takes place at the end of the section and learners have already received extensive exposure to the following:

- Structure of a virus
- Viral infections and diseases
- Transmission of viruses
- Discovery of HIV and AIDS
- Structure and Life cycle of HIV
- Immune system
- Transmission and prevention

In this lesson learners will attempt to access the beliefs and social practices embedded into their own indigenous knowledge systems and share them with others. This is to nurture socially responsible attitudes and values.

Target Group

The target group is grade 11 learners taking Biology at Cornwall Hill College. They are currently accommodated in three keys. There are approximately 20 learners per class.

They will be covering a section in the National Senior Certification Curriculum on HIV and AIDS. Sections not covered by the Learning Event will be covered during normal class time.

Different groups

Three different groups will be used.

Intimate group

Learners gather in an informal semi-circle in close proximity to each other close to the whiteboard.

Audiocasting group

Gather according to the tag number. In this group audiocastings will be scripted and recorded.

Expert group

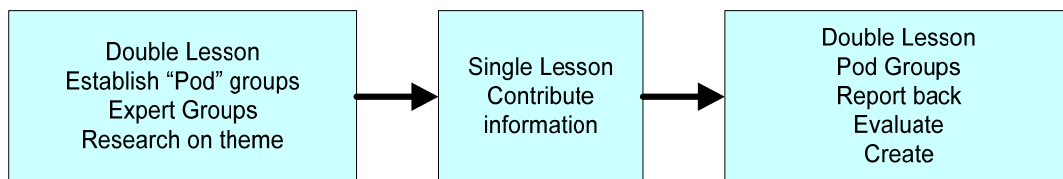
Gather according to the tag colours. The specific theme will be explored using the audiowiki and other resources.

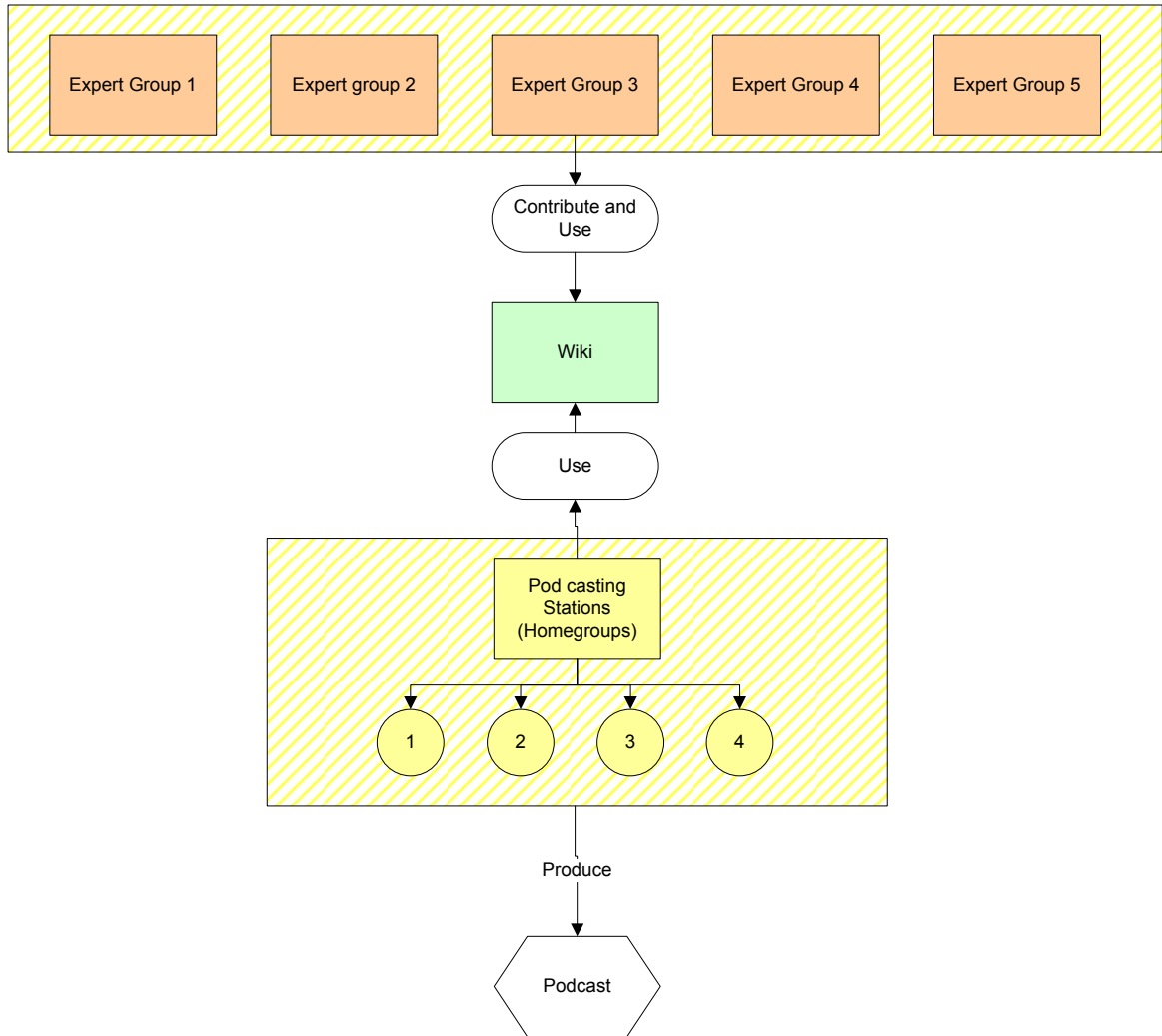
Lesson Outline

Audiocasting groups are formed and divided into five expert groups in each class. These expert groups will research different topics and themes. They will contribute to the wiki where needed from other sources and will use the wiki as a reference source.

On completing their research they will move back to their “audiocasting” groups and each expert will contribute to create an audiocast which will be saved onto the wiki. The learners will use the wiki as a reference source.

They will use one double lesson (80 min), a single lesson of 40 min followed by a double lesson (80 min).





Instructions

Make use of on Bronfenbrenner’s bio-ecological model to focus on the expected depth of exploration. It is imperative that they consider all aspects of their particular theme across all the levels of this model.

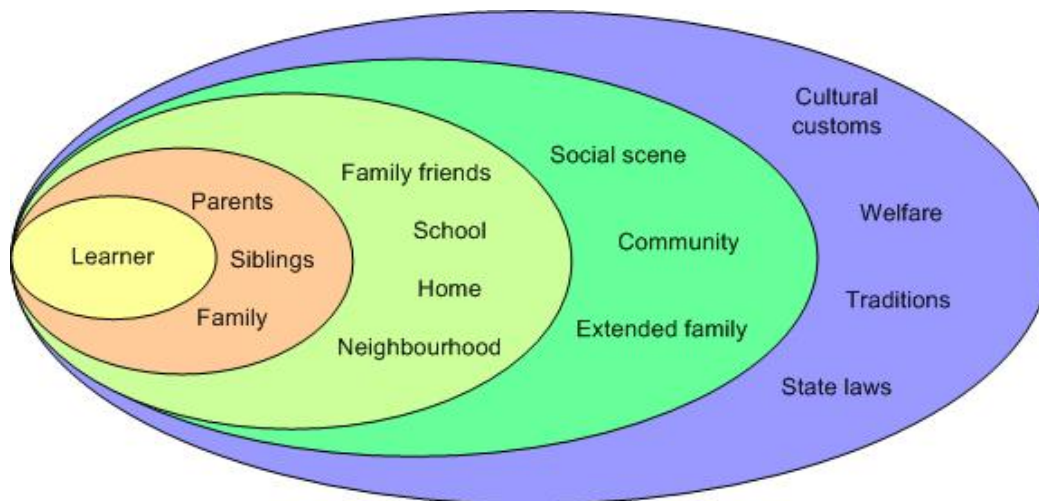


Fig 1:Adapted Bronfenbrenner's bio-ecological model as applied in HIV intervention.

Microsystem: Roles and interpersonal relationships between individuals – peers, educators, friends and family in a face to face proximity.

Mesosystem: This refers to areas in which the learner is not actively participating in but does impact heavily on their existence – health system, education,

Macrosystem: This level refers to the attitudes, beliefs, values and ideologies inherent in a particular society or culture.

In the expert groups learners have to explore their topic and construct a mind-map. They have access to additional resources other than the wiki. This is then used to identify search-words to be sent to the wiki. They are encouraged to delve into their own life experience and relate their own personal stories.

Expert group themes to be selected from:

Myths and Legends

Hero's and Villains

Rights

Support

Impact

Counselling

Community

Teenage sexuality

Beliefs and cultural issues

Response

(Those in italics will be used during this learning event)

The following Critical Outcomes as stipulated by the National Curriculum Statements Grades 10-12 for Life Sciences apply in this learning event:

- Identify and solve problems in which responses display that responsible decision using critical and creative thinking have been made.
- Work effectively with others as a member of a team, group, organisation, community.
- Organise oneself and one's activities responsibly and effectively.
- Collect, analyse, organise and critically evaluate information.
- Communicate effectively using visual, and language skills in the mode of an oral presentation.
- Use science and technology effectively and critically, showing responsibility towards the environment and the health of others.
- Demonstrate an understanding of the world as a set of related systems by recognising that problem-solving contexts do not exist in isolation.

**DETAILED EVENT SEQUENCING:
FIRST DOUBLE LESSON (80 MINUTES)**

Time in minutes	Group context	Activity		Objectives
		Learner	Facilitator	
2	Intimate	Enter and arrange seating	Receive learners	Receive learners and organise an intimate group in the front of the class. Put learners at ease.
4	Intimate	Receive coloured and numbered tags and write names on tags	Hand out cards and markers	Randomly hand out tags. This will determine the composition of the future audiocasting and expert groups.
5	Intimate	Attentive listening	Introduce various role-players	Role-players have opportunity to introduce themselves and their level of involvement in the project. Familiarize with role-players
8	Intimate	Participation	Introduction	Set the scene and the scope of the project. Explain the objectives for this lesson as well as the final deliverable at the end of the project.
4	Audio-casting	Get to know group members	Indicate meeting places	Familiarise themselves with other members and choose group name.
2	Audio-casting	Announce group name to the rest of class	Record names on board	Names to be registered to wiki for future audiocasting.
5	Expert	Gather in expert (coloured) groups and get to know other members	Hand out kits	Familiarise themselves with the contents of kit.
10	Expert	Play with phones	Troubleshoot	Assemble kit and explore possibilities of kit.
30	Expert	Conduct investigation using available resources	Introduce themes and provide alternative resources	Problem solving and investigative enquiry of themes
5	Expert	Tidy up and return kits	Collect Kits	Control of equipment
5	Audio-casting	Progress report	General housekeeping	Give opportunity for general feedback and forward planning.

SECOND SINGLE (40 MINUTES)

Time in minutes	Group context	Activity		Objectives
		Learner	Facilitator	
5	Intimate	Receive tags	Reflection and goal setting for this lesson	Revisit project objectives
20	Expert	Research using available resources	Facilitation	Problem solving and investigative enquiry of themes
5	Expert	Tidy up and return kits	Collect Kits	Control of equipment
5	Audio-casting	Report on progress and	General housekeeping	Give opportunity for general feedback and forward planning. Assign roles in the audiocasting.

SECOND DOUBLE (80 MINUTES)

Time in minutes	Group context	Activity		Objectives
		Learner	Facilitator	
5	Intimate	Receive tags	Reflection and goal setting for this lesson	Revisit project objectives introduce rubric to be used in assessing the audiocast.
10	Audio-casting	Write script for audiocast	Facilitation	Use experts from different themes and create as script for a future broadcast.
40	Audio-casting	Refine script and practise audiocasting	Monitor and support	Practice the audiocast
20	Audio-casting	Navigate menu, record, revise and save audiocasting	Monitor and support	Record the audiocast
10	Intimate	Assessing	Assessing	Listen to other groups' audiocasting and assess using the available rubric.
5	Intimate	Strategize	Facilitate	Decide on strategies to market audiocastings to the wider school community

Broadcast presentation

Group name: _____

Group members: _____

Assessment criteria	Level 4	Level 3	Level 2	Level 1
Content and creativity	Mature, insightful content with unusual points of view. Indication of thorough research and inspired thinking. Well balanced arguments.	Fairly mature, creative content with interesting points of view. Thought provoking material, well balanced arguments.	Very little thought provoking information. Some attempt at creativity. Adequate treatment of subject matter but uninspiring.	Inadequate preparation. Superficial treatment of subject matter. No creativity and material not thought provoking at all.
Structure	A compelling opening, formative middle and satisfying conclusion. Excellent development of topic.	Different structural components present but not satisfying. Good topic development.	Loss of focus with structure needing work. Little topic development.	No focus with little evidence for different components of structure. Topic development lacking.
Voice skills	Inspiring speaker. Voice reflects emotion and energy. Good control and inflection.	An adequate speaker with satisfactory inflection and control. Voice has moderate energy and carries limited emotion.	Voice is weak and speaker is uninspiring. No energy with little emotion.	Speaker is uninspiring with very weak energy. Carries no emotion.
Target audience	Captivated correct audience. Audience can associate with the presenters' point of view and visualise setting effectively.	Held correct audience attention most of the time.	Audience not targeted correctly resulting in very little audience rapport.	No audience rapport with little interest to them.
Making full use of the mobile medium	Sketches a dynamic and colourful mental picture. Additional use of sound create stimulating environment.	Use of sound supports development of the topic mental image created. An interesting mental picture created.	Use of additional sound does not support presentation adequately. Mental picture a little fuzzy.	Use of additional sound distracting and confusing. Does not support ideas and themes.
Length of Presentation	Maximum use of allocated time.	Effective use of time. Slightly over or under prescribed time.	Ineffective use of time. Too short or long by more than 30 seconds.	No consideration given to time limits. Mush too long or short by more than 45 seconds.

Appendix 5: Bug report – developed school



Bug report

(Pilot 1)



School: Cornwall Hill College

Date: 23 – 30 March 2006

Groups evaluated: 3

Learners/group: ± 18

Observers:

Adele Botha

Jacqueline Batchelor

Teemu Leinonen

Victor Zimu

1. Introduction

This report presents all the technical difficulties that were experienced during the first pilot. It also presents the comments and suggestions received from the participating learners (and some from the teachers). Additional information, with regards to details of the lesson plan used during the sessions, is available on <http://mobiled.uiah.fi/>.

2. General Issues

At the beginning of each of the meetings, between the different expert groups, the learners were given some time to familiarise themselves with the smart phones and the other equipment that they were provided with. Within few minutes of receiving the kit, the students were using the phones to take pictures, for recording customised videos, playing games, and were even changing some of the phones' settings. It was quite clear that these learners were quite familiar with technology, and specifically, cellphone technology☺.

One of the things observable was the manner in which each of the group was structured. Each of the groups contained a leader. The leader happened to be the learner with more technology savvy as compared with the others. Only in a few groups was there more than one leader. At most, it was two leaders, and those were the ones mainly interacting with the phone. The leaders play the main role during both the technology exploration and the task phase. They are also the ones from whom most of the comments and suggestion came.

3. Technical Issues

The problems that the learners experienced can be classified into three categories, and these are: navigation, voice, and hardware related. The details are presented in the sections below.

2.1 Navigation

2.1.1 Problems

1. Selecting the *Pause* option from the index menu (or other locations), during the call, causes the system to disconnect/terminate the call.
2. If the system is not able to find an article on a particular keyword, it calls back, but then the call is terminated without any form of message or notification. The same thing happens with certain keywords that are possible to find on Wikipedia when using other methods.
3. Search queries made using multiple keywords cause the system to respond in a way similar to the above (2). The learners found themselves in a position where

they had to be creative when it comes to selecting the best keyword to use first. Once this was sent, they could then, through navigation, find the sections that contain the other keywords.

4. Options in the index menu tend to be too many, e.g. for the keyword “AIDS”, the corresponding article contains close to about 50 subsections. The learners had to listen to all the subsections in order to be able to find the one relevant to their topic. As the system continues to go through the list of options, the learners’ attitude degrades to that of fatigue and boredom.
5. The rewind options, used between sections, did not work as was expected. The learners had to wait till the last section was read before they could access information from prior sections.
6. Initially, the learners would send search terms to the system; the system would reply, but then they could not navigate through the options provided. It was later found that this was because the phones were left in the ‘text message window’. The phones need to be in the main screen in order for the system to be able to capture the DTMF inputs made by the person using it.
7. The system reads the content of a menu only once. If the user did not hear the different options (whether all or some) there is no way of repeating the menu.
8. If the system doesn’t receive a response from the user, for a relatively long time period, it does not have a mechanism for assessing this and to then decide whether to terminate the call or not to. Such a mechanism is necessary since there is a cost attached to making a call back to the user.

2.1.2 Comments and Suggestions

1. With regards to the server’s response time, there were no particular queries and the learners seemed to be quite happy with that. The few that were asked about it felt that the response was within a reasonable time.
2. There were no complaints received with regards to the response time of the server during navigation (between the various menu options) as well.
3. The system is expected to, at least, give some response (e.g. an error message) if it can’t find information on a certain keyword.
4. Initially, multiple keyword searches were not supported by the system. This was not received well by the learners, and the teachers☺. No one could understand why they were limited to just one keyword.
5. There were a couple of suggestions from the learners on what we could either change or add to the system. One is an idea for a mechanism to narrow down the list of items in the index menu. This would allow the user to supply additional

keywords that could be used to find particular sections, within the current article, that contain those specific words.

6. The learners felt there is a need for an option to rewind by sentence as well. This would help in a situation where one missed something from a previous sentence, but wouldn't like to rewind an entire section.
7. Another desired feature is, a bit close to the speech recognition side, a functionality that allows the user to navigate through the different items using just voice.

2.2 Voice

These are some problems that were experienced by the learners with regard to the voice used by the system. It is important to note that these are not system related but pertain to the current 'state of the art' Open Source TTS (Text to Speech) tools.

2.2.1 Problems

1. There students found the voice unusable. The complaints received were mainly about the voice's clarity and quality. As time progressed, during the lessons, the learners opted for the reading material that they were supplied with, and didn't use the service for reference any longer.

There were some of things said, by the learners, about the voice. Some of which we thought were quite amusing. From comments like, "Is this guy speaking English?" To, "It sounds like a guy speaking underwater". Or, "It's like a voice from one of those horror movies!"... They were not impressed☺.

2. There was a difference in the volume levels between the female and the synthesized, male voice. The students could hear the female voice with more ease than the synthesized one.
3. The students felt the synthesized voice was going through the information a bit too fast and needed to be slowed down a bit for future purposes. They felt this might even compensate (although just a bit) for the overall poor quality of the voice.

2.2.2 Comments and Suggestions

1. The speed with which the synthesized voice reads needs to be adjusted and made to be slower than it currently is.
2. To the contrary, the female voice, used for the reading the menu options, was received very well, and there were no complains from the learners.
3. The idea of using different voices for different levels in an article was also received very well.

4. The learners seemed to be quite keen on having the service being offered in other languages as well. If integrated these are will probably be Afrikaans, isiZulu and sePedi.

2.3 Hardware

2.3.1 Problems

1. Most of the students felt that the Nokia smart phones (Nokia 3230) used in the pilot are not that user friendly.
2. The loudness of the speakers used was not the same between the different groups. The students with ‘weaker’ speakers resorted to other means, like shielding the sound with boxes, to both control and amplify the sound from the speakers.

2.3.2 Comments and Suggestions

1. For other pilots, try other cellphone brands as well. The current favourite seems to be Samsung.

3. Conclusion

The idea, in general, was well received. We received valuable input in general - including one learner asking that we integrate MMS capability into the system. Some of issues have already been attend to, and some, like the voice quality, may take a longer period to address.

Appendix 6: Reflective diary

JACQUELINE BATCHELOR - REFLECTIONS ON HIV PILOT.

TECHNOLOGY	LEARNER ACTIONS	GENERAL
Audio – voice clarity, earpieces, pace, no user control on voice speed	Encourage to bring own research – Only a few interviewed parents and grandparents and other relatives. They relied heavily on their own belief systems.	Time allocation to each task – too long or short
Length of cable from speaker to phone – limit handling capabilities.	Handling of phones – those more familiar did most of manipulation.	Tag allocation – random – worked well
Misspelling of audiocasting names. Delays.	Group split into active and non-active members.	Laminated worksheets for mind-maps – reusable. (Provide non-permanent markers.)
Call log – does not indicate length of call.	Played with phone capabilities. This was limited to familiarising period. Much enjoyed	Time of rubric introduction – big debate. Used only during last intervention
Assumptions – learners to be familiar with these particular phones, sms-ing, internet searching, constructing mind-maps, working in collaborative groups.	Use of radio as background during planning after conducting research.	Locations of Audiocastings – create soundproof rooms. Proved problematic. – Splintered groups.
Learners had to learn how to work a tape recorder. Not familiar with using the Play and Rec button simultaneously.	Audiocastings all failed during first intervention - Some forgot to save.	Difficult to monitor and provide support in different audiocasting venues.

None used the pause button. Took a few demonstrations before they could master it.		
	Menu quite long and tedious to follow during audiocasting – nerve wracking.	Reverted to tape recorders as backups. Audio clarity surprisingly good in comparison to mobile.
	Found it difficult to re-record a long broadcast. – lost enthusiasm and energy .	Jaded audiocasting experience after having to do it a few times. – very little educational value.
	Not all could audiocast – led to disappointment in those that couldn't.	Absentees had negative impact on groups. – either new members or absent ones.
	Waiting period after sms varied greatly. Multiple reasons for this.	Spontaneous demonstrations to visiting board members and principal. – They were very impressed.
	Multiple query words created problems – service did not call back.	Wiki accessed limited during second single lesson – due to bad voice quality.
	Calls were terminated often.	Only one learner accessed wiki out of lesson time on a single Limitations: Voice Group numbers Gender Navigation Number of phones and lines Clumsy selection of keywords occasion.
	Menu navigation long and cumbersome.	General interference and interruptions from other role-players and daily routine.
	Could not access same place as before. They had to navigate through menu and didn't ended up elsewhere.	Wiki - little local content or scenarios. Surprising to learners. They expected more relevant info to be available. General complaint – we can't

		find anything on our theme.
	Increased levels of anxiety levels during audiocasting. – Surprisingly. – Lots of hand wringing.	Keeping learners on track and motivated during technological setbacks proved problematic
	Incorrect spelling of sms query. – Resulted in long waiting periods.	Composition of classes – some more boys than girls. Not problematic – it just added to the diverse learning experiences and audiocastings. – Boys tended to be more serious.

Appendix 7: Transcribed interviews.

3 August 2006-09-11

Principal: Monyela

Q: How did you find the visit by MobilED at your school?

A: It was very important for us to get involved in this project, from an organisational side of things I think it was well organised There might have been a few hiccups here and there with the children losing the instruments for the first time.

Q: Did you have enough time to make preparations?

A: The message was well communicated. We knew very long in advance that this project will take place. I am not to sure of the readiness of the learners to use the technology and even if we could have done enough in that regard.

Q: The extra time used for the lessons?

A: It is not the a problem as such because we think the time was used fruitfully because to us anything that could be used to benefit the learners at the end of the day is appreciated.

Q: Will this technology be useful to the school?

A: Most definitely, take for instance our situation were we do not have a library and it is very important that learners access information, and the MobilED project will help us a lot. It is also important in the sense that now it gives the learners access to information immediately, they don't have to leave the class or the classroom situation, go to the library to search and soforth. In that regard it would be very helpful.

Q: Other possible uses for this system in the school environment?

A: In terms of intercom. Announcing messages but also the other thing is perhaps if you have communication problems with your parents for instance you call a parents meeting and you want to remind the parents of the meeting on a particular day then you can be useful in that sense

Q: Is this possible to integrate this tool in the daily running of the school?

A: Yes it is possible. I can say that because we used it for the first time and we will check what it is possible to use it for, for other purposes and as time goes on we will be able to disciver other functions that will be very much helpful to the school.

Q: Would you suggest this technology to other schools?

A: Yes, I Will

Teacher 1

Q: Do you think that technology can bring change in your school?

A: Because we do not have a functional library, I think it will work particularly well.

Q: Do you think that will use this technology as part of your daily lesson planning?

- A: It is more or less the same as going through the dictionary and finding an explanation of a specific word or so that could be replaced with this type of technology.
- Q: *Do you have any suggestion for improvement?*
- Q: Except for the voice which we have talked about.
- Q: *What other ways could you use the technology?*
- A: If learners have some activities to do in class, say we are working in groups not only the jigsaw, but they all contribute to the main one. Even on individual basis the learner can on his own send a sms and get a reply and that information can help him to do his day to day assignments.
- Q: *What do the learners think of the project?*
- A: They are very interested. It is a different dimension from the daily routine of dictionaries and stuff like encyclopaedias, and going to the library only to read, this is like, it bring in a new dimension. They look quite interested in the whole thing.
- Q: *Are your colleagues aware of the project?*
- A: I will be calling a meeting with tem to discuss everything, but their interest is about themselves getting personal phones. *(Much laughter)*
- Q: *Are we welcome back at your school?*
- A: Well if you talk to the top brass, if he gives the thumbs up. Ya

Teacher 2

- Q: *Do you see yourself using this technology in future as part of your lessons?*
- A: Definitely, It saves time because it, there is a lot of information available, but still using it in relation with other textbooks. I will definety use it.
- Q: *Will you suggest this technology to other teachers?*
- A: I have already discussed it with some of my colleagues and they see the advantages of this technology. But since we have used this I have noticed only a few disadvantages which can easily be corrected.
- Q: *Do you think this will help schools in deep rural areas?*
- A: I Think only if they will get the equipment the phones, not relacing the libraries, but currently they are struggling with the libraries.
- Q: *How does Irene Middle School compare with other schools in the rural areas?*
- A: Learners here are used to cell phones and some of them have cell phones, in the rural areas, lot of learners for not have cell phones. Maybe there will be small difficulties in using the sms ya in terms of sending the sms, ya it is not very difficult, I think a child could do that with some help
- Q: *Designing lesson plans*
- A: Itis very important, lesson plans are like a map if you want to arrive at your destination you want a map. Now in our lesson plans we write all the activities the I as a teachers will do and then what the learners are going to do.
- Q: *Do you think this will increase the amount of time needed for the lessons?*
- A: It is just that the timeframe for completion of the daily activities that will need moderating just have to control them to do what they are supposed to do, by that I mean by observing what they are doing.
- Q: *Ay suggestions for improvements?*
- A: The noise, is like now, sometimes children are not controlled, in terms of the volume and the voice and the system, I have noticed that it disturbs the other

groups. Because some other group have already received a call from the system and these ones lose their concentration and even after they have sent their information, when the system replies to them then this voice and that voice, there is a lot of noise. Now different ports for what do you call it earphones, each learner put an earphone, now this current earphones that we have a volume control, on the cord now each learner will adjust his according to his own needs. But so doing the whole class will be quiet no one will be talking even the other group when they are sending information those other ones that is listening to the system.

Q: Can you think of any other applications for the technology?

A: Sometimes, like now I gave them a project of the rand, they have to do that every day, I think the system can help.

Q: What if the system replied back with text?

A: Yes, some of them they are slow in writing, some of them cannot hear exactly what the voice said, the voice is not that much fast, but now if somebody writes he must reach the speed of the voice, now they will have to press the rewind and write also and press rewind again and again.

Learner 1 (learner with her own phone)

Q: It has been almost a week since we had MobilED. What did you think from us coming into your school?

A: I was surprised that you would choose our school, the phones were cool, they were very nice, especially the Nokia 32, it is very different to my own phone, the Samsung 600

Q: And the teachers, what did they tell you before we came in?

A: Well they gave us these phones and they told us that you guys were here to advertise for something

Q: How did it go with the visit how did you find it?

A: Very interesting, very interesting I did not know you could do such things with the phones,

Q: If for instance we make these phones available to you guys every day will you use it other than playing games?

A: Yes, I can actually do my homework with it.

Q: Your phone does not have web access?

A: No

Q: Can you see problems with using phones in the school?

A: No there wouldn't, we could misplace it,

Q: Did you find it difficult to use the phone

A: No it is similar to mine

Learner 2

Q: What do you think of MobilED?

A: It is actually cool, some of us we do not access to phones and we did not know phones can do such stuff and we learnt more about phones and stuff, it has more features than the phones that we are used to

Q: What is the bad thing about MobilED?

A: The only problem that you are going to get is if you come into our school and you hand us phones or if the classed the only problem that you are going to

get because nobody wants to use it for schoolwork , they will want to use it for their own use, that is the only problem that you will have maybe you can make it not to sent sms or call out because if they remember something they will want to sms a friend. That is the only problem.

Q: Any other suggestions?

A: There is a lot, If those phone come to school they should not hand them out every day there should be a day for phone or either you go the the computer center or the phone or stuff. But if you hand them out then all the phones can disappear or something like that, but then you know they have trackers and stuff. (Laughter)

Q: Were you comfortable using the phone?

A: The phone was very nice, the features were great some of them were playing games and stuff like, the games movies and stuff, but then it is cool its like If I had a phone like that I will be happy for the rest of my life and I don't have to worry about the bad moments.

Q: If it is working properly

A: If the teacher s says go do research or something, If I am far from the library then it would make it easy and I can do it at break.

Learner 3 (Had phone, now no phone)

Q: What happened at your school before MobileD started?

A: Nothing much. We had computers at our school but they were stolen. And we have to get information at the library ***** there is no one at school.

Q: How far is it from you

A: It is not very far for me

Q: What would you prefer? Library or cell phone

A: Cell phone is simpler. You use money at the library cause on taxi and stuff. It will help

Q: What did you think of the project

A: I think it was very nice, we will experience new things, things we have not experienced before most of us don't have cell phones, I don't have one, I did not know how to use the sms, my mother have a phone and I play with it, but it does not have an mms. I want it on a daily basis.

Q: Who must we make phones available to?

A: Available to grade nine only

Q: How can phones help?

A: You become stressed because of projects and assignments if you live in a rural area, cause there are no libraries there so if maybe they give you cell phones then maybe I can do my homework with the cell phone.

Q: Do you like the voice

A: I think you should change the voice, we cannot hear it properly it is too rough.

Q: How was the whole MobileD thing?

A: It was nice, but we had some difficult some of us did not have the chance to hold the phone because of the time we had it was too short but it went on and on it was so nice and really challenging, it brought new challenges to us we learnt and I would like to have it again

Q: Do you think we should do it in other schools?

- A: So that other kids could also gain information such as they need the information because our teachers give us assignments
- Q: *Do you have a phone*
- A: I used to have on, but I don't
- Q: *What would you like to change*
- A: The person who speaks. We cannot hear the person clearly and we can't hear what he is trying to say to us, so we can't give answers to the person if we wish to so I wish the speaker must the person must change and the voices and the tone must be a little bit smooth and not to be rough like that person voice because we couldn't hear what he wanted to say and it was so difficult for us to listen if we can't hear somebody trying to talk. So it was difficult
- Q: *Do you think we should make it available to other learners in South Africa?*
- A: It will mean access to them they can have enough time to do it on their cell phones. Some learners travel and in rural areas they cannot travel and make photocopies, And in the rural areas there is no such things. Cell phone will be must easier to get information not cost a lot of money. You can only use libraries that are far in the towns not in the townships.
- Q: *Do you think it will cause interruptions in class?*
- A: Sometimes when the teacher is in class and they learners want to play with the phone it will interrupt the teachers the teachers will not get the attention she or he needs from the learners and it will disturb the learners.

Learner 5 (Do not have a phone)

- Q: *What did MObilED do for you?*
- A: When you came in our school you taught us a lot of things, I did not know how to use a phone, you know, so that when they came I did know how to use a cell phone. I don't have a phone, no one in my family have a cell phone.
- Q: *How did you use the phone?*
- A: I used it to send messages, to learn all about searches
- Q: *Which phone did you use?*
- A: The silver one.
- Q: *So at the beginning you did not know how to use a phone?*
- A: Yes
- Q: *Did you think we gave you enough time to learn how to use the phone?*
- A: No
- Q: *Did you play with both phones*
- A: The silver one because it had a game, and I like games.
- Q: *Which games were you playing*
- A: The one with the cars. Racers
- Q: *Were you able to send a message now.*
- A: Yes
- Q: *Even an MMS*
- A: No No MMS
- Q: *What else do you want to be added on the whole MObilED thing?*
- A: I would like to know if it has meanings of words if our teachers are talking about other words that I don not understand so that I could look this up

Appendix 8: MobilED Guidelines policy

MobilED

(Research Initiative)

Guidelines and Policy for Using the Mobile Phones and the Prepaid Cards in the School Tests

MobilED initiative is designing learning environments that are meaningfully enhanced with mobile technologies and services. The school pilots are part of the research and development work carried out in the MobilED initiative.

The MobilED initiative is coordinated by the Meraka Institute of the Council for Scientific and Industrial Research (CSIR), South Africa and the Media Lab of the University of Art and Design Helsinki, Finland.

Ownership of the Mobile Phones the Accessories:

Media Lab, University of Art and Design Helsinki is responsible on the mobile phones and the accessories used in the school pilots. The mobile phones and the accessories should be returned for the representative of the Media Lab when the pilots are over.

Ownership of the Prepaid Cards:

The prepaid cards are property of the Meraka Institute of the Council for Scientific and Industrial Research (CSIR). The cards should be returned for the representative of the Meraka Institute when the pilots are over.

Loss or Damage of the Mobile Phones or the Prepaid Cards:

The teachers and students are expected to take good care of the mobile phones, the accessories and the prepaid cards. However, teachers or students are not responsible of any destruction, loss or damage caused for the mobile phones, accessories or the prepaid cards.

In the case of loss or damage the representative of the Media Lab or the Meraka Institution should be informed as soon as possible about the accident.

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Appendix 9: Call log - Developed school

MobilEd article access data (1 st pilot)	
Teemu: 0782642772	
Francois: 078384927	
22 March	
14:05:25:	00783049245 - Finland
14:20:32:	00783049245 - Finland
14:43:04:	00783049245 - Nokia
15:19:02:	00783049276 - Cat
15:23:26:	00783049276 - AIDS
15:50:26:	00783049276 - AIDS
15:56:41:	00783049276 - AIDS
15:57:50:	00783049276 - AIDS
17:08:26:	00782642772 - AIDS
19:36:00:	00783049276 - Cat
19:38:00:	00783049276 - Cat
19:39:43:	00783049276 - Cat
19:40:57:	00783049276 - Cat
23 March	
08:02:01:	00783049245 - Finland
08:36:43:	00783049276 - Cat
08:56:34:	00783049245 - AIDS
09:55:09:	00783049257 - AIDS
10:00:16:	00783049257 - Human rights about AIDS
10:05:20:	00734341656 - Finland
10:10:40:	00838683649 - Mythology
10:17:25:	00838683649 - HIV
10:21:08:	00783049245 - Sexually-transmitted diseases
10:21:20:	00783049284 - HIV
10:37:21:	00722824821 - AIDS
11:35:30:	00783049284 - AIDS
11:48:58:	00783049257 - Human rights
11:59:26:	00783049284 - AIDS
12:05:45:	00783049257 - HIV
12:17:11:	00783049284 - Love
12:54:10:	00783049284 - Finland
24 March	
08:05:55:	00783049245 - AIDS
08:01:18:	00783049257 - AIDS
08:13:27:	00783049284 - AIDS
08:16:56:	00783049257 - Rights
09:13:02:	00838683649 - AIDS
09:16:55:	00783049257 - AIDS
09:19:37:	00783049245 - AIDS
09:25:12:	00838683649 - HIV
09:32:07:	00783049284 - AIDS
09:33:28:	00783049284 - AIDS
13:32:17:	00782642772 - ChC1time (audio added)
25 March	
10:51:16:	00783049238 - Pretoria
10:54:00:	00783049238 - Vryheid
10:59:40:	00783049238 - Vryheid (audio added)

7 March	
1:04:59:	00782642772 - ChC4U
1:10:25:	00734341656 - ChCtime
1:17:37:	00782642772 - ChC4U
2:01:27:	00838683649 - ChC3noegee
2:05:44:	00783049284 - ChC1time
2:06:21:	00838683649 - ChC3noegee
2:13:57:	00734341656 - ChC4sim
2:15:32:	00783049257 - ChC2chuck
2:16:47:	00783049257 - ChC2chuck
2:17:31:	00838683649 - ChC3noegee
2:20:22:	00734341656 - ChC4sim
2:22:40:	00783049284 - ChC1time
2:17:28:	00783049245 - ChC2chuck
8 March	
1:34:18:	00734341656 - AIDS
1:38:26:	00783049284 - HIV
1:51:12:	00783049284 - Stigma
1:56:43:	00838683649 - AIDS
2:18:56:	00783049276 - ChC4U
2:30:18:	00783049257 - ChCgrey
4:41:49:	00782642772 - ChCblue
9 March (testing)	
09:32:44:	00783049284 -
09:51:05:	00783049276 - ChC123Testing123
11:22:40:	00783049276 - ChC123Test3
11:35:18:	00783049276 - ChC123Test4
11:36:28:	00828090411 - ChC123Test3
15:24:36:	00782642772 - ChCred
10 March	
10:55:31:	00783049276 - Cat
10:08:25:	00838683649 - ChCred
10:04:48:	00838683649 - ChCred (audio added)
10:14:28:	00783049257 - ChCgreen
10:18:54:	00783049257 - ChCgreen (audio added)
10:21:15:	00783049257 - ChCgreen
10:27:53:	00783049257 - ChCblue
10:32:46:	00783049257 - ChCblue (audio added)
11:16:00:	00838683649 - ChCblue
11:22:28:	00782642772 - chC4u
11:26:38:	00782642772 - ChC1time
11:29:35:	00782642772 - ChCred
11:37:48:	00782642772 - ChC4U
11:42:36:	00782642772 - ChC123abc
11:43:39:	00782642772 - ChC32wet
12:00:39:	00782642772 - ChC2technogeeks
12:12:29:	00783043248 - ChC32wet
12:28:07:	00732912698 - ChCgreen
12:33:11:	00732912698 - ChCred
17:10:45:	00782642772 - ChC32wet
17:33:26:	00844580593 - ChC1time
17:36:20:	00844580593 - ChC4U

Appendix 10: Call Log- Developing school

<i>Time</i>	<i>Number</i>	<i>Query</i>	<i>Comment</i>
08:44	0783049276	Economy	
08:54	0783049276	Economy	
08:59	0783049276	Economy	
09:07	0783049276	Economy	
10:00	0783049238	Aids	
11:31	0730609996	Aids	
11:31	0730609996	Aids	10 seconds after previous query
11:33	0739223821	Aids	
11:33	0731700052	Aids	
11:34	0739223816	Aids	
11:34	0739223859	Aids	
11:36	0739223859	Aids	
11:37	0730609996	Aids	
11:37	0730609996	Aids	34 seconds after previous query
11:38	0730609996	Wheater	
11:39	0730609996	Wheater	
11:39	0734177106	Wheater	
11:39	0739223859	Aids	
11:40	0730609996	Sabc	
11:40	0734177106	Aids	
11:41	0730609996	Sabc	
11:41	0739285373	Aids	
11:42	0731700052	Aids	
11:43	0739223859	Aids	
11:44	0730609996	Aids	
11:45	0739285373	Aids	

11:47	0739223816	Immune system	
11:47	0739285373	Aids	

11:48	0739223821	Aids	
11:50	0739223816	Aids	
11:51	0739285373	Aids	
11:53	0739223821	Aids	
11:53	0734249388	Aids	
11:54	0739223816	Aids	
11:55	0734249388	Gauteng	
11:56	0739223816	Aids	
11:57	0739223821	Cold ware	
11:58	0739223816	Aids	
11:58	0739285373	Subaru	
11:58	0734249388	Kwaito	
11:59	0730609996	Aids	
12:00	0739223821	Cold war information	
12:00	0734177106	Plants	
12:00	0739285373	Subaru	
12:02	0739223859	Aids	
12:02	0739223816	Beyonce	
12:02	0734177106	World war 2	
12:05	0734177106	World war 1	
12:06	0731700052	Gospel	
12:06	0739223859	Kwaito	
12:07	0734177106	Roots	
12:09	0731700052	Gospel	
12:09	0734177106	Guns	
2:10	0739223816	Aids	

12:13	0739223816	Aids	
12:13	0734249388	Listen to audio	
12:14	0730609996	Aids	
12:16	0730609996	Aids	
12:19	0734249388	Listen to audio	
13:01	0739223859	Hiphop hpp	
13:01	0739223816	Aids	
13:03	0730609996	Aids	
13:04	0734177106	Aids	
13:05	0739285373	Aids	
13:05	0734177106	Aids	
13:06	0731700052	Aids	
13:06	0739223859	Cold war	
13:06	0734177106	Hiv	
13:07	0734177106	Hiv	
13:09	0734177106	Hiv	
13:09	0734177106	Hiv	10 seconds after previous query
13:09	0739223859	Cold war	
13:09	0739223816	Aids	
13:10	0731700052	Aids	
13:10	0730609996	Aids	
13:10	0739223821	Aids	
13:10	0739223816	Aids	
13:11	0731700052	Aids	
13:12	0734249388	Aids	
13:12	0739223816	Aids.	
13:12	0734177106	Music	
13:12	0739223816	Aids.	
13:12	0734177106	Music	

13:13	0739223816	Aids.	
13:13	0739223821	Aids	
13:13	0739223859	World war	
13:14	0734177106	Music	
13:15	0739223816	Aids.	
13:15	0734249388	R	
13:17	0739223821	Aids	
13:17	0734177106	Google	
13:19	0739223816	Aids	
13:20	0734249388	Music	
13:21	0739223816	Aids	
13:21	0734249388	Hiv	
13:22	0734177106	Hiv	
13:22	0734177106	Hiv	
13:23	0739223859	Pretoria	
13:24	0739223816	Aids	
13:24	0730609996	Kwaito	
13:25	0734249388	Virus	
13:26	0734177106	Aids	
13:26	0734177106	Aids	20 seconds after previous query
13:26	0739223816	Aids	
13:26	0734177106	Aids	
13:27	0739223816	Aids	
13:28	0734249388	Kwaito	
13:28	0739223859	Aids	
13:29	0739223816	Aids	
13:29	0730609996	Virus	
13:29	0731700052	Aids	
13:30	0734177106	Aids	

<i>Time</i>	<i>Number</i>	<i>Query</i>	<i>Comment</i>
13:30	0734177106	Aids	10 seconds after previous query
13:31	0730609996	Virus	
13:32	0783049238	Kwaito	
13:33	0731700052	Aids	
13:33	0730609996	Virus	
13:33	0730609996	Hiphop	
13:34	0783049238	Aids	
13:35	0734177106	Aids	
13:35	0734177106	Aids	9 seconds after previous query
13:37	0730609996	Aids	
13:39	0739223816	Aids	
13:40	0730609996	Aids	
13:41	0734177106	Aids	
13:42	0730609996	Aids	
13:42	0730609996	Aids	12 seconds after previous query
13:42	0734177106	Aids	
13:42	0739223821	Love life	
13:43	0730609996	Aids	
13:44	0734177106	Music	
13:44	0731700052	Irene	
13:44	0730609996	Aids	
13:45	0739223821	Love life	
13:46	0734177106	Music r n b	
13:47	0734177106	Music r n b	30 seconds after previous query
13:47	0734177106	Music r n b	7 seconds after previous query
13:47	0730609996	Aids	
13:47	0739223821	Aids	

13:48	0739223821	Aids	20 seconds after previous query
13:48	0730609996	Aids	
13:49	0730609996	Aids	30 seconds after previous query
13:55	0731700052	Aids	
13:57	0739223821	Cultural and academic	
14:01	0739223821	Cultural and academic	

Appendix 11: Results developed school

Questionnaire number	Group name	Gender	Did you interact yourself with service	Did you manage to use the service?
1	CHC1TIME	F	Y	Y
2	CHC4SIM	F	Y	Y
3	CHC2CHUCK	F	Y	N
4	CHC451M	M	Y	Y
5	CHC3MOEGOE	M	Y	Y
6	CHC3MOEGOE	M	Y	Y
7	CHCCHUCK	M	Y	Y
8	CHC2CHUCK	M	Y	Y
9	CHC3MOEGOE	M	Y	Y
10	CHC2CHUCK	M	Y	Y
11	CHC451M	F	Y	Y
12	CHC451M	F	Y	Y
13	CHC1TIME	M	Y	Y
14	CHC451M	M	Y	Y
15	CHC2TECHNOGEEKS	F	N	Y
16	CHCTECHNOGEEKS	F	N	N
17	CHC4U	M	Y	Y
18	CHC32WET	M	Y	Y
19	CHC123ABC	M	Y	Y
20	CHC123ABC	F	N	Y
21	CHCABC123	M	Y	Y
22	CHC2TECHNOGEEKS	F	N	N
23	CHC32WET	M	Y	Y
24	CHC4U	F	Y	Y
25	CHC4U	F	Y	Y
26	CHC32WET	M	N	N
27	CHC2WET	M	Y	Y
28	CHCGREEN	F	Y	Y
29	CHCGREY	F	Y	N
30	CHCGREY	F	Y	N
31	CHCGREEN	M	Y	Y
32	RED	F	Y	Y
33	YELLOW	F	Y	Y
34	CHCWHITE	F	Y	Y
35	CHCGREY	F	Y	Y
36	CHC1TIME	F	Y	Y
37	CHCBLUE	F	Y	Y
38	CHC123ABC	M	Y	Y
39	CHC123ABC	M	Y	Y
40	CHC3MOEGOE	F	Y	Y
41	CHC1TIME	F	Y	Y
42	CHC2TECHNOGEEKS	F	Y	Y
43	CHCBLUE	F	Y	Y
44	CHCYELLOW	F	Y	Y
45	CHCGREEN	F	Y	Y

Someone_helped_us_e	Able_to_use_in_futur_e	Listen_or_rea_d	Use_navigatio_n	Assess_use_of_navigation_service
Y	Y	LISTEN	Y	EASY
Y	Y	READING	Y	EASY
Y	Y	READING	Y	EASY
Y	Y	LISTEN	Y	EASY
N	Y	READING	Y	EASY
Y	Y	READING	Y	EASY
Y	Y	READING	Y	DIFFICULT
Y	Y	READING	Y	DIFFICULT
Y	Y	READING	Y	EASY
N	Y	READING	Y	EASY
Y	Y	LISTEN	Y	EASY
Y	Y	READING	Y	EASY
Y	Y	READING	Y	EASY
N		READING	Y	EASY
Y	Y	READING	N	EASY
Y	N	READING	N	EASY
Y	Y	READING	Y	EASY
N	Y	READING	Y	EASY
Y	Y	READING	Y	EASY
Y	Y	READING	Y	EASY
Y	Y	READING	Y	EASY
N	Y	READING	Y	EASY
Y	Y	READING	Y	DIFFICULT
Y	Y	READING	Y	DIFFICULT
Y	Y	READING	Y	DIFFICULT
N	Y	READING	Y	EASY
Y	Y	READING	Y	EASY
Y	Y	READING	Y	DIFFICULT
Y	N	READING	Y	DIFFICULT
Y	Y	READING	Y	DIFFICULT
Y	Y	READING	Y	EASY
Y	Y	READING	N	DIFFICULT
Y/N	Y	READING	N	DIFFICULT
Y	Y	READING	N	DIFFICULT
Y	Y	READING	Y	DIFFICULT
Y	Y	LISTEN	Y	EASY
Y	N	READING	Y	DIFFICULT
Y	Y	READING	Y	DIFFICULT
Y	Y	READING	Y	EASY
Y	Y	LISTEN	N	EASY
Y	Y	READING	Y	EASY
Y	Y	READING	Y	EASY
Y	Y	READING	Y	DIFFICULT
Y	Y	READING	Y	DIFFICULT
Y	Y	READING	Y	DIFFICULT

			Assessing the information: the voice	
Prompt_response_during_session	Adequate_time_to_listen_to_article	Would_more_time_make_a_difference	Hear_voice_clearly	Comfortable_with_type_of_voice
N	Y	Y	N	Y
Y	N	N	N	Y
Y	N	Y	N	N
N	Y	Y	N	N
Y	N	Y	N	N
Y	N	Y	N	N
Y	Y	Y	N	Y
N	N	Y	N	Y
Y	Y	Y	N	N
N	Y	Y	N	N
Y	Y	Y	Y	N
N	N	N	N	N
Y	N	Y	N	N
Y	N	N	N	N
Y	Y	N	N	N
Y	N	Y	Y	Y
N	N	Y	N	Y
Y	N	Y	N	N
N	N	Y	N	N
Y	N	Y	N	N
Y	N		N	N
N	Y	Y	N	Y
Y	Y	N	N	N
N	Y	N	N	N
Y	Y	Y	N	Y
N	N	Y	N	N
N	N	Y	N	N
Y	N	N	N	Y
Y	N	N	N	N
Y	N	Y	N	N
Y	N	Y	N	Y
Y	N	N	N	N
N	Y	Y	N	Y
Y	N		N	N
Y	N	Y	N	N
Y	Y	Y	N	N
N	N	Y	N	N
	N	N	N	N
Y	Y	N	N	N
Y	N	N	N	N
Y	Y	N	N	N
N	N	Y	N	N

Use_serv ice_with_ this_voic e_in_futu re	Prefer_service_in_ another_language	What_other_la nguage	Synthesised_voice_u nderstandable	Prefer_male_or_ female_voice	Prefer_young _or_adult_voic e
N	N		MOST OF THE TIME	FEMALE	YOUNG
Y	N		A BIT	DON'T CARE	DON'T CARE
N	N		A BIT	FEMALE	ADULT
Y	N		A BIT	FEMALE	ADULT
N	N		A BIT	FEMALE	YOUNG
N	N	ITALIAN	A BIT	FEMALE	ADULT
N	N		MOST OF THE TIME	FEMALE	DON'T CARE
Y	N		A BIT	DON'T CARE	DON'T CARE
N	N		A BIT	DON'T CARE	ADULT
N	N		MOST OF THE TIME	DON'T CARE	YOUNG
Y	N		MOST OF THE TIME	FEMALE	ADULT
N	N		A BIT	FEMALE	YOUNG
N	N		A BIT	FEMALE	ADULT
N	N		A BIT	FEMALE	ADULT
N	MAYBE	ZULU	MOST OF THE TIME	FEMALE	DON'T CARE
Y	N		MOST OF THE TIME	FEMALE	ADULT
Y	Y	AFRIKAANS	IMPOSSIBLE	DON'T CARE	DON'T CARE
N	N		A BIT	FEMALE	DON'T CARE
N	N		A BIT	DON'T CARE	ADULT
N	N		A BIT	FEMALE	ADULT
N	Y	AFRIKAANS	A BIT	FEMALE	YOUNG
N	Y		A BIT	DON'T CARE	DON'T CARE
N	Y		IMPOSSIBLE	FEMALE	ADULT
N	Y	AFRIKAANS	A BIT	DON'T CARE	DON'T CARE
N	Y	AFRIKAANS	IMPOSSIBLE	DON'T CARE	DON'T CARE
N	Y	AFRIKAANS/ FRENCH	A BIT	FEMALE	YOUNG
N	N		MOST OF THE TIME	MALE	ADULT
Y	N		A BIT	DON'T CARE	DON'T CARE
N	N		IMPOSSIBLE	DON'T CARE	ADULT
N	Y	AFRIKAANS	IMPOSSIBLE	DON'T CARE	ADULT
Y	N		MOST OF THE TIME	DON'T CARE	DON'T CARE
N	N		A BIT	DON'T CARE	DON'T CARE
N	Y	FRENCH &ANY AFRICAN	IMPOSSIBLE	DON'T CARE	DON'T CARE
Y	Y	AFRIKAANS	A BIT	MALE	ADULT
N	N		A BIT	DON'T CARE	DON'T CARE
Y	N		MOST OF THE TIME	DON'T CARE	YOUNG
N	N		A BIT	DON'T CARE	DON'T CARE
N	Y		IMPOSSIBLE	DON'T CARE	DON'T CARE
N	Y		A BIT	DON'T CARE	ADULT
N	N		A BIT	DON'T CARE	DON'T CARE
N	N		A BIT	DON'T CARE	DON'T CARE
N	Y	SOTHO	IMPOSSIBLE	DON'T CARE	YOUNG
N	Y	SOTHO	A BIT	FEMALE	DON'T CARE
N	N		A BIT	DON'T CARE	DON'T CARE
N	N		IMPOSSIBLE	DON'T CARE	DON'T CARE

Appendix 12: Results developing school

CSIR MobilED: Cornwall Hill pilot						
Accessing the information: the technology						
Questionnaire_number	Gender	Interact_self	Managed_to_use_service	Someone_helped_use	Able_to_use_in_future	Listen_or_read
1			Y	Y	N	LISTEN
2	F	Y	Y	Y	N	READING
3	M		Y	N	Y	LISTEN
4		Y	Y	N	Y	READING
5		Y	Y	N	Y	READING
6	M	N	Y	Y	Y	LISTEN
7	M	Y	Y	N	Y	LISTEN
8	F	Y	Y	Y	Y	LISTEN
9	M	Y	Y	N	N	READING
10	M	Y	Y	Y	Y	LISTEN
11	F	Y	Y	N	Y	READING
12			Y	N	Y	LISTEN
13	M	Y	Y	Y	Y	READING
14		N	N	Y	Y	READING
15	M	Y	Y	N	Y	LISTEN
16	F	Y	Y	N	Y	READING
17	F	Y	Y	N	Y	READING
18	F	N	Y	Y	Y	LISTEN
19	F		Y	N	Y	READING
20		Y	N	Y	Y	LISTEN
21	F	Y	Y	Y	Y	LISTEN
22	F	N	Y	Y	Y	READING
23	F	N	Y	Y	Y	LISTEN
24	M	Y	Y	N	Y	READING
25	F	Y	Y	Y	Y	READING
26		Y	Y	N	Y	
27		Y	Y	Y	Y	LISTEN
28	M	Y	Y	N	Y	LISTEN
29	M	Y	Y	N	Y	LISTEN
30	F	Y	Y	Y	Y	READING
31	M	Y	Y	N	Y	READING
32	F	Y	Y	Y	Y	READING
33	F	Y	Y	Y	Y	READING
34	F	Y	Y	Y	Y	READING
35	F	Y	N	N	Y	LISTEN
36	F	Y	Y	Y	Y	LISTEN
37	M	Y	Y	N	Y	LISTEN
38	M	Y	Y	N	N	READING
39	M	Y	Y	N	Y	READING
40	M	Y	Y	Y	N	LISTEN
41	M	Y	Y	N	Y	LISTEN
42	F	Y	Y	Y	Y	LISTEN

43	M	Y	Y	N	Y	READING
44	M	N	Y	Y	Y	READING
45	F		Y	Y	Y	LISTEN
46	M	Y	Y	N	Y	LISTEN
47	M	Y	Y	N	Y	READING
48	M	Y	Y	Y	Y	READING
49	M	Y	Y	N	Y	LISTEN
50	F	Y	Y	Y	Y	READING
51	F	Y	Y	Y	Y	READING
52	F	Y	Y	Y	Y	READING
53	F	Y	Y	Y	Y	READING
54	F	Y	N	Y	Y	READING
55	M	Y	Y	N	Y	READING
56	M	Y	Y	N	Y	READING
57	F	Y	N	N	Y	E
58	F	Y	Y	Y	Y	READING
59	M	Y	Y	Y	Y	READING
60	M	Y	Y	N	N	READING
61	F	Y	Y	Y	Y	READING
62	F	Y	Y	Y	Y	READING
63	F	Y	Y	Y	Y	LISTEN
64	M	Y	Y	N	Y	READING
65	M	Y	Y	N	Y	READING
66	M	Y	Y	Y	Y	READING
67	M	Y	Y	N	Y	

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Use navigation	Assess_use_of_navigation_service	Menu-Options	Wait_for_call_back	Prompt_response_during_session	Adequate_time_to_listen_to_article
N	EASY	RIGHT	PROMPT ENOUGH	Y	Y
Y	EASY	TOO MANY	TOO LONG	Y	Y
Y	EASY		TOO LONG	N	Y
Y	EASY	RIGHT	TOO LONG	Y	Y
Y	EASY	TOO MANY	TOO LONG	Y	Y
Y	EASY	RIGHT	TOO LONG	Y	N
N	EASY	RIGHT	TOO LONG	N	Y
N	EASY	RIGHT	TOO LONG	Y	Y
Y	DIFFICULT	RIGHT	TOO LONG	Y	N
N	EASY	RIGHT	PROMPT ENOUGH	Y	Y
			PROMPT ENOUGH	Y	Y
	EASY	RIGHT	PROMPT ENOUGH		
	EASY	RIGHT	TOO LONG		N
N	DIFFICULT	TOO LITTLE	TOO LONG	Y	Y
Y	EASY	RIGHT	TOO LONG	Y	Y
Y	DIFFICULT	TOO MANY	PROMPT ENOUGH	Y	N
Y	DIFFICULT	TOO MANY	TOO LONG	Y	N

Y	DIFFICULT	RIGHT	TOO LONG	Y	Y
N	DIFFICULT	RIGHT	TOO LONG	N	Y
N	DIFFICULT	RIGHT	PROMPT ENOUGH	Y	Y
N	DIFFICULT	RIGHT	PROMPT ENOUGH	Y	N
Y		RIGHT	TOO LONG	Y	Y
N	DIFFICULT	RIGHT	PROMPT ENOUGH	Y	Y
N	EASY	RIGHT	PROMPT ENOUGH	N	Y
Y	DIFFICULT	TOO MANY			
Y	EASY	RIGHT	PROMPT ENOUGH	Y	Y
Y	EASY	RIGHT			
Y	EASY	RIGHT	PROMPT ENOUGH	Y	Y
Y	EASY	RIGHT	PROMPT ENOUGH	Y	Y
Y	EASY	RIGHT	PROMPT ENOUGH	Y	N
Y	EASY	RIGHT	PROMPT ENOUGH	n	y
Y	EASY	RIGHT	PROMPT ENOUGH	Y	N
Y	EASY	RIGHT	TOO LONG	Y	N
Y	EASY	TOO MANY	PROMPT ENOUGH	Y	Y
Y	DIFFICULT	TOO MANY	TOO LONG	Y	Y
Y	DIFFICULT	RIGHT	PROMPT ENOUGH	Y	N
Y	EASY	RIGHT	PROMPT ENOUGH	N	Y
Y	EASY	RIGHT	PROMPT ENOUGH	Y	Y
Y	EASY	RIGHT	PROMPT ENOUGH	Y	Y
N	DIFFICULT	TOO MANY	PROMPT ENOUGH	Y	N
Y	EASY	TOO MANY	TOO LONG	Y	Y
Y	DIFFICULT	RIGHT	TOO LONG	N	N
Y	DIFFICULT	TOO LITTLE	PROMPT ENOUGH	Y	Y
N	EASY	TOO LITTLE	TOO LONG	Y	N
Y	EASY	TOO MANY	TOO LONG	N	Y
N	EASY	RIGHT	TOO LONG	N	Y
Y	EASY	RIGHT		N	N
Y	EASY	RIGHT	PROMPT ENOUGH		Y
Y	DIFFICULT	TOO LITTLE	TOO LONG	N	Y
Y	EASY	TOO MANY	PROMPT ENOUGH	Y	Y
Y	EASY	TOO MANY	PROMPT ENOUGH	Y	N
Y	EASY	TOO MANY	PROMPT ENOUGH	Y	Y
Y	EASY	TOO LITTLE	PROMPT ENOUGH	N	N
Y	DIFFICULT	TOO MANY	TOO LONG		N
Y	EASY	RIGHT	PROMPT ENOUGH	Y	N
Y	EASY	RIGHT		Y	Y
N	DIFFICULT	TOO LITTLE	PROMPT ENOUGH	N	N
Y	EASY	TOO LITTLE	PROMPT ENOUGH	N	Y

Y	EASY	TOO MANY	PROMPT ENOUGH	Y	Y
Y	EASY	RIGHT	PROMPT ENOUGH	N	Y
Y	EASY	RIGHT	PROMPT ENOUGH	Y	Y
Y	EASY	RIGHT	PROMPT ENOUGH	Y	Y
Y	EASY	RIGHT	TOO LONG	Y	Y
N	EASY	TOO MANY	PROMPT ENOUGH	Y	Y
N	EASY	TOO MANY	PROMPT ENOUGH	Y	Y
Y	EASY	RIGHT	PROMPT ENOUGH	Y	Y
Y	EASY		PROMPT ENOUGH	Y	Y

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Assessing the information: the voice

Would_more_time_make_a_difference	Hear_voice_clearly	Comfortable_with_type_of_voice	Use_service_with_this_voice_in_future	Prefer_service_in_another_language	What_other_language
Y	Y	N	N	Y	SEPEDI
N	N	N	N	Y	SESOTHO
N	N	N	N	N	SEPEDI
Y	N	N	Y	Y	SEPEDI
	N	N	N	Y	AFRIKAANS
Y	N	N	N	Y	SEPEDI
Y	N	Y	Y	Y	N. SOTHO
Y	Y	Y	N	Y	
Y	N	Y	N	Y	N. SOTHO
Y	Y	Y	Y	Y	
Y	N	N	N		SEPEDI
	N	Y	N	N	
Y	Y		N	Y	SEPEDI/ZULU
N	N	N	N	Y	SEPEDI
Y	N	N	Y	Y	SEPEDI
Y	N	N	N	N	
Y	Y	Y	N	Y	SEPEDI
	N	N	N		
Y	N	N	N	Y	N. SOTHO
Y	Y	N	N	N	
Y	N	Y	Y	N	SEPEDI
Y	N	N		Y	SEPEDI
N	N	N	N	N	N. SOTHO
N	N	N	N	Y	SEPEDI
	N	N	N	N	
	N	N	N		
Y	N	N	N	Y	SEPEDI
Y	N	N	N	Y	SEPEDI
Y	N	N	N	Y	SEPEDI / ISINDEBELE
y	N	N	N	Y	XHOSA / PEDI / ZULU

Y	N	N	N	Y	ISINDEBELE / SWATI
Y	N	N	N	Y	
N	N	N	N	Y	SOTHO
Y	N	N	N	Y	ENGLISH
Y	N	N	N	Y	NDEBELE
Y	N	N	N	N	
Y	Y	Y	Y	N	
Y	N	N	N	N	
Y	Y	Y	Y	N	SEPEDI
Y	N	N	Y	Y	SEPEDI
Y	Y	Y	Y	Y	SEPEDI
Y	N	N	N	Y	N. SOTHO
Y	N	N	N	Y	SEPEDI
Y	N	N	N	Y	TSWANA
N	N	N	Y	Y	SEPEDI
N	N	N	N	N	
Y	N	N	N	Y	XHOSA
Y	Y	Y	Y	Y	
	N	N	N	Y	SEPEDI
Y	N	N	N	N	N. SOTHO
Y	N	N	N	Y	SEPEDI
Y	N	N	N	Y	XHOSA
Y	N	N		Y	ZULU
Y	N	N	Y	N	
Y	N	N	N		
Y	Y	Y	Y	Y	AFRIKAANS
Y	Y	N	N	Y	SEPEDI
N	N	N	N	Y	SEPEDI
Y	N	N	N	N	
Y	N	N	N	N	
N	N	N	N	Y	N. SOTHO
Y	Y	Y	N	Y	DON'T CARE
Y	Y	Y	Y	Y	SEPEDI
Y	N	N	N	Y	XHOSA
Y	Y	N	Y	Y	ENGLISH
Y	Y	N	Y	Y	SEPEDI

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Synthesised_voice_understandable	Prefer_male_or_female_voice	Prefer_young_or_adult_voice
UNDERSTOOD A BIT	FEMALE	YOUNG
UNDERSTOOD A BIT	FEMALE	YOUNG
IMPOSSIBLE TO UNDERSTAND	FEMALE	YOUNG
UNDERSTOOD MOST OF THE TIME	FEMALE	YOUNG
UNDERSTOOD A BIT	FEMALE	ADULT
UNDERSTOOD A BIT	FEMALE	
UNDERSTOOD A BIT	FEMALE	YOUNG
UNDERSTOOD MOST OF THE TIME	FEMALE	YOUNG

UNDERSTOOD A BIT	FEMALE	YOUNG
UNDERSTOOD A BIT	FEMALE	YOUNG
UNDERSTOOD A BIT	FEMALE	YOUNG
	DON'T CARE	DON'T CARE
IMPOSSIBLE TO UNDERSTAND	MALE	YOUNG
IMPOSSIBLE TO UNDERSTAND	FEMALE	YOUNG
UNDERSTOOD A BIT	MALE	
UNDERSTOOD A BIT	FEMALE	YOUNG
UNDERSTOOD A BIT	FEMALE	YOUNG
	FEMALE	YOUNG
UNDERSTOOD A BIT	FEMALE	YOUNG
	FEMALE	YOUNG
UNDERSTOOD A BIT	FEMALE	YOUNG
UNDERSTOOD MOST OF THE TIME	FEMALE	YOUNG
IMPOSSIBLE TO UNDERSTAND	FEMALE	ADULT
UNDERSTOOD A BIT	FEMALE	ADULT
IMPOSSIBLE TO UNDERSTAND	DON'T CARE	DON'T CARE
	DON'T CARE	DON'T CARE
UNDERSTOOD A BIT	DON'T CARE	DON'T CARE
UNDERSTOOD A BIT	DON'T CARE	ADULT
UNDERSTOOD A BIT	DON'T CARE	DON'T CARE
UNDERSTOOD A BIT	FEMALE	ADULT
UNDERSTOOD A BIT	DON'T CARE	DON'T CARE
UNDERSTOOD A BIT	DON'T CARE	DON'T CARE
UNDERSTOOD MOST OF THE TIME	DON'T CARE	DON'T CARE
UNDERSTOOD A BIT	FEMALE	DON'T CARE
UNDERSTOOD A BIT	FEMALE	DON'T CARE
UNDERSTOOD MOST OF THE TIME	DON'T CARE	DON'T CARE
UNDERSTOOD MOST OF THE TIME	DON'T CARE	DON'T CARE
UNDERSTOOD A BIT	FEMALE	DON'T CARE
NO PROBLEM UNDERSTANDING	DON'T CARE	YOUNG
UNDERSTOOD A BIT	FEMALE	YOUNG
IMPOSSIBLE TO UNDERSTAND / UNDERSTOOD MOST OF THE TIME	DON'T CARE	DON'T CARE
UNDERSTOOD A BIT	FEMALE	YOUNG
UNDERSTOOD A BIT / NO PROBLEM UNDERSTANDING	FEMALE	YOUNG
UNDERSTOOD A BIT	FEMALE	YOUNG
	MALE	ADULT
UNDERSTOOD A BIT	MALE	YOUNG
UNDERSTOOD MOST OF THE TIME		
UNDERSTOOD MOST OF THE TIME	DON'T CARE	ADULT
UNDERSTOOD A BIT	FEMALE	ADULT
UNDERSTOOD A BIT	FEMALE	ADULT
UNDERSTOOD A BIT	FEMALE	ADULT
UNDERSTOOD A BIT	DON'T CARE	DON'T CARE
NO PROBLEM UNDERSTANDING	FEMALE	YOUNG
NO PROBLEM UNDERSTANDING	DON'T CARE	DON'T CARE
UNDERSTOOD MOST OF THE TIME		
NO PROBLEM UNDERSTANDING	DON'T CARE	DON'T CARE
UNDERSTOOD A BIT	DON'T CARE	DON'T CARE
UNDERSTOOD MOST OF THE TIME	DON'T CARE	DON'T CARE

UNDERSTOOD A BIT	FEMALE	YOUNG
UNDERSTOOD A BIT	FEMALE	DON'T CARE
UNDERSTOOD MOST OF THE TIME	FEMALE	YOUNG
UNDERSTOOD A BIT	FEMALE	ADULT
UNDERSTOOD MOST OF THE TIME	DON'T CARE	YOUNG
UNDERSTOOD MOST OF THE TIME	DON'T CARE	DON'T CARE
	DON'T CARE	YOUNG
UNDERSTOOD A BIT	MALE	YOUNG