Analyzing the Impact of Mobile Technology on Mobile-Centric Youth in South Africa

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A thesis submitted in fulfillment
of the requirements for the degree of
MASTER OF SCIENCE
at the
UNIVERSITY OF CAPE TOWN

January 2012

Abstract

Our research documents the successful development of a system for stakeholders in the low-income urban environment, to facilitate the dissemination of information through enhanced mobile technology.

The research project took place in Khayelitsha, Cape Town. Before beginning the formal study we entered the environment to better understand mobile technology practices amongst low-income urban teenagers and how we could supplement these practices by providing a means of media dissemination to the relevant stakeholders in the environment. We allied ourselves with two local stakeholders, the Ikamva Youth NGO and the Nazeema Isaacs local library staff. These organizations would provide us with access to low-income urban teenagers, and they were interested in adopting alternative technology to disseminate media to these youth.

For our analysis phase, we carried out a survey of 46 teenagers, a formal interview session with twenty teenagers as well as informal interviews with the Ikamva Youth and Librarian staff. We also introduced new technology (The Big Board situated display system) into the environment, in order to better understand the potential interaction of the technology with the demographic and to devise a more effective intervention. From the results of the analysis phase we concluded that using a situated display, the Big Board, would be an appropriate means to disseminate content to the youth. Both sets of stakeholders agreed to use the Big Board to distribute their content to the youth in the community. We used user centered design techniques to devise a content management system to empower the stakeholders to accomplish this.

We then created and evaluated prototypes of a prospective Big Board Content Management System (BBCMS). Each prototype incorporated more refined functionality. We monitored the usage of the BBCMS for over a five-month period in two phases. We varied the control each stakeholder group had over the Board, and as we increased the level of empowerment with regard to the screen allocation, Big Board usage increased. The BBCMS could be successfully used to disseminate media to the youth.

Our study confirmed the importance of contextualized content. Empowering local stakeholders to create their own content was more beneficial to the community than having us, as outsiders, with not as much insight into the community, control the display content.

Acknowledgements

First and foremost I would like to thank my supervisor, Gary Marsden, whose knowledge and guidance was paramount in completing this project. I really could not have asked for a better supervisor, and will forever be grateful for everything you have done for me over the last two years.

I would also like to thank Marion Walton and Silke Hassreiter for all the help in creating the project as well as all your support and insights during the ethnography and requirements gathering of the project. You both were an inspiration in the field, and made the whole process both fruitful and enjoyable.

This work was supported by grants from the National Research Foundation of South Africa and Nokia Research Kenya.

To all the Ikamva Youth staff, Joy, Leisel, Nombu, Luyanda, Pinky, Winile, Zukile, Sinathemba, Neo, Thobela, Funeka, Phillip, Lorna, Unathi and Sipho as well as all the other volunteer tutors. Thank you all! Everything Ikamva Youth stands for is so amazing, and I thank you for letting me be apart of it. I will always remember how positively you dealt with adversity and I will cherish my time with you all. As you guys always say: 'once an Ikamvanite, always an Ikamvanite!'

To all the librarians, Simphiwe, Nomangesi, Zingisa, Nomandla, Lunga and Simphiwe, your insights were so valuable to my work. Thank you all for being so enthusiastic with the project. Also thank you for teaching me about life in the townships. I will forever admire your attitude to improving literacy levels with the youth in Khayelitsha.

To Mphumzi Klaas, you were taken far to early from us. You are a true hero and though you are gone you will never be forgotten.

To all my ICT4D lab mates, Mike, Raymond, Chris, Shikoh, Ilda, Graeme, Thomas, Xolu, Eddie, Pierre, Grace, Ritchie, Tsabi, Bonnie, Anja, Muthoni, Christine, Ntwa and of course…. Fritz! You guys made my two years really enjoyable. Keep up the good work!

To my Grandfather, Dwight Allen, thank you so much for proof reading my thesis, correcting my terrible grammar and providing me with feedback during the early writing phases of the thesis.

To all my friends and family all across the globe, thank you so much for being in my life. If I begin to start mentioning all these names I will go over the acceptable limit for this thesis. But you all know who you are! Thanks for everything past, present and future.

Thanks to my parents, Dana and Flora and my sister Yvette you guys are the best and everything I have accomplished in my life is thanks to you ☺

Finally, to all the Khayelitsha youth, this thesis is dedicated to you. Your involvement with me, Ikamva and the library tell me that the future is looking bright for South Africa. Never give up, and anything is possible!

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1. Introduction

Media sharing amongst teenagers is a well-observed process all across the world [Mizuko, *et al.* 2008]. This research project continues on this path, and in particular, analyzes media sharing and mobile technology usage of low-income African youth in a South African township.

The current mobile technology practices with urban teenagers living in South African Townships are dictated by a lack of funding for airtime, lack of access to desktop devices, power issues and a high crime rate in the area [Donner *et al*., 2009][Kreutzer, 2009][Walton *et al.,* 2009]. These shortcomings, however, do not deter mobile technology usage amongst these teens, but rather create a new set of practices that are different from how people living in first world conditions make use of mobile technology. The term "mobile-centric" is often attributed to these teenagers' living in low-income, urban areas, as a cellular phone is the primary computational device in the majority of these individuals' lives [Kreutzer, 2009]. Our research uncovers some of these practices in order to better understand the demographic, thus being able to create more appropriate technology.

By mobile technology, we mean usage of cellular phones to perform a variety of functions, such as calling, SMSing, media sharing, media consumption and storage. Media retrieval and sharing is practiced in the form of short bursts of Internet activity for media retrieval and Bluetooth networking amongst friends and family for sharing [Donner *et al*., 2009]. Two reasons for this are that Bluetooth sharing is free of charge, and is platform independent.

This research project is about reaching out to low-income urban teenagers and supporting them with low-cost information retrieval. We provide a means of media dissemination, using a situated display system that is free of charge with Bluetooth. We ally ourselves with NGOs and other institutions that work with teenagers in the area that have already studied what media would be most suited to the youth audience, and thus we seek to empower them to provide that media content.

1.1 The Research Location

Our research will be taking place in Khayelitsha, a township located next to Cape Town, South Africa. Khayelitsha is the largest single township in South Africa, and boasts a young population. It has been stated by a population register update to the national census that two-thirds of the population in Khayelitsha is younger than the age of 30 [South African Population Sub-Directorate, 2007].

Figure 1 Khayelitsha welcome sign

We chose this area to be our research site as there is easy access to low-income teenagers that are mobile centric. These teenagers have access to technology, yet have financial constraints that hinder them from making use of this technology [Kreutzer, 2009].

We have identified three major groups of stakeholders in the area, which we will work with. The first are the Ikamva youth NGO members, the second are Nazeema Isaacs library staff and finally the youth themselves.

1.2 The Environment Stakeholders

1.2.1 The Ikamva Youth NGO

We have aligned ourselves with an NGO named Ikamva youth (see Figure 2) in order to gain access to teens engaged in media sharing activities. Ikamva Youth is a South African non-profit organization focussed on the empowerment of youth through education, e-literacy training and career guidance. They provide us with access to teenagers living in Khayelitsha.

Figure 2 Ikamva Youth Logo

Ikamva Youth is interested in providing the teenagers various forms of media. They are interested in using some form of technology as an educational tool to distribute information to the learners, as long as it is accesible and at no additional cost to the learners.

1.2.2 The Nazeema Isaacs Library

A second stakeholder is the library staff of the Nazeema Isaacs Public Library where Ikamva Youth holds all of its activities. We chose to work with the library as they serve the needs of the youth in the area by providing study materials and a central location for groups to work.

Beyond just lending books, the library provides workspace for students where they come after school to work on projects and/or to study for exams. According to the library staff, around 90% of the people visiting the library are students that go to the three schools located near the library. The librarians are often questioned about a specific topic, which is usually the students' project for the week. For example, one week was 'drug awareness' week and the library staff described how students, from different schools and grades, were asking to obtain resources about this topic for their projects. The topics covered change on a weekly basis. One problem encountered by the library staff is that students borrow books and tear out pictures from the books to use in their projects. Another problem is the lack of computer infrastructure present in the library, and queues form daily to make use of these services.

The librarians claim that, "Only non-fiction books are read by the students and there is no interest in reading for the sake of reading". Non-fiction books are popular according to the librarians, but only if they coincide with the students' schoolwork. These books are often in short supply and there are waiting lists to obtain them.

According to the library staff there could be as many as 1000 visitors to the library in a day during school term times. The library is not the typical quiet study zone library, but rather a community centre where the students can do their work in groups, or alone. As books are currently being vandalized, there is a need to provide digital media for the students to create a sustainable learning centre.

1.2.3 The Teenagers and the greater community

There are 132 learners enrolled this year at Ikamva Youth. They range from grade 9 (around 15 years old) to grade 12 (around 18 years old). The application process is first-come first-served, with preference going to learners currently enrolled from previous years. Ikamva Youth claim to have around five hundred applicants each year but can only take a limited number as a result of lack of resources and space. Our observation and interview data confirm that teenagers are media consumers and creators and use their phones to play music, take pictures, instant message with friends and share media. These teenagers report that they create and download media more than their parents and older guardians, and that they download, create and share data amongst themselves.

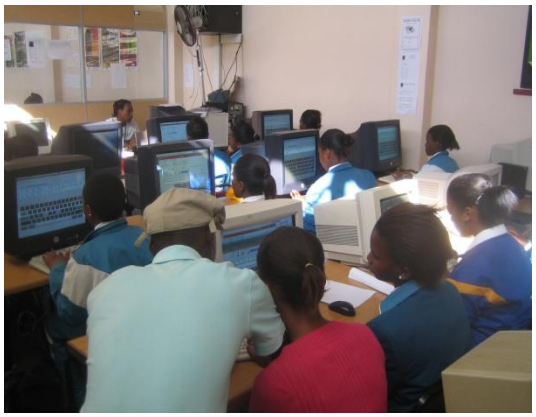


Figure 3 Some of the Ikamva students In a Computer literacy class

1.2.4 Cooperation with other researchers

The research environment can cater for a wide scope of research projects. We will be working together with another group of researchers who are focused on the possibilities of video editing processes on cell phones in a low-income environment. This collaboration will occur during the initial ethnographic observation period. We will combine our findings as we share the same users. Once this period is over we will focus on developing a system and answering our research questions.

1.3 Finding out the Problem

As the initial project goal is to investigate mobile technology usage as well as create a means to facilitate media dissemination, our objective is to establish a relationship with each of the stakeholders, in order to understand their unique needs and explore possible solutions to mobile digital media access.

Our research will require multiple separate interventions to ascertain relevant information pertaining to mobile phone usage amongst teenagers in Khayelitsha. Specifically, we will observe the environment, administer a survey and conduct interviews on their phone usage and based on our findings, propose a system to supplement media sharing.

1.4 Problem Statement: The Desire to use Mobile Technology for Information

Despite the financial limitations for these teenagers, there is a desire for obtaining media for consumption on one's phone. Various studies, as well as our initial informal observations, have confirmed this [Donner *et al.,* 2009][Kreutzer, 2009]. These media include music, pictures, games and information. Cell phones have become the main portal to the Internet for these low-income urban teenagers [Walton *et al.,* 2009]. When given the opportunity (by saving up allowances for airtime), teenagers search for new information and download new songs and/or pictures. The cost of downloading new material is a barrier to these youth and a cost-free or cost-reduced solution for the end user would dramatically increase media sharing. One method to supplement media dissemination is to use a situated

display as a media portal. The situated display would interact with a user's mobile phone and provide a means to obtain content.

1.5 Proposed solution: Using the Big Board System

The Big Board system [Maunder *et al.,* 2007] is a situated display service that makes use of Bluetooth to transfer data to and from the display free of charge. The Big Board system was developed in Khayelitsha, South Africa, and would be an ideal system to install in the environment. The system interacts with mobile technology free of charge to the end user. In addition the Big Board system does not require any software to be downloaded onto the user's cell phone, thus most devices with a camera and Bluetooth capabilities can make use of the system.

The system functions by having separate windows for each media pack. For example there could be a picture of Nelson Mandela representing a file containing images and information about his life. An individual would then take a picture of this file and send the image to the Board via a Bluetooth connection. The system recognizes the image sent and proceeds to send back all related files to the phone that sent the original picture. Users can also push their own data onto the board, for example local music artists might want to upload some of their songs for public exposure. Any media items sent from users' phones are placed in the corresponding file and are available to the public at no cost to them.

Figure 4 Summary of the Big Board System

1.6 Some Challenges Associated with the Big Board System as a Solution

One challenge when deploying the Big Board system is to identify the actual content that would be useful/desirable by the youth in the area. Although the technology might be in place, without the right content, it would be rendered almost useless. Churchill *et al.* comment on the value of contextualized content, saying that one of

the reasons for the successful deployment of their situated display system was the fact that users were given control over the content that was shared [Churchill *et al.,* 2003]. We could perform in-depth studies in order to understand what the youth may want/need, or we could empower the relevant stakeholders to provide content for the community. Empowering the various stakeholders would provide a more sustainable solution, thus we will explore this option as part of our research.

The Big Board system makes use of XML files to structure the media for download. An XML (extensible markup language) file is used for presenting data, describing data structure and supporting the creation of data viewing and manipulation [Watkins *et al.*, 2003]. The system can specify a set of objects, elements and their attributes in an XML file. The Big Board system makes use of two types of XML files. The first being the startup XML file that specifies information about all the media packs, containing information such as media pack title, media pack ID, the folder location, the spot on the board and the cover image. The second is a media pack XML file, where each individual media pack has its own XML file attributed to it. Information in this media pack includes the number of items within this media pack and the names and paths of these items.

Currently, in order to place content onto the display, one undergoes a relatively tedious task of generating key files for images, creating XML files for file structure as well as finding the actual content. It would be unrealistic to expect any of the stakeholders to have the necessary skills for these operations, as they require an understanding of XML file structures and image key generation.

Furthermore, the Big Board system can only be updated via local interaction. With multiple users, this could pose a challenge as some of the NGO members or librarians might not have ready access to the board itself. Some of the Ikamva Youth staff members are not based in Khayelitsha and would have to travel to the research site in order to update the board. Ikamva Youth often organize trips and excursions for the Youth and a means to update the board remotely could cater for stakeholders that might want to update the board when away.

Thus a system that generates XML files without hand-editing would have great value. Also, a remote solution with some form of security to allow only the designated stakeholders power over the content generation would cater for the various stakeholders in the environment who might not have ready access to the display itself.

1.7 Research Questions

During the course of our research we will be investigating the following questions:

- *How is mobile technology currently being used for media creation and sharing?*
  We want to collect baseline data to understand where the strengths and deficiencies lie within the environment's stakeholders. This will inform our

design and capture the existing situation, so we can see if our intervention has made a difference.

- *How will the community interact with a situated display?*

We will introduce a situated display into the environment to facilitate media sharing amongst the youth. We will use the technology probe method, and the results we gather will determine how we modify the situated display to cater for the specific user requirements within the community.

- *Is it possible to create a content management system to serve multiple user groups in the environment?*

We will be working with multiple user groups who might have differing ideas on how to create a system. We would thus be interested to know if it is possible to create a system given the dynamics present.

- *If the previous research question is true, what is the impact of empowering the stakeholders to create content?*

We will be observing how the community utilize the technology we introduce into the environment. We will modify the situated display to see how much power should be given to the stakeholders over a situated display content management system. We will also be interested in discovering what media the stakeholders create, what media the community consume, how the stakeholders make use of the system and what patterns emerge as a result of the system being deployed.

1.8 Evaluation Criterion

Our goal will be to work with the various stakeholders to create a means to facilitate media transfer for the youth living in the area. To know if we have accomplished this, we have set the following criteria in consultation with the stakeholders that would use a potential system:

- The users endorse the features of a prototyped system.
- The users are able to upload media for the community.
- The community downloads this media with sufficient frequency, identified by the stakeholders, to validate its acceptance.

1.9 Document Structure

This thesis is organized into eight chapters.

Chapter one, this chapter, provides the background and context of the study and proposes use of the Big Board system as one likely solution to media access by cost-constrained teen mobile technology users.

Chapter two discusses the current mobile technology context amongst low-income youth. We also discuss how situated displays, specifically the Big Board system, have been used before.

Chapter three outlines the methodologies we use for the duration of the project.

Chapter four highlights the ethnographic observations of the environment. We also investigate the user interactions with a technology probe of deploying cell phones and a situated display, and summarize findings gathered from formal interviews and a survey.

Chapter five outlines the creation and deployment of a low fidelity prototype and a high fidelity prototype of a potential system, and the reactions observed by the stakeholders using both prototypes.

Chapter six outlines the design, creation and evaluation of a system that different user groups can use to remotely upload content onto the situated display.

Chapter seven outlines a longitudinal study where the users make use of our system to create media packs, and our observations as a result of varying the level of empowerment over the Big Board System.

Chapter eight discusses overall findings for our study and answers our research questions. Finally we outline possible future issues for investigation and conclude the project.

2. Background

2.1 Introduction:

The previous chapter dealt with framing the project and introducing the research questions. To answer the research questions we will analyze the current situation in South Africa by focusing on mobile technology usage amongst the youth. According to Walton *et al.* mobile technology is a primary technology in Africa and the term 'mobile centric' is used to describe low-income urban teenagers, as their main technology access is mobile phones [Kreutzer *et al.,* 2009][Walton *et al.,* 2009][Donner *et al.,* 2009]. This chapter examines the prevalence of mobile technology in our selected research environment, Khayelitsha in Cape Town. We review other research projects that have studied the deployment of situated displays. We will review the current Big Board System [Maunder *et al.,* 2007] by outlining how it functions, how it was deployed and how it was used by other projects. We then introduce the Big Board as one possible solution to disseminate content via mobile media into the environment with enhanced features to cater for the stakeholders outlined in the introduction chapter. We will use the Big Board to empower our stakeholders to create content.

Our literature review will include academic papers, surveys, books, and government and industry statistical reports.

2.2 Mobile Technology Prevalence in South Africa Focused on the Youth

We have chosen to research mobile technology as the findings of previous studies, such as the M4Lit project [Walton, 2010] have shown that mobile technology is more prevalent than either laptops or desktop machines.

One of the goals of the M4Lit project [Walton, 2010] was to highlight the prevalence of mobile technology amongst the youth in Cape Town. The M4Lit project investigated literacy levels of township teenagers. The project developed a mobile platform to allow youth to access literature via their mobile devices. The project argued that traditional findings of literacy did not factor in mobile literacy levels and that mobile phones created new uses and practices for literacy, mainly due to the ubiquitous use of text messaging [Thurlow *et al.*, 2009].

The M4Lit study also highlighted how in the urban townships of South Africa there was a growing number of youth who accessed digital media and the Internet via their mobile phones [Kreutzer *et al.*, 2009][Donner *et al.*, 2009].

The methodology for the M4lit project [Kreutzer *et al.*, 2009] included a number of surveys and interviews administered to a group of 61 teenagers living in the townships. The questions surrounded mobile phone use and the focus was on literacy. One question asked about writing activity on the day before the survey. Of the 61 teenagers 56% said they did not write anything, 41% used a mobile device by using MXIT (MXIT is an instant messaging mobile chat system) or writing an SMS,

and less than 3% reported other writing activities such as essay writing, updating a diary, poetry, and school projects. This information can be interpreted as identifying the mobile phone as being used extensively in these youth's lives. Similarly they were asked about their reading activity on the previous day; 56% reported not having read anything, 36% reported reading something on their phone (SMS or MXIT message), 16% reported reading a magazine with scattered mentions of other activities including school work and reading novels.

The participants were also asked about their technology usage of mobile phones, TV, Radio, and desktop and laptop computer. The results are shown in Figure 5.

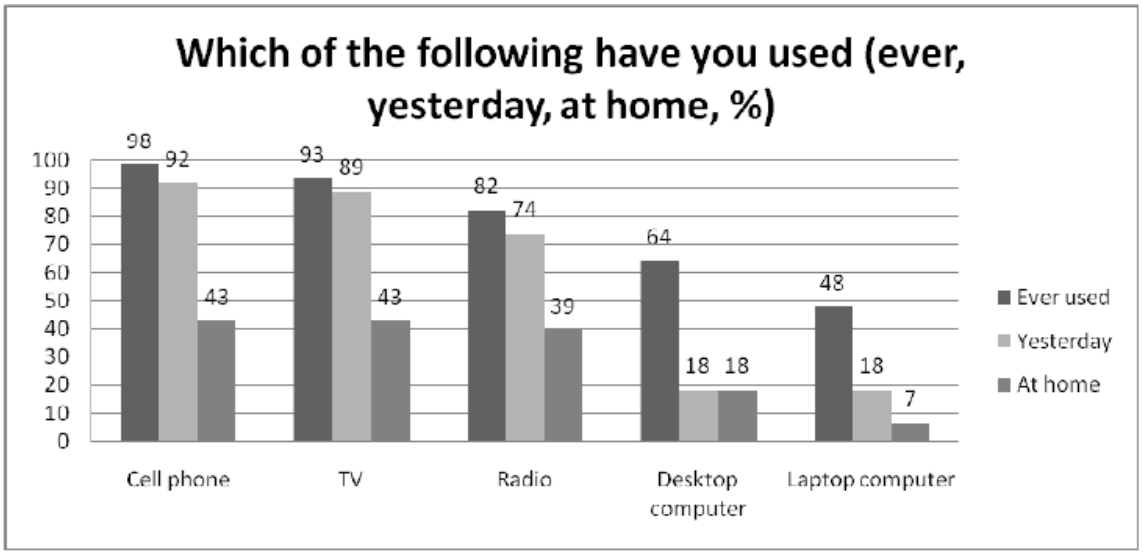


Figure 5 Graph showing technology experiences Graph [Walton, 2010]

When analyzing Figure 5 we can see that almost all (98%) of the participants have used a cell phone at some stage of their lives and that nearly all of those (a total of 92%) had done so the previous day. Fewer than 29% had access to either a desktop or laptop computer. In another study done by Kreutzer [Kreutzer *et al.*, 2009] during October 2009, a larger sample size of 441 grade 11 students in low-income areas in Cape found that all those students had used a cell phone at some stage in their life with 96% having access the previous day with their own phone. Thus we can see the importance of the mobile phone amongst this demographic.

Walton found that mobile phone usage averaged 6.2 hours a day, including activities such as MXIT, games, calling, SMS, and music listening. This was higher than their reported TV usage of an estimated mean of 4.7 hours. [Walton, 2010]

Web usage was also found to be more prevalent on a phone than on a desktop machine according to the Walton survey [Walton, 2010]. It was reported that 60% of the participants had at least one opportunity to use the Internet via their phones on the previous day. This is contrasted with a 45% usage with a desktop machine. The most common purpose of the Web sessions with their phones was stated as

being for 'fun' (36%), downloading songs and ringtones (33%), accessing news (26%), email (26%) and visiting Facebook (25%).

Peer-to-peer sharing of media was also investigated, where 62% of the participants reported to have shared media via mobile phone to other mobile phones at some stage and 41% stating they had transferred files the previous day.

One of the main reasons teens are accessing this mobile Internet is to use instant messaging services such as MXIT. These chat programs provide an inexpensive method of communication as one only has to pay the cost of the data which is negligible when compared to that of a regular SMS. According to a company representative, MXIT has 15 million registered users, 13 million of whom are South African, and 49% of these are between 19-25. Chigona *et al*. [Chigona *et al.*, 2009] reported that despite the media panic of the harmful effects of MXIT (for example chat room stalking) MXIT is a useful tool for strengthening social bonds without the need to pay network costs. Other researchers have thus recognized the possibilities MXIT has and have developed additional options to take advantage of this form of communication. These projects include the facilitation of cheaper and more accessible messaging for development communication [Chigona *et al.*, 2009] and m-learning [Ford *et al.*, 2007] where a form of tutoring via MXIT that includes question and answer sessions occur.

These MXIT statistics contrast other findings dealing with traditional literacy. A national survey found that, on average, South African children have access to about 32 books at home, but that two-thirds report having no books or less than five books at home [Moloi *et al.*, 2005].

According to the ITU [ITU, 2010], in 2010 there were 330 million mobile phone subscriptions in Africa. There are only 13 million fixed phone lines. The ITU also reported that South African mobile phone use reached 92.67 mobile phone subscriptions per 100 people in 2009 [ITU, 2009].

Mobile communications costs in South Africa are relatively high when compared to other countries. In South Africa the average cost of calling a mobile phone is R1.90 per minute, data bundles are R1 per megabyte and the cost of one SMS is 50 to 80 cents depending on the time of day, i.e. peak and off-peak (Average of 3 South African mobile providers[MTN, 2011][Vodacom, 2011] [CellC, 2011].)

These studies confirm that mobile technology is used extensively in almost all young persons' day-to-day affairs in a low-income urban setting. Projects that explore alternative uses or develops new infrastructure for mobile technology could prove to be of benefit to these youth. Exploring alternatives for enhancing access to situated displays, as a means of providing a low cost media access portal for low income teenagers has high potential to facilitate media dissemination as desktop and laptop computer access is not common.

2.2.1 How Cost Affects Behaviour

Media services, such as cloud media storage, that could be used for media dissemination amongst teenagers are not feasibly accessible by youth in a low-income urban environment given the cost to use these resources. These youth overcome financial limitations by making use of other avenues for information transfer that is free of charge, such as Bluetooth file transfer [Walton, 2010]. Thus any technology usage after deployment in this environment would be affected by the overhead costs, if these costs were to be passed onto the end user (the youth in the community). Hence a potential system should be made available to the youth at little or no cost to them.

2.3 Situated Displays and their Effect on the Community

A situated display is any display that is left in a public setting, that displays content accessible by all who see it. Systems can allow users to interact with the display in the form of content creation or retrieval onto a mobile device e.g. the Big Board project [Maunder *et al.*, 2007], while other systems provide for public display only e.g. the City Wall project which allows users to view and manipulate pictures on the display only [Peltonen *et al.*, 2008]. We feel using a situated display is an important tool to enhance information dissemination to low-income teenagers.

According to O'Hara *et al.*, situated displays are a 'ubiquitous part of our environment and visual culture' [O'Hara *et al.*, 2003]. The authors relate the use of situated displays to the next stage of human visual communication, and compare them to cave paintings, framed photographs, posters, billboards and road signs. The authors state that as a result of the advancement of technology these displays have become more sophisticated in nature and the capabilities of information display have become more abundant. Other projects that make use of situated displays [Heath *et al.*, 2000][Bellotti *et al.*, 2000] have highlighted the importance of involving end users in the creation of displays and more importantly honoring their views on the type of content that is displayed.

One challenge that has arisen when deploying a situated display is to develop a protocol for deciding what information is presented on the screen. Projects such as the Plasma Poster by Churchill *et al.* [Churchill *et al.*, 2003] make use of a timed model where information on a screen is cycled periodically. A queue system was also implemented in the system developed by Cheverest *et al.*, for the Hermes photo display [Cheverest *et al.*, 2005], where new content displaces previous content and only the most up to date information is present. The conclusions of these projects was that through discussion with the users involved, a method of information display could be implemented best serving the users at hand.

Another issue is identifying who should have control over the display. Projects can vary over the degree to which the users have control over the situated display. For example Churchill *et al.* [Churchill *et al.*, 2003] provided a group of users with content creation access over their situated display but employed the use of a

gatekeeper to mediate the content. They found that there was a fine line between users as content creators and content consumers. They concluded that as one increased the level of ownership over a display, there was an increased responsibility over content creation.

What we can learn from these projects is that consultation on how to display any information amongst the various stakeholders is important in order to ascertain the optimal information dissemination platform for target users. The level of control one gives to the stakeholders should also be considered; with increased control comes increased responsibility. Experiments will have to be done to see what sort of mediation is required when empowering user groups to generate content for a display.

Once content is created, situated displays can be used to disseminate information previously available only through desktop architecture. Given the fact that mobile technology is prevalent in a low income African context, it would be useful to look into a means to use a situated display to disseminate information to mobile devices. One such system is the Big Board system [Maunder *et al.*, 2007]. Big Board was created to be a media distribution tool and was prototyped and deployed in a similar low-income urban setting and was selected as an input to the research environment.

2.4 Big Board, Bluetooth and the Way Forward:

As this project has been identified as an extension of the Big Board system developed by Maunder *et al*. [Maunder *et al.*, 2007], we will analyze the system and the impact the research had in the environment in which the Big Board was deployed. The Big Board project was proposed as a means of disseminating free information (in the form of media packs) in an area. The architecture of the system combines large public displays interacting with a user's mobile phone via a Bluetooth connection. Bluetooth is a wireless communication protocol that enables the transmission of data over short distances (roughly 10 metres). Bluetooth is free to use (i.e. no network charges apply to transmit data) and thus it has emerged amongst mobile phone users as a standard means for sharing media [Bluetooth Sig, 2010]. Many modern mobile devices currently have Bluetooth as a standard feature and file transfers can occur with the device without the need to install additional software.

2.4.1 The Big Board System Overview

The Big Board system consists of the following parts:

1. A large display screen (To attract attention as well as provide a big enough image to capture)
2. A server machine that runs the actual system.
3. A Bluetooth access point in the form of a Bluetooth dongle or built in device to provide the server machine the ability to receive files via Bluetooth.

4. A client device, specifically a mobile phone with a camera, Bluetooth file transfer capabilities, and sufficient memory space for any downloaded media packs.

The system is deployed in a high traffic area, to attract the attention of potential users. The screen displays media packs (typically eight at a time) that are either created by an administrator or by the public. A media pack is a collection of images, audio clips, text files, video clips and/or contact information. The content creator should plan what a media pack will contain before uploading the data, taking into account mobile technology limitations such as phone memory and screen size.

A user can interact with the Big Board in two ways:

1. Downloading content already present on the board.
2. Uploading content from their own mobile device to the board for sharing amongst the community.

2.4.2 Downloading Content from the Big Board

There are eight media packs being displayed at a given time on the display. The user first identifies a media pack he/she is interested in. He/she then proceeds to take a picture using his/her mobile device. For example there could be a picture of Table Mountain representing a file containing images and information about the landmark. An individual would then take a picture of this media pack and send the image to the server machine via a Bluetooth connection. The system receives the image that was sent and performs an image recognition algorithm to determine which picture the user took. If there is a match, the system proceeds to send back all the files associated with the media pack to the phone that sent the original picture one item at a time, where the user can then accept or reject the incoming media objects.

2.4.3 Uploading Content to the Big Board

The system allows users the ability to share media they currently have on their mobile device. This is accomplished by having the user send a V-Card file to the system (A V-Card file is a file used by some mobile phones to store contact information). Once the System receives a V-Card, it creates a media pack that is associated with that unique phone identity. A user would then send a picture file, whose purpose is to be the identifier of that media pack for other individuals to see and capture in the same manner as described in the previous use case. Any subsequent media files sent from that phone will be associated with that media pack and the user can send as many files as he/she wishes for the public to consume.

The Big Board system was deployed at an NGO office in Khayelitsha that deals with providing job skills training to people living in the township. The system was prototyped and deployed over varying periods of time to test the usability and functionality of the system. A three-month evaluation period found the most useful feature of the system for that specific community interacting with the board was to

provide the participants a means to share gospel music and choir practices amongst each other.

Extensions to the Big Board project have used a variety of technology probes in a community and have identified limitations with the current system.

In one project a cheaper, more portable Big Board service was created [Smith, 2011]. The motivation behind doing so was that the current Big Board equipment is relatively large, expensive and requires a constant power supply and thus would not be able to be deployed in areas that do not have a power source and/or where space is not available, for example in a mini bus taxi or other moving vehicle. The system replaced the server machine with a mobile phone, the image recognition algorithm was simplified to accommodate the computational limitations of the new mobile server device, and bar-coded paper posters replaced the large electronic display. The user interaction of taking a picture and using Bluetooth to send and receive files remained the same.

The Big Board was also used as a tool to provide voter education to a community [Gitau, 2010]. A tool was developed called the Media Pack Generator for the purpose of allowing political figures to create media packs outlining their campaign. The resulting media packs were placed on the Board for public consumption, to better educate the community for an upcoming election.

2.5 Conclusion

The Big Board is a system that facilitates the free sharing of media without the need of having to install client side software onto phones, and we feel it is an appropriate tool to serve our needs to provide a way to aid and assist the dissemination of media amongst the stakeholders in the Khayelitsha environment.

However the challenges highlighted in the introduction do need to be taken into account when deploying the Big Board system. For example content creation is accomplished either by sending media via a cell phone or having an administrator go through a task of creating XML files and image key files in addition to finding actual content, which poses difficulties for typical stakeholders to accomplish.

The Big Board system previously used did not allow remote user groups to update the display. Given that there are three user groups in the area (Students/ Librarians/NGO workers), there should be a way for the users to be able to create and share content, even if they are not in the vicinity.

These individuals might have differing ideas on how to make use of the Board and what content should be uploaded. Thus a way to empower and monitor various user groups as they create media for the community should be put into place.

We chose to emphasize local empowerment, as these individuals will have greater insight into the type of content that would be useful to the community. These people are part of the community and are the people guiding the youth with their academic work, which was identified as the target user group we wish to assist.

Deploying an enhanced Big Board with the stakeholders involved with co-creating a community content management system forms the basis of our research. The next chapter discusses the various methodologies we will utilize to obtain user requirements, synthesize, deploy and evaluate a usable solution.

3. Methodology

3.1 Introduction

The goal of our research is to address media dissemination amongst multiple user groups in a low-income urban setting using both human and technical approaches. Specifically, these methods are: rapid ethnography, technology probes, contextual and user centered design, prototyping, contextual inquiry and critical incident interviews. We will be guided by an ethnographic action research mindset.

3.2 The System Project Lifecycle

We shall be taking an iterative approach and involving the users through each stage of the project. Figure 6 highlights the methods we use during each stage of the project's lifecycle.

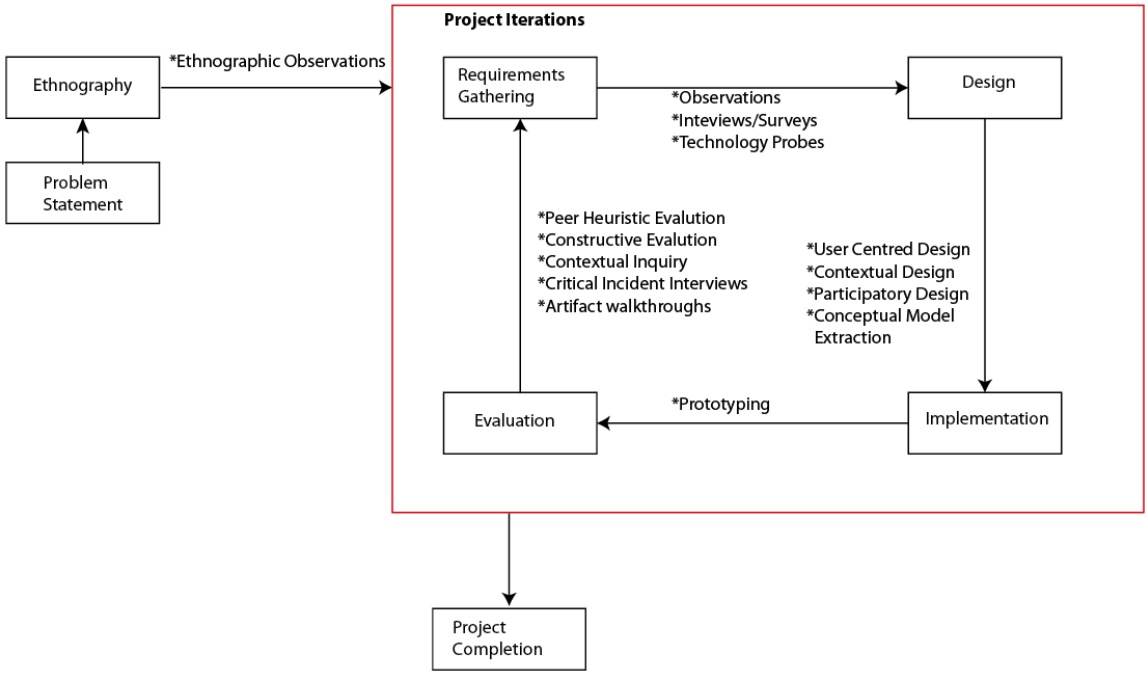


Figure 6 The system project lifecycle

Given our problem statement and our selected technology strategies, we begin our project by carrying out an ethnographic study of the environment, in order to better understand the stakeholder's situation in a broad context. We first obtained ethics approval from the UCT Science Faculty office before conducting the ethnographic study. From this ethnographic study, we can identify the stakeholder's requirements for a prospective system. We will then implement the prototype, a low fidelity mockup of interfaces, followed by a high fidelity usable system in a second iteration. This prototype is then taken back to the users to test and evaluate. The comments received and the actions observed restart the cycle and the prototypes are refined in another iteration. This process continues until the stakeholders deem the system

usable (according to their stopping criteria) and request few changes. Only then will the system be deployed, allowing us to monitor the usage patterns of the system to answer our research question regarding use of a mature content management system.

3.3 Ethnographic Action Research

We will use ethnographic action research to guide our actions throughout the project's lifecycle. We chose to use this approach as it provides a systematic framework for planning, deploying and evaluating our interventions within the environment, and thus would provide a more efficient end product when compared to entering the field without a methodology in place. Ethnographic action research [Tacchi, 2003] is based on combining two research approaches: ethnography and action research. Ethnography is a research approach that has traditionally been used to understand different cultures. Action research is conducted in the actual target environment. The methodology cycle is summarized in Figure 7.

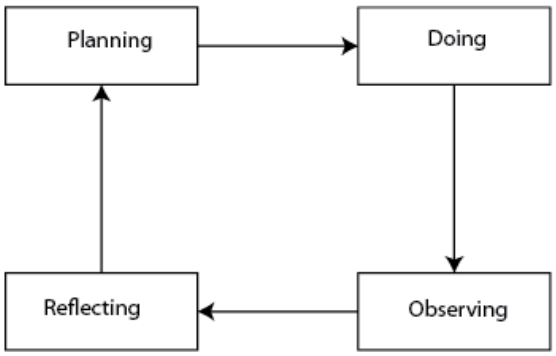


Figure 7 Ethnographic Action Research Cycle

Figure 7 shows the cyclical nature of ethnographic action research. Researchers enter a community as outsiders and involve themselves in the regular actions that occur within this community. After sufficient planning, an action strategy is implemented and researchers proceed to observe the community to understand the effects of the changes. Changes in actions are documented and reflected upon to understand the meaning. These reflections form the next phase in the research project.

Our research will follow this cycle. We will enter the Khayelitsha community as outsiders, and involve ourselves with Ikamva Youth's activities. We will first plan then deploy technology into the environment to increase youth access to information at no cost. Then we will observe the responses associated with this new technology and analyze the impact. We will continue with iterations of the same action research process until we have documented an appropriate outcome (or

conclude that our interventions cannot be successful). A crucial part of our strategy is to identify human access points, collaborators within the community to champion the technology deployments and co-develop a usable solution.

3.4 Human Access Points

Marsden *et al.* state that it is difficult for users in developing environments to conceptualize what a system could do for them without being part of its development process [Marsden *et al.*, 2008]. A contact from the community is required to create more appropriate prototypes for specific users. These people are referred to as human access points with insight into the thought process of the members of the community. In essence they become the technology champions of the project and become liaisons between the community and the researchers/designers. Figure 8 outlines this process.

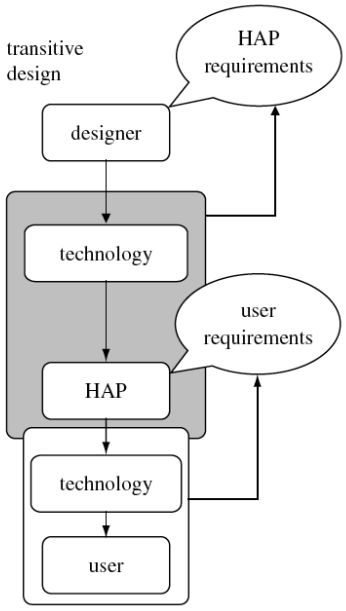


Figure 8 Human Access Point (HAP) Design [Marsden *et al.*, 2008]

We have to identify someone in each of the target communities that can serve as human access points. As our project deals with multiple user groups within the community multiple human access points are required. Once these people have been identified we will work with them during the project lifecycle in order to design optimal use of the technology we are investigating.

3.5 Ethnography

Ethnography is a detailed study of a group's culture, customs, methods and actions [Monk *et al.*, 1993]. This study requires a researcher to be immersed in the given environment in order to capture the relevant information. He/she adopts an uninformed outsider role whose goal is to understand the observed people from their own point of view. Tools within an ethnographic study are mainly observation,

but interviews, questionnaires and studying artifacts could also be used. Data gathering is an opportunistic process whereby once an interesting event occurs the details are captured. Crabtree outlines the following materials that might be recorded and collected [Crabtree, 2003]:

- Job descriptions
- Rules and procedures of the participants
- Descriptions of activities observed
- Informal interview where participants explain details of observed activities
- Physical layout of objects
- Photos of artifacts being used

Given our time constraints, we will use a rapid ethnographic approach. Rapid ethnography takes the goals of ethnography and condenses the immersion stage to fit into a smaller time frame by carrying out a series of short, focused studies in the field [Hughes, 1994]. Millen suggested additional time saving tactics for an ethnographic study. Given our time restraints it is important to choose the most strategically appropriate times to be present to observe the relevant processes [Millen, 2000]. With the help of our HAP we will identify those situations, which will provide the most insight into the given problem and be present for those situations. We will also involve more than one researcher and combine the insights gathered.

We will start with the tutorial sessions held by the Ikamva youth NGO. The reason for this is we will be able to observe the main process of the Ikamva Youth NGO and be able to observe the youth interacting with the NGO. These sessions are held in and around the library allowing us to observe the youth within the community. We will join other researchers during the ethnographic phase of the project, in order to combine observations and unite resources. The other research team will be concerned with video editing capabilities with mobile technology amongst low-income urban teenagers. Their research topics target similar user groups, and it will be useful and efficient to combine insights.

We will attend the tutorial sessions and observe the participants. We will volunteer to help facilitate a computer literacy class for some of the youth and use this as a platform to conduct informal interviews and observe how these youth interact with mobile and computer technology. We will also observe the library environment and watch how the library staff interacts with the community, especially in the high traffic times, after school hours on weekdays, and Saturday mornings.

3.6 Requirements Gathering and Planning in Context

3.6.1 Research Relationships

In order to determine requirements for a system we must first establish, and then maintain open channels among stakeholders in the environment. We must eliminate the “us vs. them” mentality present in many software engineering projects where outsiders bring new technology to an environment without taking into

consideration the context, thoughts, feelings and desires of the people living in the community. We seek to create a perception of co-ownership by involving potential users of our system participate in the design phase of the project, responding to concerns voiced by the users by consultation and mutual decision-making.

According to Heeks, close to 70% of initiated information and communications technology for developing world (ICT4D) projects fail within the first few yeas of conception, mainly due to not taking into consideration the users' context [Heeks, 2002]. Gitau recommends that the stakeholders involved in a project develop together a meaningful evaluation method that can be applied to the end system [Gitau *et al.* 2009]. The objective is for all the stakeholders involved in a project to benefit from the interventions in their environment. As a result of these open channels and having stakeholders evaluate successive iterations of a potential system, useful user requirements and design insights can be obtained.

In our case the stakeholders will be consulted to obtain end user requirements during the design phase of the first prototype. During the initial project questioning, the librarians and the Ikamva Youth NGO were interested in a way to freely disseminate media to teenagers in the local community, supporting the base goal for our system.

3.6.2 Technology probes

A technology probe is an intervention whereby a system or piece of technology is deployed into an environment [Hutchinson *et al.*, 2003]. The purpose of a technology probe is to expose users to technology in context, as opposed to testing labs. The methodology is used for identifying potential applications and impacts of the technology. We use this methodology as 'unanticipated social uses of an application' can occur where users may not know the best way to use certain technologies. Thus by introducing the technology we can co-realize with the stakeholders the best applications [Donner, 2009].

We will be using the technology probe method in our initial planning phases to explore the potential extensions to the Big Board system. We will train a few key library staff and some of the Ikamva Youth members in the environment on how to use the display and on the functionality of the system. After a period of time we will question the individuals on their insights into how best to use the technology to develop our next iteration

3.6.3 Interviews, Surveys and Observations

Other information gathering techniques include interviewing stakeholders for qualitative data, and providing surveys for quantitative feedback, as well as observing individuals in the environment and documenting how they complete tasks. A survey will be used in the initial stages of the project to gather statistics about youth in the area. Questions will be focused on mobile technology usage. Interviews and observations will occur during all iterations of requirements

gathering. Interviews will either be formal sit down interviews with a given structure, or informal interviews in the form of conversations where stakeholders can express themselves freely [Sharp *et al.*, 2007].

3.7 Design

3.7.1 User Centered Design

Having the users at the centre of the design process enables us to create a usable system that integrates with the users' processes, as the relevant people will be involved at each stage of designing a system. Involving the users in designing a system will occur within the planning and reflection stages of the ethnographic action research process where the users will provide feedback on how best to deploy a system, how to use the system and what changes they require in the next iteration. User centered design places the user of the system at the centre of development, where the main focus is to produce usable systems [Jones *et al.*, 2006]. This methodology produces a system directly relevant to the user's work, and focuses on human skills and insights that will support rather than constrain a user. There is also less likelihood of a user rejecting the system if they have been involved throughout the design process and have developed a sense of ownership. [Gulliksen *et al.*, 2003]

Gould *et al.* laid down three principles defining an effective user-centered-design mindset [Gould *et al.*, 1983]:

- Early focus on users and tasks
- Empirical measurements
- Iterative design

These three principles define a user-centered approach where the main emphasis is placed on the early involvement of users in designing a system. We will draw from these principles to create a usable system for users in a low-income context. From the beginning of our project, we will involve different user groups in an iterative design process when prototyping our system. Throughout the project we will note user reactions and suggestions and incorporate them into subsequent iterations.

3.7.2 Contextual Design

Contextual design builds on user-centered design and focuses on an organizational level rather than on an individual level [Beyer *et al.*, 1995]. The stakeholders in the environment where we will be prototyping a system have been identified as an NGO and a library. We chose to adopt a contextual design mindset to create a usable system then holding review meetings with different people within the organizations. According to Sharp *et al.*, the key principles for contextual design are:

- To keep an open mind and to always understand the users and the context that occurs.
- Discuss ideas with the stakeholders as much as possible
- Use low fidelity prototypes to get feedback

- Iterate continuously

In contextual design, ideas are explored in the context that they are created, and the stakeholders are exposed to different aspects of a solution. [Sharp *et al.*, 2007]

We will facilitate group discussions regarding the system amongst different user groups on a weekly basis during the design phases to identify potential problems and find solutions through consultation. We shall use low fidelity prototyping to gather rapid feedback and iterate into higher fidelity prototypes.

3.7.3 Prototyping

Rather than creating and deploying a system in an environment, we shall first create prototypes of a system in order to identify features of a potential system. These prototypes will be used as tangible design tools to present to the various stakeholders in the environment, where they can give feedback at each prototype deployment rather than at the end of the project where changes would be harder to implement. A prototype of a system is the expression of the design ideas gathered during the design phase of a project [Jones *et al.*, 2006]. Prototypes range from a paper prototype that consists of hand drawn interfaces to prototypes with extensive functionality that resembles a final system. Prototyping should be a rapid process, which allows the designers to "fail fast" [Jenson, 2002]. These failures need to be identified and then addressed. Presenting a prototype to a user is an efficient way to discover potential problems.

We will begin with a low fidelity prototype of a system and iterate into higher fidelity prototypes. Low fidelity prototypes are prototypes that do not resemble a final system with limited functionality. These could include mockup drawings of interfaces, models of devices, storyboards on how a system navigates and scenarios. They are useful in identifying preliminary design directions and features. High fidelity prototypes resemble a final system and have high functionality. These prototypes can be used to test various functions as well as identifying the limitations of a system and what possible additions/subtractions can be considered.

3.7.4 Participtory Design/ Conceptual Model Extraction

In order to design a system that conforms to the users' context we shall employ participatory design methods, specifically conceptual model extraction. Conceptual model extraction allows the user to form ideas on how a system should move from various states, highlight relationships between different parts of a system and builds a picture on how the system would be held together by presenting a prototype to the stakeholders and extracting the necessary information to improve the prototype [Jones *et al.*, 2006]. We will create a low fidelity prototype of a prospective system using mockup drawings of a content management system, based on our findings gathered during the ethnographic stages of the project. This prototype will be presented to stakeholders in a conceptual model extraction session to identify potential problems and successes. These ideas will be noted, and if needed

discussed further and added to the design specification of the next iteration. Each iteration will build upon the previous iteration gradually moving towards higher fidelity prototypes where conceptual model extraction sessions will be replaced by constructive interactions, artifact walkthroughs and critical incident interviews.

3.8 Evaluation

3.8.1 Contextual Inquiry

During the evaluation stages of a prototype, we will use contextual inquiry to obtain requirements and manage the situated display's content. Contextual inquiry is a structured approach to the collection and interpretation of data from fieldwork in order to create a system for the targeted users [Holtzblatt *et al.*, 1993]. Contextual inquiry is used to uncover requirements relating to the context of the use of a system by following ethnographic methods. Contextual inquiry allows us to gather insights rapidly and form a co-ownership bond between the stakeholders, given the collaborative nature of the methodology.

We will gather data from the stakeholders in the environment about the use of the system and its effects, observing their processes and interviewing them in context about their insights. After gaining understanding with respect to their actions, we would further refine the prototype to take into consideration these findings. The use of constructive interaction, artifact walkthroughs and critical incident interviews will form the basis of our prototype evaluation.

3.8.2 Constructive Interaction

Constructive interaction is where two people complete various tasks on a prototyped system simultaneously, and verbalize their thought process to each other when completing the task set [Jones *et al.*, 2006]. This technique is used to gather the thought processes of the users when given a task, to identify potential problems and areas for streamlining. This methodology will be natural in our context. During our initial observations we observed that the librarians and NGO workers worked together and talked to each other about decisions they would make during meetings and interactions.

3.8.3 Artifact walkthroughs

Artifact walkthroughs involve the researcher systematically introducing the areas of a system to the users, stating how each area works and then asking the users to imitate the actions introduced [Jones *et al.*, 2006]. It will be particularly useful when training new members of the organization that might join in the later stages of the project how to use the system. Problems noted during these walkthroughs will be carried forward into future iterations.

3.8.4 Critical incident interviews

Critical incident interviews occur after an artifact walkthrough or constructive interaction session is completed. They involve interviewing the participants in order

to gather more insights regarding a prototype. Questions will target areas where problems emerge. The purpose of these interviews is to gather more insight into these problems to better address them in the next iteration. Potential solutions are identified and consulted on with the users during these interview sessions.

In our context, we will identify design insights for improving the current prototype. We want to know if the current prototype is something the users would be able to use intuitively, and if not why? We will observe how users performed the tasks, and what they say to each other during the constructive interaction sessions. We will note where and when they ask for help, if they experience any signs of confusion and/or encounter errors. After the task set is completed we will interview them about the general system design, and ask what they would change as well as question them about specifics of the walkthrough. These points will be compiled and used as input for the next design iteration.

3.8.5 Heuristic Evaluation

In order to provide a high quality system for the users, we shall heuristically evaluate the high fidelity prototypes of our system. Heuristic evaluation is an evaluation technique whereby usability experts undertake to evaluate a system using a set of design principles (heuristics) [Jones *et al.* 2006]. These usability experts will be members of the ICT4D Lab in the University of Cape Town. Heuristic evaluation alone does not take into consideration the actual users as usability experts are used in the place of the end users, thus this method shall be used to identify rudimentary shortfalls and issues within our system before having the users evaluate our prototype.

3.9 Conclusion

We will employ a range of methodologies designed to encourage user inputs during our study, keeping an ethnographic action research mindset. The project will proceed in a cyclical manner, plan, do, observe, reflect, and the next three chapters outline stages in this cycle. The next chapter highlights our ethnographic study of the environment, and the actions observed when interacting with technology probes.

4. Ethnography, Interviews, Surveying and Technology Probes

4.1 Introduction

In the previous chapter we discussed the various methodologies we will use during this study. In this chapter we discuss how these methodologies were applied to understand media technology. The ethnography and technology probes were some of our first interactions with the community and formed the foundation for our research.

4.2 Understanding the Environment Stakeholders

Before we could design a prototype for the stakeholders, we would first need to understand these potential users in order to define the elements of a system. To accomplish this we would hold interviews, conduct a survey, deploy technology probes and observe the interactions occurring within the environment.

As outlined in the introduction, there have been three major stakeholders identified in the environment that we could aid to investigate media sharing amongst low-income youth. These are:

- The Nazeema Isaacs Library Staff, who provide services for the youth. They are constrained by the lack of resources available to cater to all the youth's requests for educational content. Thus these staff have expressed interested in using technology to help the learners in the community with their school projects.
- The Ikamva Youth NGO workers, who also serve the youth with academic support, and are interested in using technology to supplement their activities by providing media in the form of announcements and advertisements, as well as academic work.
- The youth within the area, that make use of mobile technology to exchange media amongst themselves (Please see the background chapter for more information regarding the popularity of mobile technology amongst low income urban youth).

4.2.1 Current Processes Gathered From Observations and Informal Interviews

The purpose of our first intervention was to gather the current processes employed by the stakeholders by holding informal interviews and observing the stakeholders in the environment. The data we receive will inform us on the directions we take when introducing new technology. Specifically, we would be looking at the financial limitations in the area, how familiar the youth are with mobile technology, if a technology intervention would be acceptable by the stakeholders as well as general demographic information to better understand our user base. These observations would then be used in justifying the usage of a potential system to aid media dissemination amongst the youth.

Currently the library offers a variety of services to the community other than just lending books to the general public. It provides a workspace for students to use after school where they work on projects and/or to study for exams. According to the library staff, approximately 90% of library users are students. The students come from three schools located in close proximity to the library.

The librarians are often questioned about topics related to students' projects for the week, for example 'drug awareness'. Many students, from different schools and grades, ask to obtain resources for these projects. The topic can last from one week up to a few months according to a librarian. One problem encountered by the library staff is that students borrow books and tear out pictures from the books to use in their projects.

There are also five computers located in the library that students use for research purposes. These computers are not always working, and usually have a queue to use them.

The library is open from Monday to Saturday from 8am to 5pm. It is not only the typical quiet study zone but also serves as a community centre where the students do their work in groups. There is a quiet area should the students need to work in silence. According to the library staff there can be as many as 1000 visitors per day, each coming and going an average of eight times, as shown by a visit tracker which in September 2010 logged 192007 visits. (The tracker is a device located at the exit of the library that logs the number of people that leave the library.) These figures do not portray unique visits, but confirm that the library is an integral part of these student's lives. During the school holidays, the number of visits decreases; in January 2010 the tracker logged only 116161 visits.

Located outside of the library is a large board where people can post notices for the community to read. The library staff must approve each notice, but has never had to deny any request (suggesting that people respect the notice board, recognizing it as a community empowerment tool and do not abuse it). The largest notice size that an individual can post is A4. The usual items posted are business advertisements, job advertisements (both hiring and offering of services), school notices, community event notices, and art projects.

The members of the Ikamva youth program are also frequently in the library area to attend the NGO's programs. For example, every Wednesday afternoon after school finished (around 3:30 pm) Ikamva Youth held a computer literacy class for grade 10 learners. We helped facilitate this class and were able to carry out additional informal interviews and observations as a result. During this class we observed that students would sometimes use their cell phones to communicate with their friends, or play music when doing exercises such as typing. The typing exercise was interesting to observe, with many of the students struggled with typing at high speeds, but when using their mobile devices, they could type out an SMS or MXIT

message with relative ease. When questioned about this, the students claimed they could type much faster on a mobile device than on a desktop machine.

The main event for the Ikamva Youth NGO is the Saturday morning tutorial session. All enrolled learners are supposed to attend. Volunteer tutors provide help on a student's homework, or help prepare them for upcoming exams by going through past papers and/or revision notes. After the tutorial sessions are over, other events could be organized for the learners' benefit. For example, one week three members from an NGO came in to talk about AIDS awareness, and another week people came to talk about career options and how to apply to universities.

According to the some of the youth we questioned during the Saturday morning tutorial sessions, music and picture sharing are most frequent media objects shared amongst themselves. Those individuals with video capable phones did not use video functions frequently, as they did not have a platform to share videos amongst themselves. Phone memory constraints are also an issue as memory cards are scarce in the township environment. Only three of more than 30 interviewed reported having reasonably large (larger than one gigabyte) memory cards, which inhibits sharing of media as there is no space to keep data. According to the students, the only regular access to Internet connected desktop computers for all the students was the Ikamva Youth computer labs and the library where there are limited machines to cater for the demand. Bandwidth issues for media sharing via YouTube and/or Facebook also exist; for example, the Ikamva labs discourage data uploads to social media websites as the NGO has to pay for the bandwidth. There are Internet cafes in the area, but the youth report them being too expensive to use. A cost effective system that provides external storage and facilitates media sharing would transform the media technology environment for these youth.

From our initial informal questioning of the youth in Khayelitsha we found that the average amount of spending money an individual would receive per week from their parent/guardian (n=20) was around R5, and none of the students had any knowledge of the existence of data bundles (purchasable data packs that are exclusively used for Internet usage via a mobile device). Data bundles are a cheaper way to access the Internet rather than using prepaid airtime. These township youth represent a small, but significant demographic with considerable mobile technology limitations as a result of financial restrictions. Thus a low-cost or cost-free solution should be considered.

4.2.2 Initial Interviews

In order to develop a system that would be useful to the Khayelitsha community we performed in-depth interviews of twenty teenagers living within Maccassar, Khayelitsha. We also observed the participants using their cell phones and documented what media they currently stored on their phones. The participants interviewed were all grade 10 students living in the area who were part of the

Ikamva program. We found these students were committed to providing valuable information during the observation/interview process.

The first set of interviews took place over a period of two weeks where one of three members of the research team individually talked to each of the teenagers. Interview questions were formulated beforehand in a survey style to determine current mobile phone usage, particularly media sharing and consumption patterns. The interviews lasted on average 30-45 minutes per individual. All interviews were recorded for later review.

4.2.3 The Interview Questions

The interview questions were designed to confirm mobile technology usage patterns from interviewees. Questions focused on if they had a phone and if so, how did they use it (e.g. sharing with family/friends)? How did they use the camera and video features of their phones? How and why do teens share media such as pictures and music was also asked. The interview ended by asking some open-ended questions on life in Khayelitsha, what they like/dislike about living there and how much the community supports each other. A sample of the interview questions can be found in Appendix C.

4.2.4 Phone Sharing

The answers gathered from the interview sessions confirmed some of our views as well as giving new insights.

It is widely believed that the mobile phone market penetration is extremely high and our interview sessions confirmed this. Every one of the participants had at least some access to mobile technology, whether it was through their own phone, a family member's phone or a close friend's phone. Phone sharing became a much-discussed topic. Most of the individuals do not openly admit to sharing their phones but after talking to them it became very clear that they do. They do not hide this fact because of privacy, but rather because they do not think that what they do is considered phone sharing.

4.2.5 Sharing Practices

One interesting finding is the practices that occur while the students share phones while making a call or sending an SMS. According to the interviewees, the community is financially constrained and some of the students run out of airtime for varying periods. During this time, they will borrow a friend's phone to make a call or send an SMS. Usually payback is not necessary, but it is implicitly expected that when the borrower has airtime he/she will allow the other to use the phone. When an individual does not have access to a phone, for example it has been lent out, broken or stolen (which are all common occurrences in the area according to the students), he/she borrows a friend's phone to make a call, recharges with a R5 voucher, uses R3 or R4 for a call, and leaves behind the remainder as a courtesy for letting the person use their phone. There is usually no formal agreement

beforehand, so it is up to the borrower's discretion on what he/she does to thank the person.

4.2.6 Reasons for Sharing

Other than airtime constraints, one reason for individuals to borrow a phone is to make use of features that might not be available on their current phones. Functions such as games, mp3 players, camera/video functions and Internet access all play a large part in phone swapping. An interesting practice we observed was that two individuals exchanged phones so that they could listen to each other's music library. When asked why not Bluetooth the music over, they replied that it was just easier to swap phones for the day than spend time waiting for the Bluetooth file exchange to be completed.

Phone sharing has become natural to the members within the community. We asked what would happen if they were to refuse giving their phone to a friend who had asked to borrow their phone, and most responded that they would be perceived as hiding something important from their friends, thus they usually obliged a lending request.

4.2.7 Bluetooth Sharing

Part of the interview involved us asking them if they know how to use Bluetooth and how often they make use of this feature. The result was that 100% of the students said they knew how to use Bluetooth and have used it at some stage in their lives. A majority of the interviewees make use of it on a weekly basis. We also asked some of the participants to Bluetooth some of their music, videos and pictures to a laptop for our analysis. Their practice confirmed their fluency with the technology, and we noticed some interesting outcomes. About 60% of the participants' memory on the phone was being used for storing music and pictures. Only two of the teenagers had videos on their phones and those videos were exclusively music videos. While all the participants said they knew how to transfer media via Bluetooth, all were unfamiliar with the 'mass send' option via Bluetooth that their phones supported, suggesting that they would only share media one artifact at a time. Some students were also more technology literate, helping other students if they had troubles with Bluetooth. During file transfer session, two of the students' phone battery expired while sending media so they came up with creative ways to continue the process suggesting that power issues happen often and they have mitigation strategies to overcome this limitation. The first student found a similar battery he borrowed from his friend just to finish the transferring, while the second student borrowed an actual phone where she transferred her memory card into in order to continue the process.

Figure 9 Two students Bluetooth some files

4.2.8 Surveying the Demographic

Using a survey instrument similar to that used by Deumert for a mobile literacy project, which was used to gather statistics on low-income learners [Deumert, 2009], we surveyed 46 of the youth in the area. We added questions dealing with mobile phone usage. The other researchers with whom we were sharing the results focused on the literacy levels within the demographic. The questions we were interested in focused on the demographics of the participants, technology access and mobile phone usage. The survey was completed in one day and the participants were rewarded with R5 worth of airtime for participation. The questions used can be found in Appendix D.

4.2.9 Survey results

Of the 46 participants, 14 were male 32 were female. All the participants lived in the area and attended school. The mean age was 16.9 years. All the participants spoke either English or Xhosa or a combination of the two languages.

The survey clearly confirmed the disparity between mobile device and desktop machine ownership. Of the 46 youth, only six owned desktop machines and two owned laptops. By contrast almost all, 44, owned their own mobile phone. 42 reported they had access to desktop machines, but they were in an inconvenient location. 22 said that they shared a phone that was not easily accessible to them, for example, they would share a device with a family member.

Regarding mobile phone usage, only two of the participants claimed to not use the SMS functionality of their phone and 14 reported usage several times a day. 27 of the youth reported using PCM (Please Call Me) several times a day. PCM is a free service offered by mobile providers where an SMS is sent to a number of the sender's choice asking the receiver to call them back. This practice has been adopted by the youth for a number of mutually agreed reasons – for two of the participants it was a way of saying goodnight to a friend, and for another two it was a means of saying that they miss someone. The main reason outlined by 18 participants for using PCMs, was that they ran out of airtime and were unable to phone someone. 21

participants reported 'never' or 'very rarely' using their phone to make calls. Fifteen participants claim to use their phones 'at least once a day' or 'several times a day'. Six participants said they used their phones 'every few days'. The average spent on airtime a week, R21.52, was higher than the amount estimated in our initial informal questioning of the youth.

4.3 Using Technology for Media Dissemination

From our initial interviews and observations, we have seen the need for cost-effective information transfer amongst the various cost-constrained stakeholders in the environment. Advanced feature phones are entering this low-income environment, and hardware limitations are lessening [Kreutzer, 2009]. Thus a technology probe of a situated display, running the Big Board system, can feasibly act as a probe to explore the information transfer process. Big Board was specifically chosen given that the system provides a media-sharing platform which was desired by all three stakeholder groups, is free to use by the end users and makes use of Bluetooth technology, which the teenagers reported to be familiar with. We shall make use of the technology probe methodology to deploy the Big Board in the environment to co-realize the best applications of this technology with the stakeholders.

4.3.1 Planning for the Technology Probe Deployment

We held two separate meetings with six librarians and six Ikamva Youth staff about the prospect of introducing a situated display into the environment as part of the planning stage in the ethnographic action research cycle. The goals of these meetings were to ascertain the best way to deploy the Big Board system, as well as mention any ideas they might have to make use of the system.

The librarians were enthusiastic about the prospect of integrating situated displays into the library. Their concern was the content present on the screen and who would manage this content. When given the prospect of themselves managing some of the data on the screen, they shared their perspectives on the impact of the technology. They all thought there would be a positive influence on the community and that the students would benefit from the information posted onto the screen. They suggested that they be given the power to upload content they would obtain from the Internet based on the students' work at that time. For example, they could post information on drugs for the drug awareness week that the schools assigned students to research. They would primarily upload text and picture files obtained from the Internet. They also thought that some videos would be appropriate, but thought it might be difficult procuring this data. They also suggested incorporating functionality for students to upload user-generated content.

The librarians proposed that some slots should be dedicated to having non-educational content such as music or lyrics. (Song lyrics are one of the most printed

items in the library printer according to the library staff). The reason for this was to attract the students to the board on a weekly basis, thus enticing them to download the educational content. Educational content could be stored on the student's phone, or sent to print on one of the computers located in the library or computer labs. Situated displays could also be used to advertise community events, as does the notice board outside the library. One librarian suggested it be used on special weeks such as careers week, to display information on different careers, which could be uploaded by the public. The library staff thought that once the students knew how to use the system, and if the right content were put up on the board, the system would see a very high usage rate. By the end of the exploratory phase the librarians were very positive about the possibilities of hosting the system in the library.

The Ikamva Youth staff also voiced their concern over what content would be available to the community. They felt that if they were given the responsibility for placing content on the screen that it would benefit the learners. Specifically they would like to place pictures and text as well as educational videos to which they had access. They planned to use the board as an announcement platform for learners as well as for the committee members that organize various events. The board could also provide the learners with useful tips to deal with exam stress and how best to prepare for tests. They also suggested they could use the Board as a platform to share photos taken at the various Ikamva Youth activities and have the system be located in the library given the close proximity to their events.

4.3.2 Technology Probe Deployment

In order to study media usage, we introduced a large situated display running the Big Board software into the environment to act as a technology probe. The display was placed in the Nazeema Isaacs library and used by the intended users, not the more conventional pilot in testing labs, to give all parties involved in deploying and using the system real-time experience, and to identify potential applications and impacts of the technology.

Figure 10 Some of the Youth Interacting with the Display in the Library

The situated display deployed in the library was seeded with music, text documents, pictures and some small movies. These were selected based on interview question responses. For example, we used music from popular artists that the teenagers said they enjoyed. We also provided some wallpapers for phones given the students said that they exchanged 'cool pictures' via Bluetooth amongst each other. The movies were of educational content e.g. a small picture documentary on Robben Island, where Nelson Mandela was incarcerated. We also provided some pictures that the students themselves, took on a photography workshop and some information about UCT given that one of the main reasons students join Ikamva youth is to help get accepted into a tertiary institution.

The library staff and some of the Ikamva youth leaders were trained on the functionality of the system so they could help learners to use the display as well as to empower the staff to have some form of control over the system. After five weeks we followed up with the same individuals on their insights into how best to use the technology. We confirmed that we would have to create a system allowing the stakeholders to upload data to the display. According to our human access points for both user groups, management of the content on the situated display is required if there is to be effective media dissemination, and merging the power associated with each stakeholder into a system becomes an interesting problem, forming the basis of our project.

4.3.3 Initial Big Board Usage Observations and Results

We observed the usage of the Big Board by the youth during the observation phase of the ethnographic action research cycle. As the Big Board was a new form of technology, the library staff was trained on how to download/ upload media onto the board and if asked they could teach the students how to use the board. However, the students were too shy to ask the staff for help, and would end up staring at the screen and either walked away or tried to figure out how to use the system on their own. Our observations confirmed that usage is not intuitive at first, but once understood it was easy for them to continue using it and to teach others how to use the system as well. Unfortunately, the media we placed was not popular amongst the youths with the exception of the music tracks, and a better strategy needs to be employed to identify attractive content.

During the first deployment of the Board, four people had uploaded some of their own content. Of those four, three of them were taught by us how to use the board. The content uploaded was mainly personal pictures as well as some music files. Some of the individuals went by nicknames to identify their profiles; others used their personal name. Ten people chose only to download data from the board and not upload anything. Music (both ringtones and mp3 files) was the most popular downloaded item, followed by some of the educational documents and videos about UCT and Robben Island. Interestingly nobody downloaded pictures that students had taken during a holiday photography workshop, entitled 'soccer fever.' The 2010

FIFA soccer world cup was underway in South Africa at the time, and it was thought that this could be a popular media pack.

4.3.4 Suggestions By the library staff on the usage of a remote media management system

The next stage in the ethnographic action research cycle was to reflect on the technology intervention. After the Board was running with our content for eight weeks, we interviewed the librarians on their thoughts on the deployment and how to improve the next intervention. The librarians were enthusiastic about the prospect of integrating the Big Board into the library. We offered them the opportunity of managing some of the data on the screen – they all thought it would be a positive resource for the community and that the students would benefit from the information posted onto the screen. They suggested that they would upload content from the Internet targeted on the students' current work. They envisioned the board being updated not more than once a week with a new media pack. The type of content they would upload would primarily be text and picture files. They also thought that some videos would be appropriate, but thought it might be difficult to procure this media. They also suggested reserving two slots for students to upload user-generated educational content that would cycle at a fixed rate to ensure general access. They suggested that another two slots be dedicated to non-educational content such as music or lyrics. One librarian suggested the system be updated on weeks such as careers week, so information on different careers could be uploaded for the public.

The library staff thought that once the students knew how to use the system, and if the right content was put up on the board, the system would see a very high usage rate, and were very positive about the possibility of having the system in the library.

4.3.5 Suggestions By the Ikamva Youth staff on the usage of a remote media management system

A similar ethnographic action research reflection session was held with the Ikamva Youth staff after the eight week Big Board deployment. The Ikamva Youth staff agreed with the librarians about using a content management system. The staff expressed an interest in using the system to upload content to the board to advertise upcoming events, place announcements for committee members, and show pictures of events, educational material and general tips for the learners. The Ikamva Human Access Point was identified to be the head of the branch at the time. He was excited about the prospect of integrating a new novel system and having some control over it. He mentioned how it could 'supplement the Ikamva activities very well and help the learners'.

4.4 Reflections on the Interventions

There have been failed technology attempts at the library. One example is the freedom toaster. The freedom toaster allowed users to copy open source software free of charge onto a CD for use anywhere. The library staff gave a number of

reasons for its failure. Firstly the software the system was offering was not useful, as many members of the community do not own a desktop or laptop computer to install the software. The library staff also heard complaints that the instructions were to hard to understand and read, claiming that some of it 'was in Italian'. The library staff believed that the Big Board would not experience a similar rejection, as the platform to access the data is cell phones, which a majority of the library visitors have access to, rather than desktop computers. The library staff suggested holding a workshop for students on how to use the board, predicting that this knowledge will then spread through the community.

This fluency with Bluetooth combined with the apparent desire for new media led us to believe we needed to employ a central portal whereby students would be able to obtain media, via Bluetooth, to their phones. This portal would be a situated display, which would be installed in the local library, a place where all the youth in the area frequent.

The situated display combined with a content management system is designed to satisfy the needs of each of the stakeholders as follows: For the students, it provides a central point where they can freely obtain and share media from the library, Ikamva Youth, or from their peer group. Ikamva Youth's and the library's needs for a platform to disseminate information to their community in a central location is fulfilled. Target individuals are financially constrained and need a way of accessing data at no cost. The situated display provides this service, as it makes use of Bluetooth technology, which is free to use, to facilitate file transfer.

4.5 Conclusion

Whilst the Big Board has been designed to enable the greater community to share their media, it will also be useful in handing over control of the content creation to people who make use of it in a more systematic fashion. Content can exclusively be community created, but in our technology probe deployment we confirmed that the main user generated content is pictures of individuals and is seldom updated. This media, whilst important, is not beneficial to the NGO or librarians.

What would be valuable for the stakeholders is to utilize the board to provide the students with media that benefited their schoolwork or media pertaining to the operations of the Ikamva Youth NGO.

The next chapter highlights the design, implementation and reflections of a low fidelity and high fidelity prototype of a potential content management system.

5. Prototyping A System

5.1 Introduction

In this chapter we discuss the prototype development of the Big Board content management system (BBCMS) taking into consideration our findings of the ethnography, interviews, survey and technology probes. There were two prototypes developed, a low fidelity prototype with a mockup design of a potential system, and a high fidelity prototype, incorporating a system that simulated potential functionality. The low fidelity prototype would be used to rapidly gather design insights on how a potential system should look, and thus highlight areas of functionality to develop. The high fidelity prototype would be used to refine our design with the stakeholders and provide them with a system to demonstrate how functionality could behave before implementing a fully functional system. This functionality would come from the feedback received during the prototype evaluations.

5.2 Current Constraints when using the Big Board System

We identified the following major constraints during the ethnographic phase of the project:

- The Big Board could only be updated locally, which did not suit some of the Ikamva Youth staff that did not have easy access to the library, where the Board was located.
- The Big Board had to undergo a complicated process to generate the media packs, which would be unreasonable to expect the stakeholders to accomplish.
- The content we placed on the Board during the technology probe phase was not popular with the youth. The Librarians and Ikamva Youth staff members expressed interest to place some of their own content on the Board that they felt might be more desirable. Currently there was no way for them to do this.

Thus it was decided in consultation with both stakeholder groups, to create a means for the stakeholders to update the Big Board, with the success criteria highlighted in Chapter 1. We started to prototype a system to accomplish the goal of remote Big Board content management. Our main contact to each user group would be the designated human access point but we would also consult with other members of a user group when designing and evaluating our prototypes as we were following a user-centered methodology within the ethnographic action research mindset.

5.3 Low Fidelity Prototyping

5.3.1 Plan

According to Jenson [Jenson, 2002] it is useful to start the prototyping process using a fail-fast mindset. First we created a low fidelity prototype to identify areas of potential focus. Given the remote nature of the solution, designs for the web

interface were created to give the library staff and Ikamva Youth members that would possibly use the system, power to upload content to the board. Feedback from these designs would be used in the next prototype iteration where a more functional prototype, that would behave like an actual system and simulate functions such as site navigation and content creation, would be made available.

Microsoft PowerPoint was used to mockup system screens to present to the stakeholders. We chose to use PowerPoint as the software allowed us to rapidly create interface mockups that could be edited by the stakeholders should the need arise. Both the Librarian and the Ikamva Youth human access point expressed a preference for seeing mockup designs on a computer screen and did not want to be a part of a paper prototyping session, hence we accepted their request.

We would introduce the prototype into the environment as a technology probe, similar to the Big Board deployment, to understand how best to create a system. Each slide would present a sample of what the system could look like. We asked them to give both positive and negative comments, to help design a higher fidelity prototype. The prototype would be presented in two participatory design workshops, one for the librarians and again for the Ikamva Youth staff. Amin *et al*. state that by using a participatory workshop, they were able to better understand the users from the environment they live in thus an additional workshop goal was to get further acquainted with the stakeholders in their natural environment. [Amin *et al.*, 2005]

No actual system functionality to update the Big Board was to be implemented in this iteration. The design for the prototype was created using the insights learnt from observing the students, library staff and the Ikamva Youth members interact with the technology probe, with a follow up meeting held to discuss their ideas.

Both Stakeholder groups expressed an interest to use the Big Board to upload educational content and provide announcements for the students. The librarians and the Ikamva Youth staff formulated a tentative screen-sharing plan for the Big Board. Given the fact that Big Board could optimally display eight media packs, they suggested dividing the media pack ownership evenly, while still providing the community with the means to upload content. Thus each stakeholder group would control three media packs that would be updated via the proposed system. Two media packs would be reserved for student and community media creation and sharing, which would be updated via their phones.

5.3.2 Do

The low fidelity prototype, the first implementation of the system, consisted of a login screen, a homepage screen and other screens showing alternatives. The prototype would build upon the current Big Board system, and make use of the concept of media packs containing various forms of media to be distributed to the

community. Figure 11 shows a 'view media' mockup and Figure 12 shows a 'create media pack' mockup.

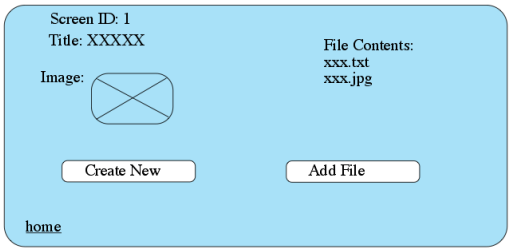


Figure 11 View Media Pack

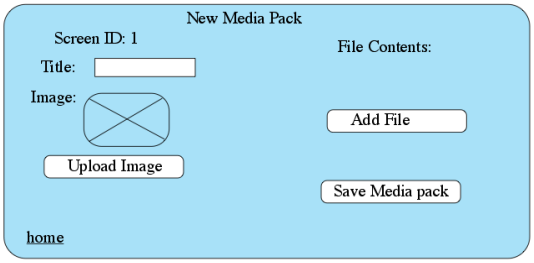


Figure 12 Create Media pack

The existing Big Board layout to depict the media packs was used as the design for the home page, shown in Figure 13. During the observation stages one of our human access points, the Ikamva Youth coordinator, inquired about a way to differentiate which media packs Ikamva Youth had control over. He mentioned that 'there should be an easy way of seeing what we can access'. Thus a red outline was placed around the media packs to highlight the media packs a stakeholder had control over.

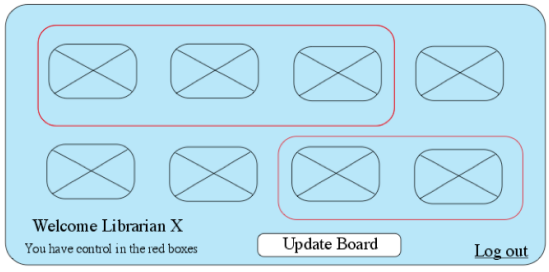


Figure 13 Librarian Homepage

5.3.3 Observe

Library Staff Prototype meeting

We presented the prototype to six of the librarians in a group conceptual model extraction session. The purpose was to gather their thoughts on the interface design, and to obtain their input on how the system should look and perform.

Security and who would have access to a content management system was discussed at the beginning of the session. We confirmed that the system was envisioned to allow access only to the library staff members and Ikamva Youth staff, with each group having exclusive access to their media packs. Blocks reserved for community-generated content accommodated the expectation for people to upload content via the cell phone. Once we explained their sphere of control, they became very enthusiastic on the potential of such a system.

They agreed the proposed login screen was necessary, simple enough to use and similar to other login screens that they were familiar with, such as Facebook and Gmail. Participants commented that the homepage screen resembled the Big Board, which they had been introduced to previously. No changes were proposed for either screen.

We then asked the librarians for suggestions on how to update or change a media pack. They proposed clicking on the respective media pack, which is how we envisioned this interaction.

We then displayed a media pack selected from the homepage. The librarians claimed to understand the layout and the flow of information. One librarian was confused about how to update the media window as opposed to creating a new one. We agreed this screen would need to be modified to reflect this. How to access past media windows if they wanted to 'recycle' data was their next question. This needs to be considered in future iterations.

The librarians claimed that they were satisfied with the general feel of the screen presenting a new media window creation. They understood that they needed to store on their computer any file they wanted to upload it to the Board. The file traversal would be like any other file traversal they had worked with such as attaching an image to an email.

After the prototype demo was completed, the staff expressed concern about the physical safety of the situated display. The Big Board was unsecured during the initial technology probe deployment, whereas all of library's computer equipment had been secured using a lock and chain. The staff suggested that the Big Board be secured in a similar manner. A chain was obtained and the Big Board was secured

against a pillar as shown in Figure 14. The librarians insisted that they should not possess the keys, as according to the librarians, other libraries have fallen victim to crime.

Figure 14 Lock and chain securing the situated display

The library staff were excited about the possibilities of using a system and started to take some ownership as a result of being involved in the design process. They had no doubt that the students were going to use the Big Board. One librarian was convinced 'that it could become a huge part of the library experience for the students'.

Ikamva Youth Staff Prototype Meeting

The Ikamva Youth prototype meeting yielded similar results to the library meeting. Screens were presented in a similar manner and comments were recorded. The staff commented that the homepage looked too simple, but that they would wait to see how it would look like in a final system. It should be noted that the Ikamva Youth staff are technologically literate and make use of social networking, email systems and computers on a daily basis.

The Ikamva Youth staff asked if they would be able to see the media packs the librarians created and if they could edit them. It was explained that all stakeholders would have access to view the entire system; but each user group only had control over their designated media packs on the Board. This could change with consultation with the stakeholders if they felt that modifications should be tried (e.g. co-ownership of media packs rather than exclusive ownership). After the discussion, the youth staff felt that it was reasonable to share power with the librarians and that each party should have control over their own specific blocks. The staff approved of the idea of being able to see what content was currently on the Big Board, and that they had control over what was placed in their allocated media packs. They also were satisfied with the three media packs allocated for Ikamva Youth content.

Creating and editing media packs were seen as simple and effective, one member stated: 'the core functionality is there and it should be easy to use as there are buttons and labels saying what I expect'. When asked if the system was lacking any functionality, the response was that there were no glaring deficiencies. They wanted to actually use a system before they could give more detailed feedback.

5.3.4 Reflect

Having completed the two prototype meetings, with positive feedback we concluded that we were ready to create a high fidelity prototype of the system in order to gather more detailed feedback from the stakeholders. The next prototype would take the screens we created in PowerPoint and convert them into an interface that the stakeholders could use.

While field-testing the low fidelity prototype a new coordinator was appointed to be the head of Ikamva youth operations in the Khayelitsha branch. This caused some concern to us as the old coordinator was identified as being our HAP for the Ikamva youth stakeholder group. Our project stalled for a week, as we briefed the new coordinator. The new coordinator, our new HAP for the group, became enthusiastic about the prospect of using the Big Board.

5.4 High Fidelity Prototyping

After incorporating the feedback gathered from the low fidelity prototyping sessions, a high fidelity prototype was developed to test user interface for the stakeholders in the environment. Kangas *et al.* state that 'the most important aspect of the design process is to provide users with the real usage context[Kangas *et al.*, 2005].'

5.4.1 Plan

HTML was chosen as the language to implement the high fidelity prototype. HTML (Hyper Text Markup Language) is the predominant language used for creating websites, and HTML elements form the building blocks [Kennedy *et al.*, 2007]. We chose to use HTML, as we knew we had to create a remote web-based solution and we wanted the users to experience using a web application.

The prototype could run on any web browser. It simulated how a potential system would look and behave without making any connections to databases or servers or generating the actual files required by the Big Board. A task set was created asking the user to perform various activities one would accomplish while using the actual system in order to evaluate the prototype and note changes for the next iteration.

Constructive Interaction/ Critical Incident Interview

The method chosen to gather feedback was constructive interaction followed by a critical incident interview. Constructive interaction is where two people complete a prototype task sheet, and then discuss the steps needed to complete the task at hand. This method is used to understand the participants' thought processes when accomplishing a given task. During the observation stage of the project, we noticed that both the librarians and Ikamva Youth staff consulted with each other about decisions they would make. Hence we provided opportunities for communication in the constructive interaction session. After the walkthrough, specific questions pertaining to areas of weakness were asked in order to ascertain areas of needed improvement. General questions on usability were also asked and answers noted for

the next iteration of the prototype. Each session lasted 15-20 minutes depending on the speed of completion of the tasks and the amount of feedback received by the participants. The task sheet used can be found in Appendix A.

5.4.2 Do

From the feedback gathered from the initial low fidelity prototype, we created a usable frontend for our high fidelity prototype to gather insights into interface design and potential functionalities. The system did not store any files, generate any image keys or XML files needed by the situated display, but simulated this action by the use of pre-determined screens revealed once the appropriate user interaction had occurred.

The user would traverse the HTML pages using hyperlinks. The homepage depicted the actual situated display screen and a minimalist design approach was employed so as not to clutter a browser and provide an easy to use interface. Once the home page was displayed, the user was informed via an instruction tag that he/she had control over the media packs outlined in red, a feature carried over from the low fidelity prototype. The user could then click on the respective media pack to bring up an information screen pertaining to that box where he/she could then edit a media pack or swap it for another existing media pack. The user could also create a new media pack with a link provided on the home screen. The site map is provided in Figure 15.

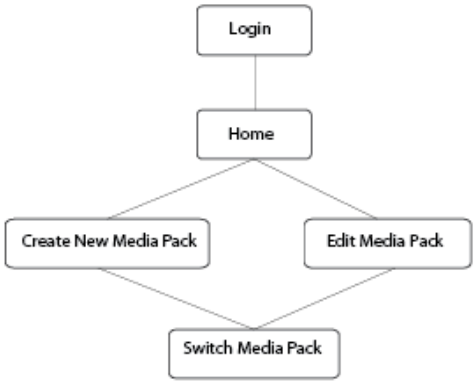


Figure 15 Prototype Site Map

Figure 16 shows the home page of the system, a user would click either on the 'create new media pack' link or on one of the images over which they have control.

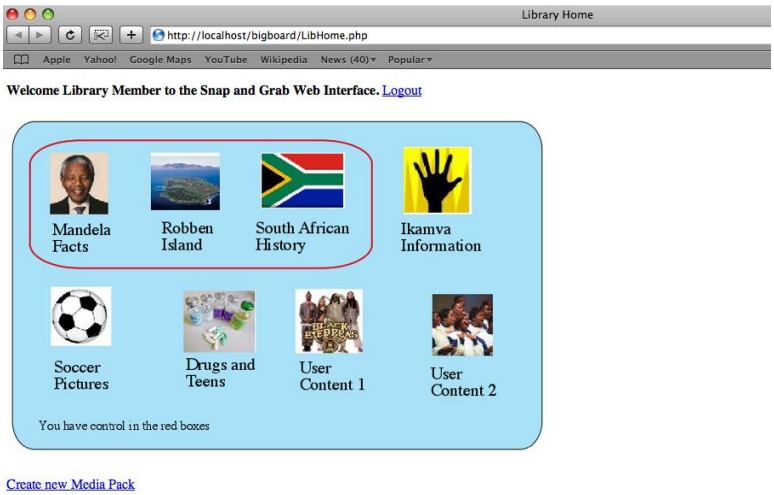


Figure 16 Prototype Homepage

If the user clicked on the Nelson Mandela screen they would be taken to the page shown in Figure 17, where they could edit the contents of the media pack

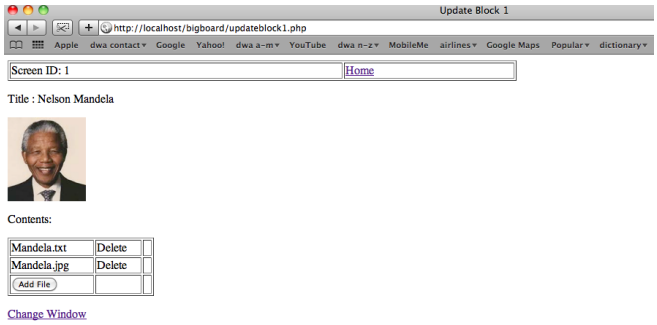


Figure 17 Edit Media Pack

If the user clicked on the change window hyperlink, he/she would be taken to the screen outlined in Figure 18 where he/she could swap the media pack with another in the database.

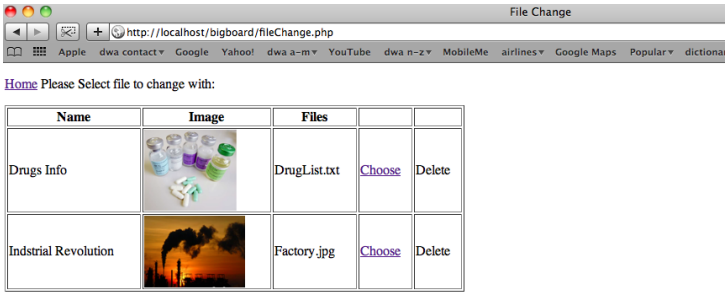


Figure 18 Change media pack

If the user clicked on 'create new media pack' link on the homepage, they would be taken to a form where he/she could create a new media pack to replace any one currently displayed.

5.4.3 Observe

Feedback

The high fidelity prototype provided a valuable contextual tool for the stakeholders to envision a potential system. We received more comments and criticisms than for the low fidelity prototype. By actually interacting with the system they could gain insights into how they thought the system should look and behave.

From the feedback we received it was concluded a substantially revised interface was required, given the usability issues that caused confusion amongst the participants. These issues would need to be resolved in the next iteration of the system.

The first Ikamva Youth Staff evaluation session

The first evaluators of the prototype were two of the senior Ikamva Youth tutors, who were in their mid twenties. They went through the task sheet, found in appendix A, and offered comments to improve the interface. They also offered insights about potential system use. They logged into the system as expected and proceeded to complete the tasks one by one. All the test cases were completed relatively quickly, but there was some confusion on which boxes they had control over. One of the participants read the bottom instruction on how the red boxes were the ones that they had control over and enlightened the other participant. No major issues were noticed. In the follow-up interview they offered suggestions on how to improve the system, and make it more 'user friendly'.

They suggested changing the overall appearance to the website 'to make it more like other websites'. They brainstormed on how the homepage of the interface could be improved. The homepage was the place they thought the most confusion would take place 'especially to those that don't use computers that much'. They suggested that instead of having red boxes indicating which media packs the user had control over while showing all the packs, the system should show only the media packs that they had control over, and have the current state of the board as a menu tab option.

The tutors said they would want to put up material pertaining to their mentoring program for the teenagers; such content could include information about university programs, careers and school subjects.

One of the tutors had a concern that the system would be exclusively accessible to those students that had feature phones, but the other tutor pointed out what we have noticed in our ethnographic study, that all students had some sort of access to mobile devices via phone sharing with their peers and family. He then went on to

estimate that at least 60% of the students he saw had their own phone and a large majority of the rest had access to a phone.

The second Ikamva Youth staff evaluation session
The next interviewees were the coordinators of Ikamva Youth in Khayelitsha and Nyanga (another Ikamva Youth branch). It was interesting to note that they explored every option the system had to offer before completing the task sheet. They also suggested removing the red box method for identifying the boxes for Ikamva Youth control and display only the media packs that they actually controlled.

One of the participants felt that this system would be a valuable tool for communicating with the learners; perhaps the best method to disseminate information, as the learners frequently visited the library, where the system was situated. He also stated that if the learners saw something new on the Board from Ikamva they 'would be wise to download it'. He also added that the Big Board itself would give the Khayelitsha teens a voice within the community.

During this time another Ikamva Youth coordinator was appointed for the area. This coordinator embraced the Human Access Point role but this change caused our project some delay, as we had to re-introduce our project to the new coordinator.

Library Staff
The library staff that gave feedback consisted of four members, whose ages range from 30-60. We followed the constructive interaction methodology and questioned two librarians at a time. Since we used a laptop with a trackpad for the demo of the system, the library staff found the system much less user friendly compared to the Ikamva Youth staff. None of the librarians had used a trackpad before. There was a learning curve for the librarians to adjust to using the trackpad, but when asked if they wanted us to procure a mouse, they insisted to learning how to use the trackpad, and adjusted accordingly. All the librarians completed the tasks on the task sheet. In order to mitigate any unforeseen uneasiness, all future prototype demos used technology the users were familiar and comfortable with, that being their own computers.

The first library staff evaluation session
The first set of librarians commented on how innovative this system was. They then explained how they thought there should be more instructions on how to accomplish tasks, specifically how to upload the content. It was interesting to note that the one of the librarians would click on the file name to add the file, rather than the add file button, he quickly learned however that this was not how it was designed.

One of the librarians commented on how excited he was to make use of the board. He said that 'It will make the library state of the art, which will ultimately help the students'. Both commented that they thought the system was user friendly, and

completed all tasks. Figure 19 shows the two participants going through the constructive interaction session walkthrough.

Figure 19 Librarians using the prototype

The second library staff evaluation session

The second group of librarians also completed the set of tasks. At the end of their walkthrough one commented that if librarians used the system frequently 'they would become familiar with it', but she said that there 'should be some more instructions for first time users on every screen'. Both commented that the home page was confusing with all the media packs displayed at once, and how they thought it would be simpler if only the media packs that they have control over be displayed. Both participants talked through their thought process when creating new media packs. They wanted each process to be distinct so as to avoid confusion. They wanted to create a media pack first, and then add media to the pack once the pack was created.

Training the Library staff to find data

As a result of the prospective use of a content dissemination system, the librarians became interested in learning how to use the Internet for finding relevant data for the learners. A training session was held on how to make use of search engines and access free information websites, such as Wikipedia, to find information to post onto the Big Board. The librarians were not using such reference websites though they had visited these sites once or twice beforehand for personal reasons. The introduction of the interactive Big Board should change this behavior. When students request information on a certain topic librarians will need to be able to find such information on the Internet to help them. Wikipedia was chosen given the open source nature of the resource. The librarians were made aware of the implications of using copyrighted information.

According to the librarians, the youth request the same topics on a yearly basis, depending upon the projects that they are undertaking. An average school project's duration is three weeks; thus the Board will need updating within this time interval.

5.4.4 Reflect

The login system did not cause any problems for the users – it resembled other login systems, such as Gmail, which they have experienced in the past. Thus no changes to the login system were required. All agreed that the home page was confusing. Thus the home page screen will have to be redesigned.

Users suggested developing an instructional piece explaining all the functions of the system. New users would be able to learn quickly what functionality each area of the system accomplishes. They also suggested adding a static menu bar for site navigation to the various sections to the website. While the users did not want to start by showing the state of the current Board, they wanted this feature to be preserved and added as one of the pages within the web application.

The users commented that it would be less confusing to add or change a media pack if only the blocks that the specific user has control over were displayed. The rest of the interface was simple enough to be used by everybody with ease, but they suggested adding instructions on each page summarizing that page's function, to aid first time users of the system.

The users also expressed a desire to separate tasks to avoid confusion. Specifically they wanted to add files to a media pack after it had been created (as opposed to being required to add them during the creation).

They suggested that the appearance of the website be redesigned to make it more aesthetically pleasing. We will also add a static navigation bar, which will be always visible on the page, as opposed to links within the page for navigation.

5.5 Conclusion

With the feedback we received from prototype walkthrough we were confident that our final system would be an effective tool for use by the library and Ikamva Youth staff.

The two prototypes provided the insights required to produce a usable system. The next stage of the project is the design, implementation and deployment of a functional system. Using and commenting on prototypes also provided the users in the environment a chance to take ownership of the system. While doing the walkthroughs, one of the participants commented on how he felt empowered by being a part of this design process. This was the first time in his experience that users were involved from the beginning of the design lifecycle.

6. The Big Board Content Management System (BBCMS)

6.1 Introduction

In this chapter we discuss the design, implementation, evaluation and deployment of the Big Board Content Management system (BBCMS). We take into consideration the feedback received from the prototyping sessions to design a system to cater for the stakeholders.

6.2 Plan

In order to design a system we need to analyze current use cases and typical interactions a user might make when interacting with such a system.

We decided to use the same screen-sharing plan that was proposed during the prototype creation phase of the project. The library staff was given control over three of the eight blocks. The Ikamva Youth staff was also given control over three of the eight blocks. Two of the blocks would be reserved for student and community media creation and sharing which would be updated via the traditional means, i.e. from mobile phones. This plan is summarized in Figure 20.

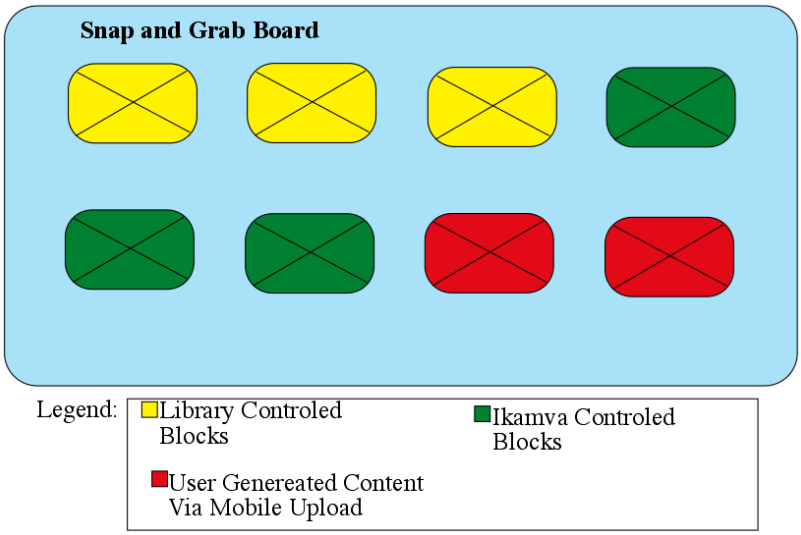


Figure 20 Proposed Screen Sharing Plan

6.2.1 Components of a Web Application

The web application will utilize a three-tiered architecture: the main interface layer which users interact with, the business logic layer which handles user queries and actions, and the data layer for storing the data to be accessed by the system [Eckerson, 2000].

PHP is a widely used, general-purpose scripting language that was originally designed for web development, to produce dynamic web pages [Hugh *et al.* 2004]. Thus PHP was chosen rather than HTML for the final system, as it is a more

powerful language to process forms and link to databases, allowing more functionality. Security implementations (via access control lists) would also be more robust in a PHP page, a second important reason for this change.

6.2.2 Security and Administrators

As there were various user groups accessing the web-based system, a security protocol was required with various 'layers' of security being created, varying by users. An access control was also required. The data being accessed was not likely to be sensitive, thus extreme security measures such as encryption were not considered. A simple password protection security system separated access among user groups and blocked access to outside users.

An administrator role to monitor the system was created. This administrator would be responsible for managing access control lists as well as monitoring general functionality of the system.

6.2.3 Use cases

Our plan was to afford different user groups access to the web application. The librarians and Ikamva Youth staff would have standard access to the system and their media packs. The administrator would be able to access all the media packs as well as access and edit information about user groups. We assumed the role of the administrator for the duration of the project, but it was envisioned that a Human Access Point would take over this role if and when the system was adopted for long-term usage. Figure 21 highlights the use cases of the respective stakeholders

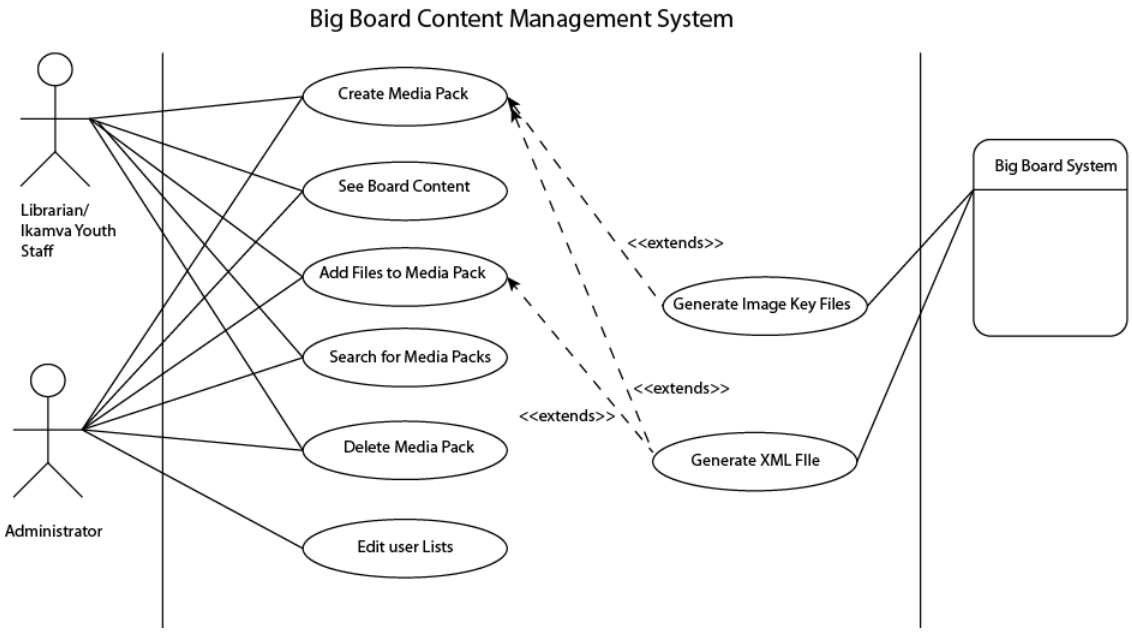


Figure 21 Content Management System Use Case Diagram

Figure 21 outlines the main functions of our system. All user groups will have access to the basic functionality of the system in accordance with their user categories. Viewing the Board, creating and updating the media packs as well as scrolling and searching through the media packs. Administrators will have additional responsibilities to monitor content and to edit the user access control lists. Creating media packs and adding files to the media packs will generate the appropriate XML and image key files required by the Big Board system.

6.2.4 Interface design

The interface of the system will incorporate comments received from our prototyping to design an interface. The main comments dealt with creating a homepage outlining the system functionality for new users, creating a static navigation bar and making the website look more like a web application rather than a prototype.

6.2.5 System Design

The functionality of our system was based on the use case diagram and our prototype feedback. We would create a standard login system using usernames and passwords. A procedure for adding new users would also be created. Once logged in, the home page displays features of the system. Each of the use cases were translated into a feature within the menu bar. The system contained links to pages to create a media pack, see the current board, access previously created boards and add files to a media pack. Figure 22 outlines the proposed plan for the website.

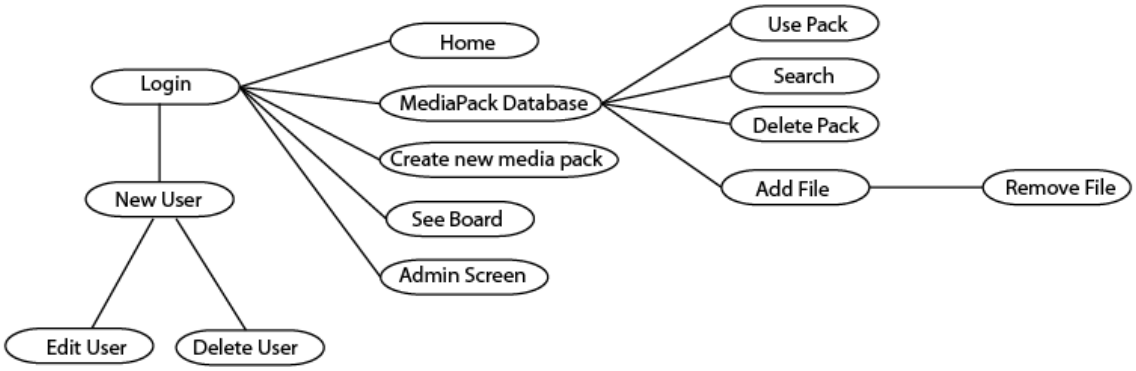


Figure 22 Site Plan

6.2.6 Database Design

As we will be creating a dynamic web application, we need to plan the database layer used by the system. The database containing all user and media pack information forms the backend of our system. The database contains three separate tables, with foreign keys to link them. One table will store the user data, the data required for any user to log into and use the system. The second table to create will store all necessary details for a media pack. The final table will store details related to the uploaded files. The table structure can be summarized in the following entity relation diagram, Figure 23, where PK indicates the primary key for the tables and FK indicates the foreign key to link the Media Pack table and File table when the application needs to know where each file belongs.

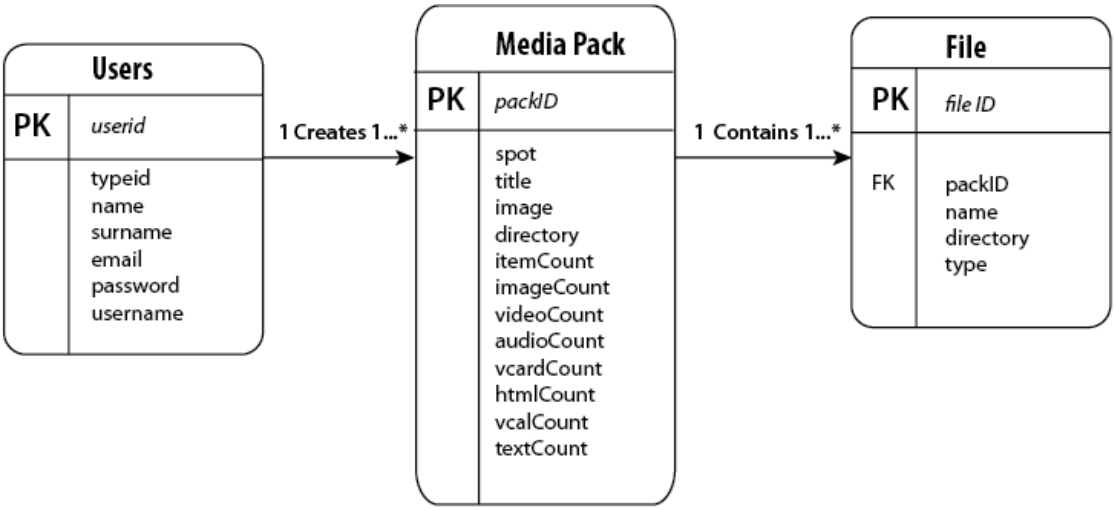


Figure 23 Entity Relation Diagram

The fields in the media pack table and the file table (e.g. the spot, title image, etc) are the same fields used by the Big Board. The system can generate the relevant XML files by calling on functions that take the relevant fields from the database. The user table is generated from standard user identifier attributes. It is envisioned that one user can create one to many media packs, and one media pack can contain one to many files.

6.2.7 System Architecture

The system architecture will accommodate both the Big Board system and the content management system on the same machine. Any uploaded media packs will be available for display on the Big Board. The situated display will serve all the relevant pages to the users and provide the portal to upload media. Figure 24 shows this interaction.

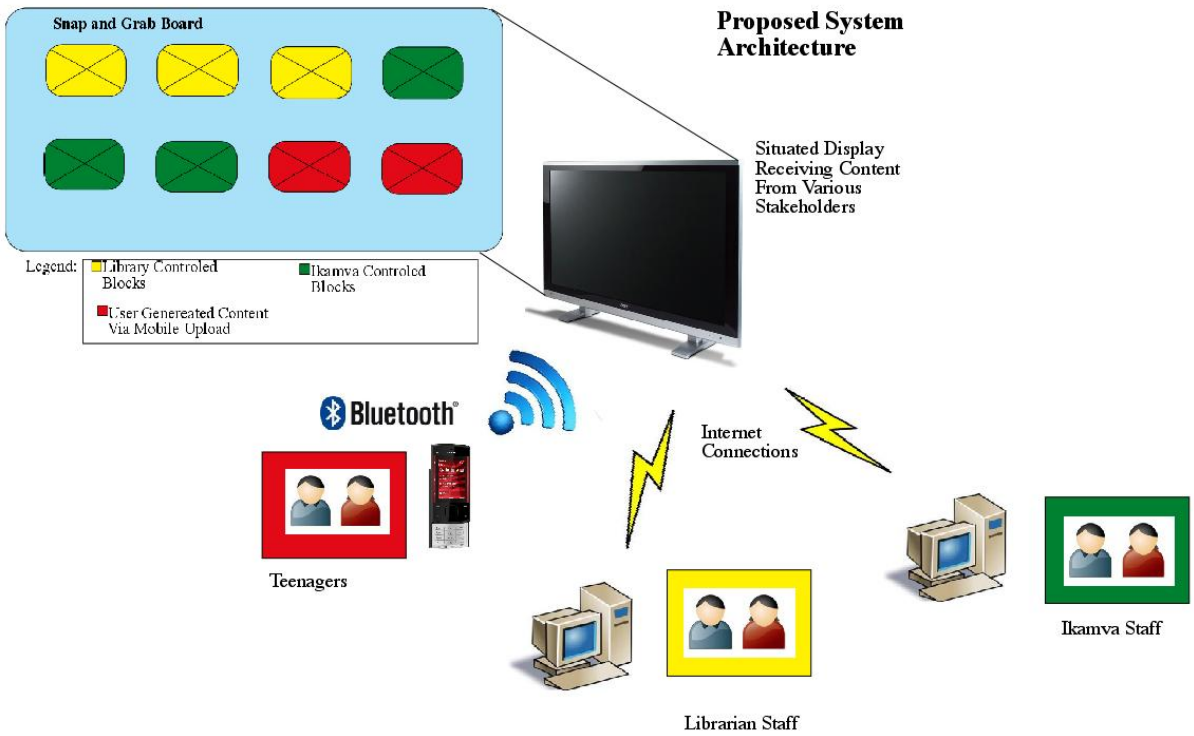


Figure 24 System Architecture

The teenagers will upload media via their mobile phones at will. The librarians and Ikamva Youth staff will use an Internet connected computer to upload media to the Board.

6.2.8 System Requirements

The basic hardware requirements for the electronic content management system are:

- A computer server: - Used to store all the Content management website files including the MYSQL database where the media packs and user data will be stored.
- A Reliable ADSL router or other form of Internet connectivity

The software required in order to operate the content management system is as follows:

- The actual content management system PHP pages loaded onto the server: - this includes all the necessary interfaces that interact with the stakeholders, as well as the back end administration system that deals with the user access controls.

- The Web server software: - The web server directs all incoming traffic to the appropriate file by using the servers IP address. We decided to use the XAMPP web server. XAMPP is an easy to install, open source Apache

distribution containing MySQL and PHP (Apache is the web server technology used). The database software used is MySQL. MySQL is an open source package that is trusted and widely implemented by many web developers.

6.3 Do

6.3.1 System Functionality

The first step in the system's implementation was to install all the necessary software onto our testing server. Specifically the XAMPP server was installed and configured and the database tables were created to store the data entered by the users utilizing the web application. The next step was to create all the necessary PHP pages used for the website.

Website development was divided into two sections, website administration, including user registration/login and access control lists, and the content management section with functionality to create, upload and manage media packs. During the prototyping phases of the project we described the Big Board system as the 'Snap And Grab" system to the stakeholders, and thus decided to continue to use that name in our interface.

6.3.2 Website Administration Section

A simple login system was implemented where a page is served to the users who would then input their login credentials. This screen is shown in Figure 25.

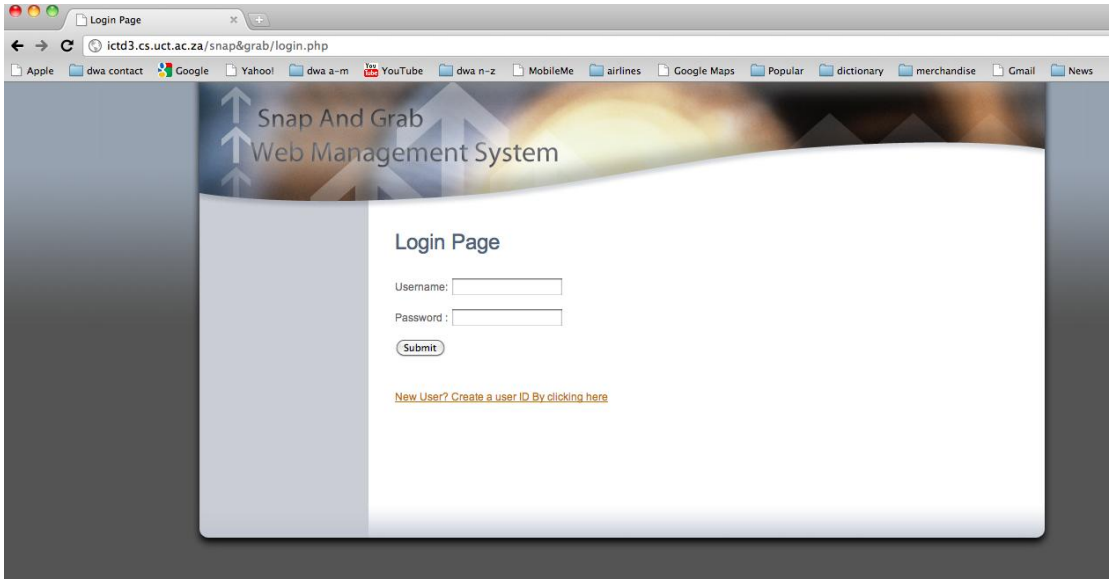


Figure 25 Login Page

If a user does not have login credentials, he/she can choose the link to create a new account and then is taken to a standard form where to input login details. This form is shown in Figure 26.

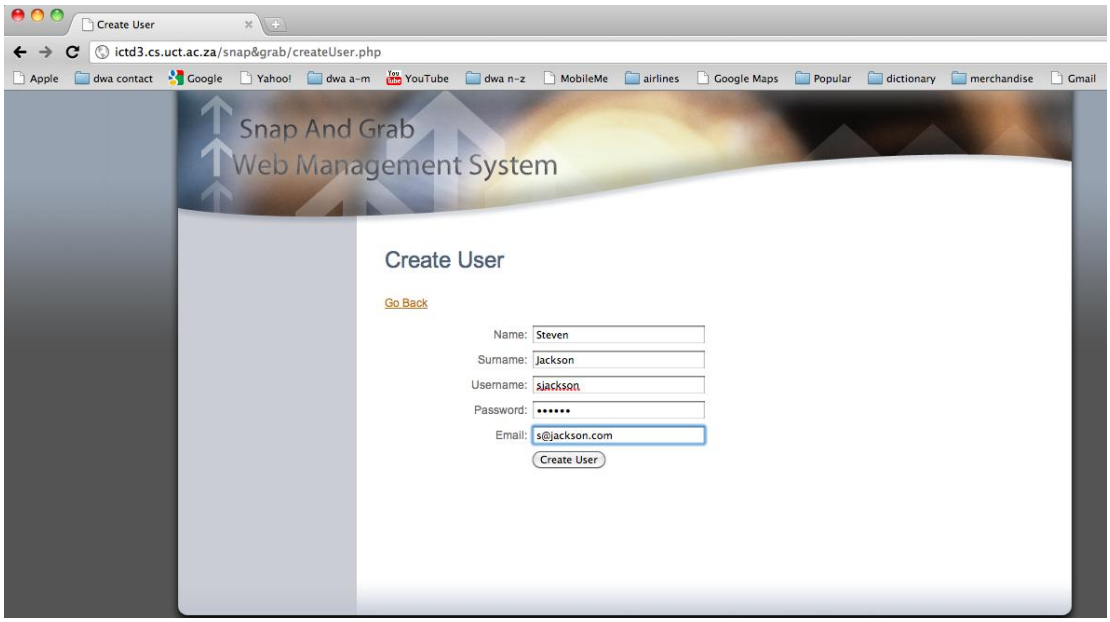


Figure 26 Create New User Screen

Once the user has been created, access to the system is delayed as user status in the database is set to 'unknown' and the user will not have access to any part of the system. This is to prevent unauthorized individuals from accessing or changing information in the system. The administrator has the responsibility to verify the person by contacting him/her and confirming that an authorized individual was trying to join the system. Once the user is verified, he/she has access to the system with the chosen username and password.

The administrator has access through the “edit user lists” section of the web application. This is shown in Figure 27. The process of validating a user is outlined in Figure 28 showing how the administrator can change the status from ‘unknown’ to ‘Ikamva’ or ‘Librarian’, thereby creating an access control list.

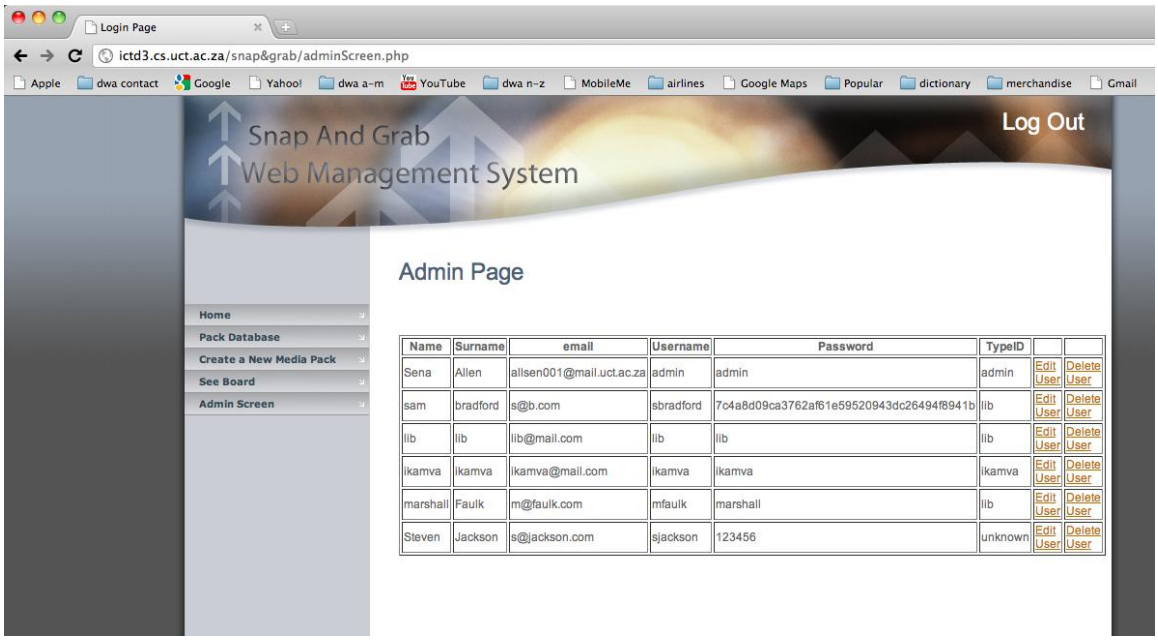


Figure 27 Admin Access Control List

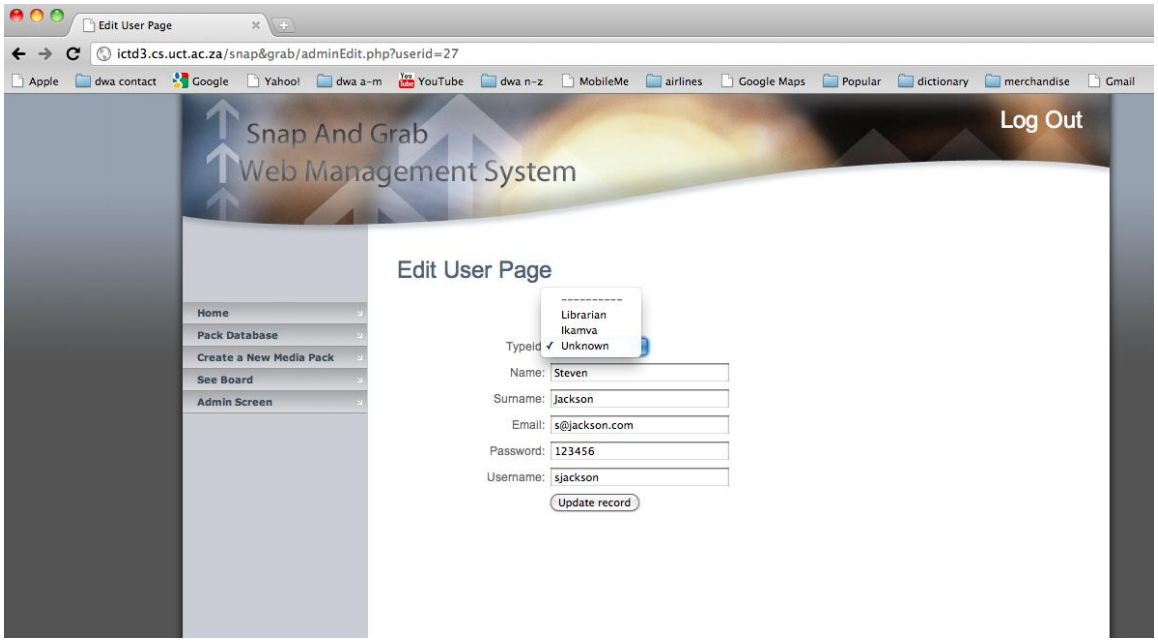


Figure 28 Edit User Access

6.3.3 Content Management Section

The main functionality of the system comes in the content management section. The three user groups (admin, library and Ikamva) have access to this section to differing degrees. All three-user groups have access to the same sections of the web application (with the exception of the admin who has access to the admin tab on the navigation panel). Figure 29 shows the homepage for the system once logged in. One can also see the current state of the Big Board by clicking on the See Board tab, illustrated in Figure 30. All the information that is presented to the user has been retrieved from a MySQL database using a number of SQL statements that the system calls (SQL statements are queries used to retrieve and insert information into a database).

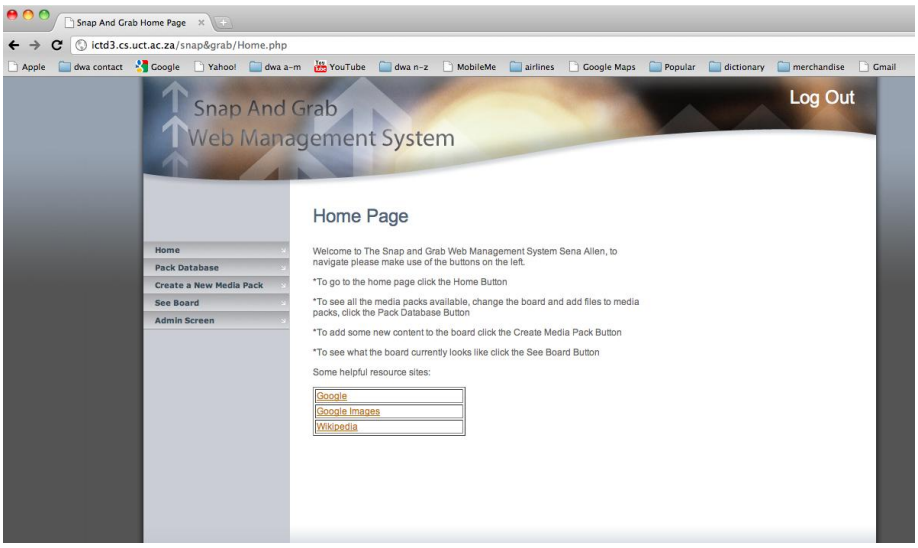


Figure 29 The System Home Page

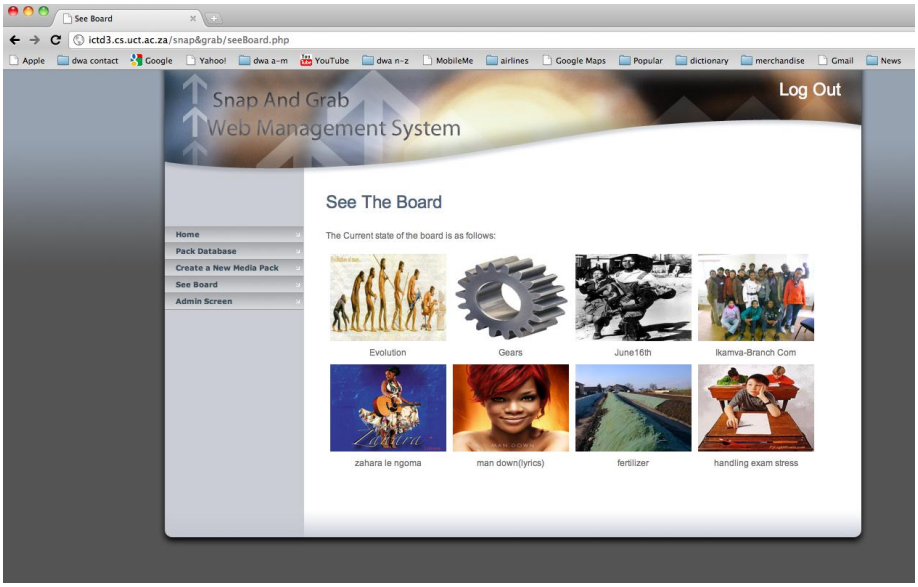


Figure 30 See Board Screen

In order to create a new media pack, a user clicks on the 'add content' tab where he/she is taken to the 'Add Content' screen shown in Figure 31.

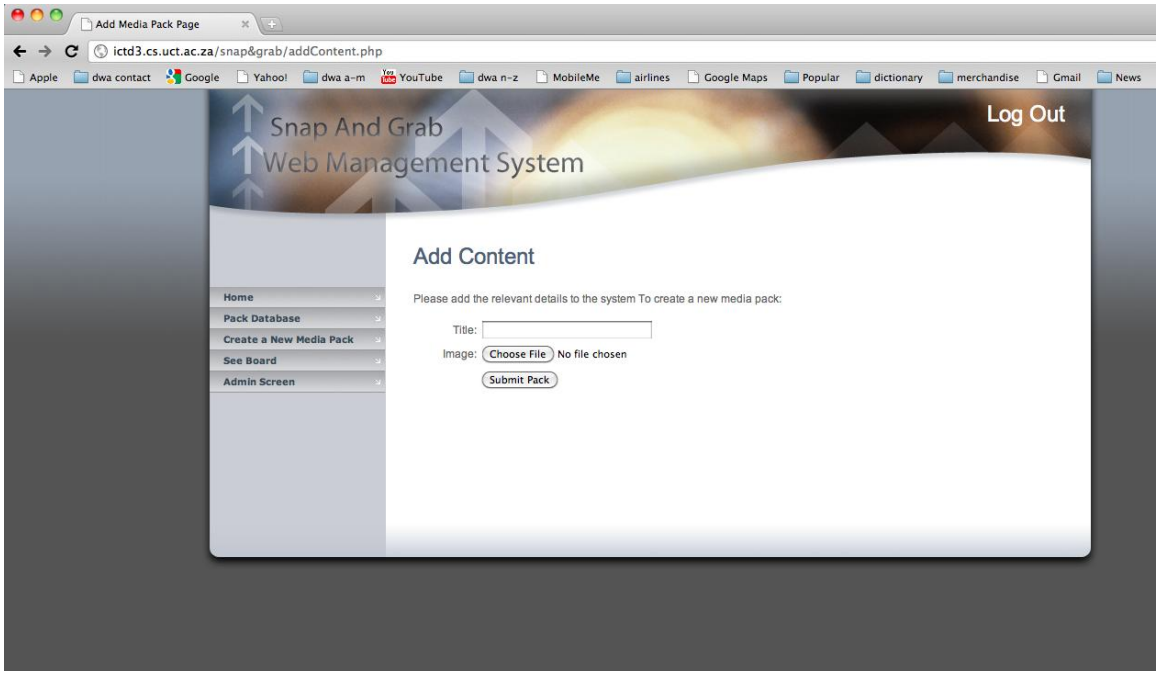


Figure 31 Add Content Screen

Both server side and client side validation checks were implemented on this page. For example, if a user clicks on the submit button without entering any data, client side validation prevents the form from being submitted. This is shown in Figure 32. Server side validation also occurs, if a user does not upload an image file (for example the user accidently clicks on a PDF file to load as an image) the server prevents the uploading of the file as it checks to see if it's a valid image file. Similar validation checks also occur when a user uploads media files to a media pack. Assuming the right file type and title screen are not left blank, a SQL query is executed to insert the data into the MySQL database once the user submits the form.

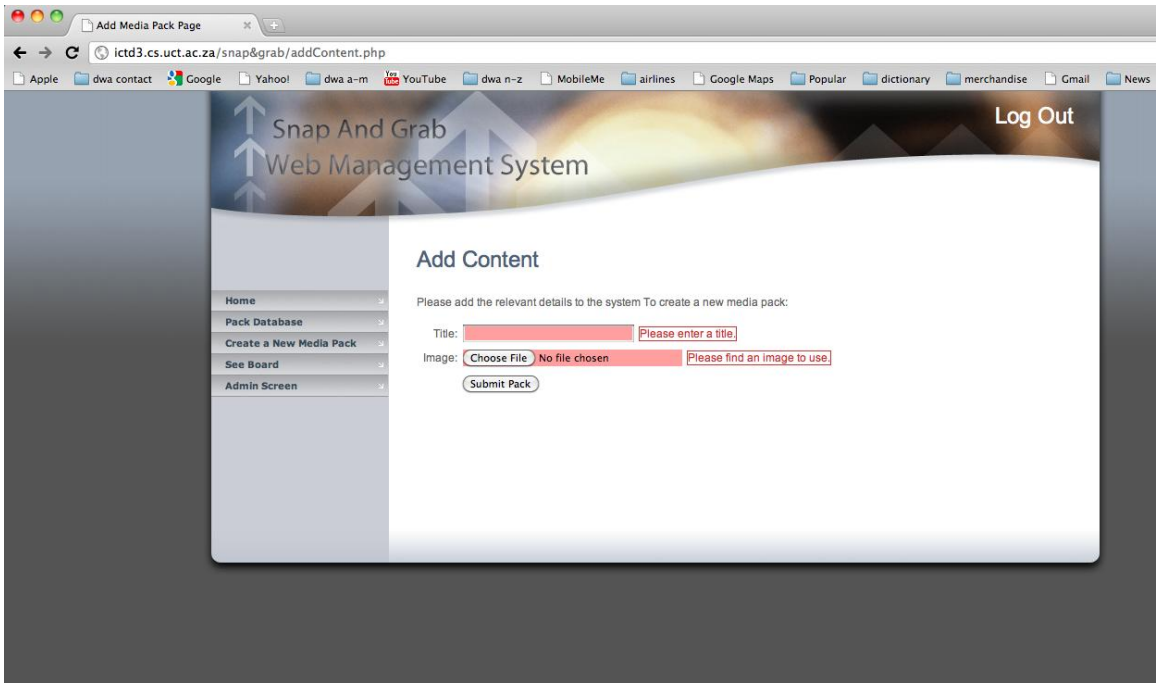


Figure 32 Validation Check

The 'Pack Database' page is where the editing and managing of the media packs occurs. What is displayed depends on the user group that accesses the page. If an administrator accesses this page, he/she has access to all the media packs. If a librarian accesses he/she only can see and manipulate blocks one to three inclusive, the same is true for Ikamva who have access to blocks four to six inclusive. Figure 33 shows the pack database page when being accessed by an administrator, and Figure 34 shows the same page when accessed by a librarian.

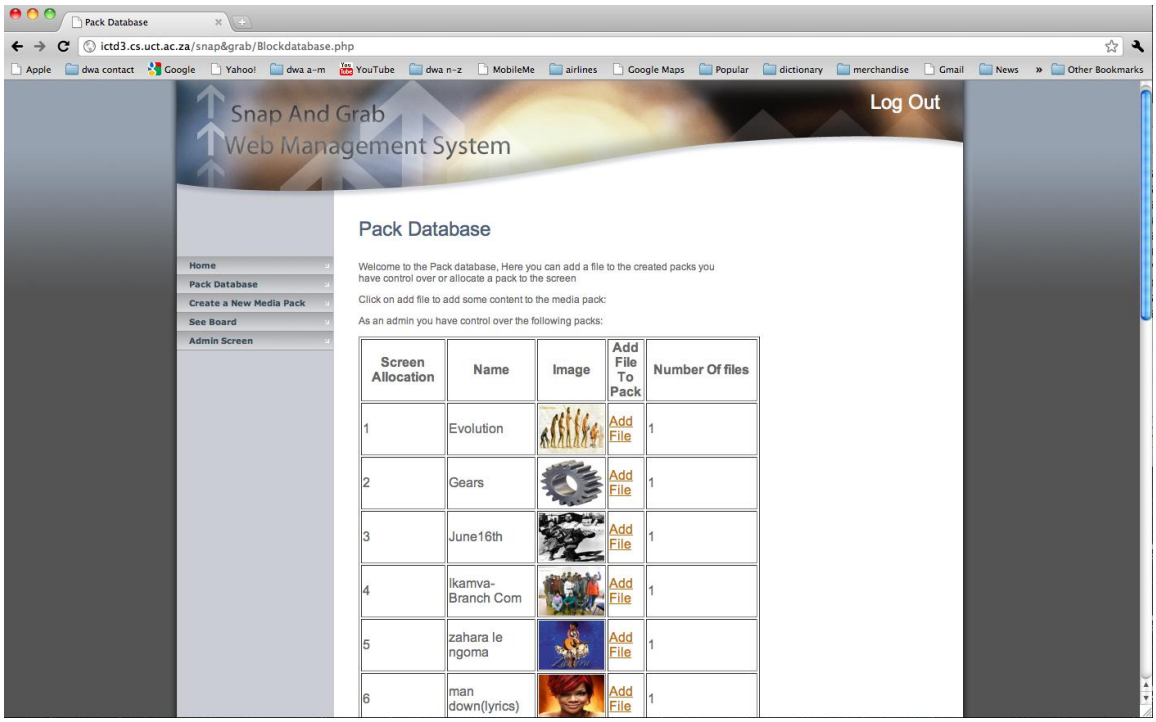


Figure 33 Admin Pack Database Screen

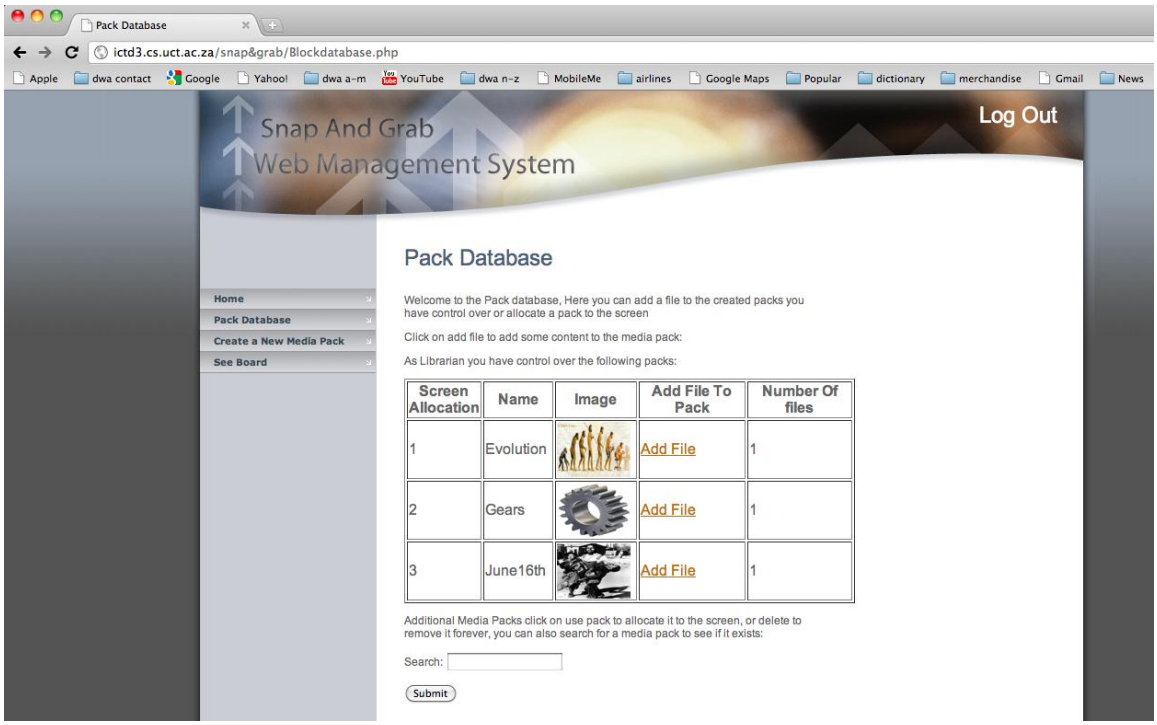


Figure 34 Library Pack Database Screen

The pack database also contains a list of all the previously created media packs to be re-used by the stakeholders, if they deem it necessary. During our ethnography and low fidelity prototyping evaluation stage of the project, the librarians explained that school projects are often reused in subsequent years, creating the need for a system to access and re-post previously created media packs. A user can browse through all the media packs and click on the use pack button to choose a block for the display of that media pack on the Big Board. Figure 35 shows an administrator accomplishing this use scenario, with options for placement. Figure 36 shows an Ikamva staff posting a pack and how it can be placed in blocks four to six inclusive.

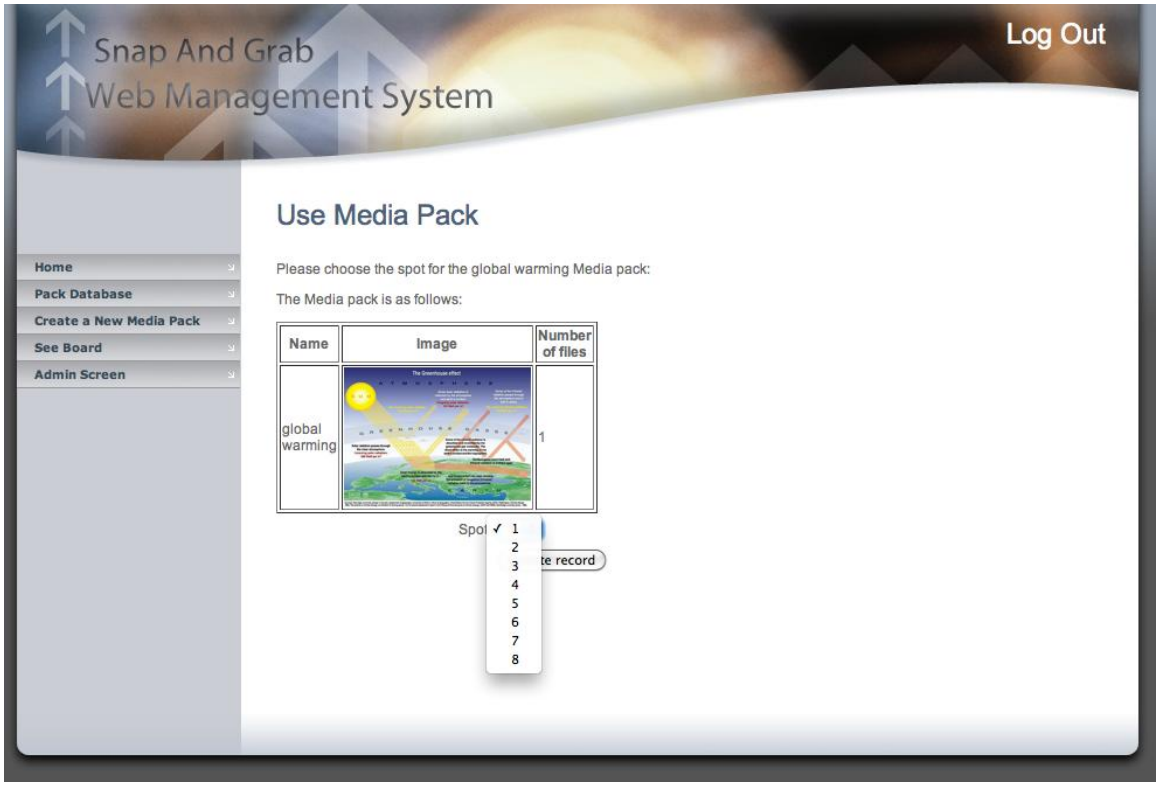


Figure 35 Admin Use Media Pack Screen

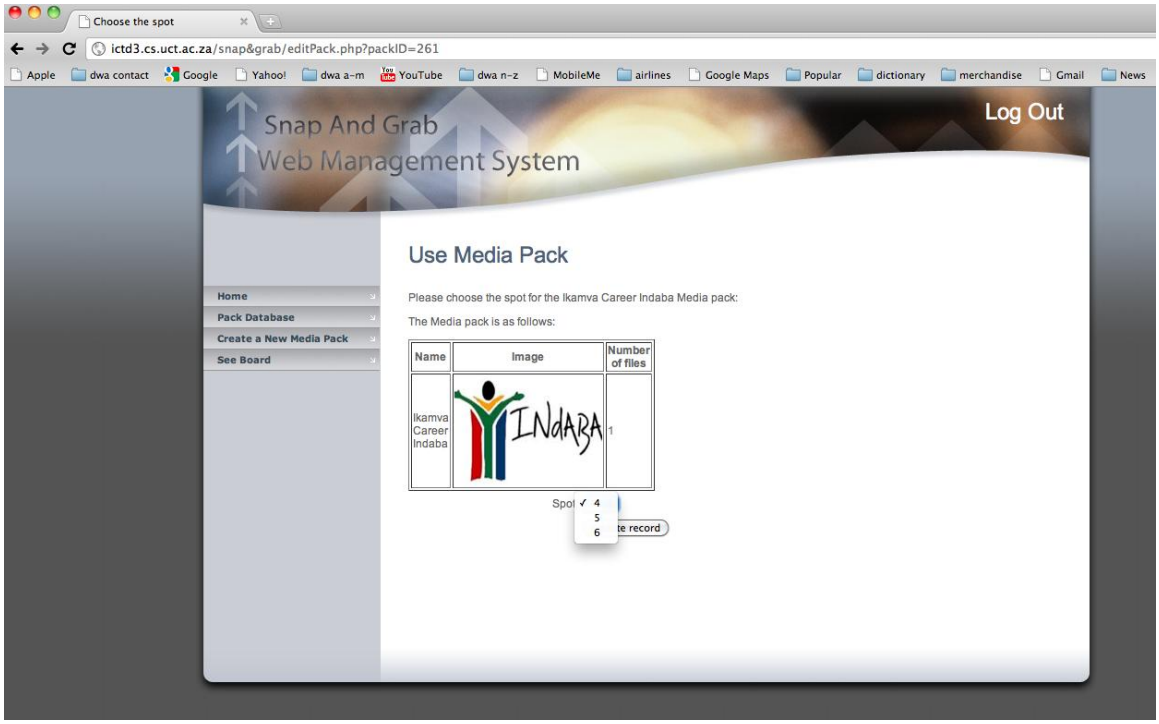


Figure 36 Ikamva Youth Use Media Pack Screen

Users can log out of the system at any time by clicking on the logout link on the upper right hand section of the screen. The static navigation bar is present at all times when logged into the system (a feature requested by the stakeholders). Other validation and warning techniques were used. When a user wants to remove a media pack he/she is taken to a page confirming that is actually what he/she wants to do. The media pack swapping function was designed so that to remove a media pack from the board, one must first identify another media pack to substitute in its place. This function was made to make it impossible for the users to ruin the Big Board file structure.

6.3.3 User Centred Design Implementation Summary

As we were following a user centered design mindset, comments received by the users guided the design and implementation process. The users requested the following features, which we implemented:

- A familiar login system similar to that of Gmail and Facebook.
- A homepage dedicated to having instructions exclusively.
- A page showing the current state of the Big Board, which we implemented in the 'See Board' section.
- A static navigation bar to be used to traverse through the website that was accessible at anytime.
- The ability to create media packs for the Board, which we implemented in the 'create new media pack' section.

- The users desired to separate the ability to create a media pack and to add files to a media pack as they felt this was a less confusing operation.
- The users felt that they should only see what media packs they had control over rather than seeing all the media packs. This was implemented in the 'Pack database' section where according to the ID of the person logging in, the appropriate media packs would be displayed

6.3.4 XML Media Pack Analyses

The system generates two types of XML files. One called the startup.XML file that the Big Board uses on startup to determine which media packs to display, and secondly, individual media pack XML files that the Big Board uses to send the relevant files. The startup.XML file is created each time the board structure is updated, for example if a user exchanges one of the media packs with a newly created media pack, the startup.XML file is regenerated. Similarly if the user adds or deletes files from a specific media pack, the relevant XML file will be altered. Figure 37 shows examples of part of the startup.XML file and a media packs XML file.

Figure 37 The Two-XML File Types, startup.XML (Left) and mediapack.XML (Right)

The information found in the database populates all the fields in the XML files. When a user creates a new media pack, he/she enters the title and cover image, this information is stored for later retrieval when the XML file gets generated.

6.3.5 Image Key Generation

For the Big Board image recognition algorithm to function, a key file pertaining to the image representing the media pack must be created. The Big Board functions by

having all the relevant key files (identified by the ID number) stored in one file. When a user takes a picture of a media pack, a key file is generated for that image, and then compared with all the key files of the media packs. Once a matching key file is identified the relevant files for that media pack are sent to the mobile device. Our system generates the key files in the same way the Big Board generates a key file for a user's image. We make use of the SURF (Speeded Up Robust Feature) libraries to generate the image key file. SURF is an image descriptor that can be used for image recognition [Bay *et al.,* 2008]. We call on the libraries using the PHP exec function within our code. When a user creates a media pack he/she has to include an image file (validation checks make sure he/she does so). This image is then passed as a parameter for the SURF algorithm and a key file is generated and stored on the server.

6.3.6 System Testing

Before presenting the system to the users, the system underwent a series of tests to remove bugs and ensure the system was appropriate for usage.

We ran a series of white box and black box tests. White and black box tests are software engineering terms, where white box testing investigates the internal structure of the code, and black box testing checks the external structure (e.g. the user interface interactions) [Chen *et al.*, 1998]. These tests occurred in the development labs during, and directly after each prototype implementation phase, in order to test the functionality of the system. The tests focused on checking to see that the functions we used produced the appropriate outcomes. This was accomplished by executing the methods from within the code; for example, the 'create a user method', where we tested the internal structure of the code by running this code to see if a user is created when the method was invoked. We then tested the interface interactions by calling the method from within the interface and proceeding to the next test case when we observed the expected outcome.

We tested the system during the implementation phase of the iteration as we added functionality to the site. This was done by checking to see if the expected outcomes occurred within each part of the system. We tested all functions again once the system was completed to see if we had overlooked anything, and to see how a user would interact with the site in its entirety. We first tested the links within the site to see if each one mapped correctly to the desired page. We did this by starting at the login screen and systematically traversing the website. We also tested the relevant functions of the website to confirm the expected outcome. We checked to see if the relevant XML files were created and confirmed that the structure used by the Big Board was correct.

The image key file was tested with the Big Board by observing if the file would produce a match, which did occur. The testing process started by using 15 generic images of various animals and scenery that were significantly differentiated from each other. Keys were generated for the images using the SURF algorithm in the

system and were subsequently tested with pictures of the images using the standard Big Board procedure of taking pictures and then using Bluetooth to send pictures to the system to see if there would be a match. The expected outcome occurred for each of the 15 test cases. The next phase of testing involved using the system to create media packs for the University of Cape Town ICT4D Centre for a public event. Eight media packs were created representing the various projects that were taking place at the time and images were chosen to highlight the projects. Two of the media packs caused conflicting results and the correct match would not occur when a picture of either media pack was sent to the system. It was concluded that the images were too similar and the SURF algorithm could not significantly differentiate the image files to produce the correct outcome. Replacement images to represent the media packs (that were significantly different) were used and the correct outcome was noted. It was thus realised that when using the system there was a limitation that the images would need to be varied for the image recognition algorithm to differentiate between media packs. The user login/registration system was also tested to make sure each stakeholder could only manipulate his/her sponsored media packs.

6.4 Observe

6.4.1 Peer Review And Heuristic Evaluation Of The System

Before the system was taken to the stakeholders in the environment, a heuristic evaluation of the system with four members of the ICT4D lab in the University Of Cape Town, who had previous experience in user interface design, was conducted. The purpose of this was to review the aesthetics of the site as well as to gather second opinions of the website structure and identify any potential problem areas. The site was generally regarded as being well thought out. Some features, however, were suggested for change. Since participatory design practices were considered in the prototyping, the features would stay, specifically the “see board” functionality being used only for display purposes, homepage used solely for gathering information about the site functions, and separating the “adding files to a media pack” function from the “creation of a media pack”.

Some rudimentary aspects were changed, such as adding more padding to the cells in the see board page, adding a more centralized look to the media pack database and other cosmetic changes.

One major change was implemented to combine the administration log in system with login system of the main page. Before the change, the administration section was completely separate from the main web application section. After the change, part of the navigation tab had a link, only visible to the administrator that would access the ‘access control list’ of the web application. This change would prevent an administrator from having to log in twice if he/she wanted to change the access control list and access the Big Board content. An admin user has control over all the media packs as well as the user groups of the system.

6.4.2 System Evaluation

Continuing the iterative design lifecycle, we scheduled another prototype walkthrough/critical incident interview session with the stakeholders. We modified the walkthrough task sheet to include additional questions to reflect the system changes. The goal was to get design insights for the more capable system, and to ascertain whether it was ready for use by the stakeholders. The task sheet can be found in Appendix B.

6.4.3 System Evaluation/ Ikamva Staff

A follow up prototype session walkthrough/critical incident interview took place to evaluate the system. Four of the Ikamva staff members went through the prototype task sheet in groups of two as per the constructive interaction methodology. Neither group encountered difficulty in system use.

The participants reported that the system was easy to use and that they would be able to upload content to the display. The participants identified a few minor changes to the system. These were as follows:

- When creating a file there was no need to have the end user name the directory to which the content will be saved. The solution was to remove the field and have the directory name be the same as the title. This should not create any problems and will lessen the number of fields the users see.

- Arrange the media packs by date created rather than in alphabetical order, this made it easier to find the most recently created media pack.

- Add search functionality to the pack database allowing the user to enter a desired subject and have the relevant media packs come up if they exist. The participants thought that when there would be more media packs in the pack database, it might get tedious trying to search through a long list of packs.

Logging in was familiar to the participants as was navigation through the web page. The creation of a media pack was accomplished as expected, as well as the changing of the media packs already on the board. The ‘see board’ page was also commented on as being useful. The users were satisfied that the system was ready to be deployed, once the issues highlighted above were dealt with.

Following the session the Ikamva Youth staff held a brainstorming meeting amongst themselves on how to develop the initial content to upload to the Board. This event was initiated by the Ikamva Youth staff out of their own accord, and did not follow any of our methods. This meeting is an example of how they started to take greater ownership of the system. They suggested that one of the staff members be put in charge of the system and all content will be passed through him (subsequently he become our new Human Access Point for the user group). The brainstorming session was also used to identify what content they wanted to create and

disseminate to the youth in the area. One of the participants thought that they might need more than three blocks for content but was willing to compromise given the screen sharing dynamics presently in place with the librarians.

6.4.4 System Evaluation/ Librarians

The librarians undertook a similar process to evaluate the system. The general consensus was comparable to that of the Ikamva staff. Logging in and using the system was satisfactory and the participants completed the task sheet's activities, and were able to create and edit media packs.

One observation was that choosing the directory name when creating a media pack caused some confusion, further justifying its removal. The participants understood the navigation structure and all the functionalities and commented on the user friendliness. The librarians did not have anything further to add to improve the system and said that it satisfied their requirement to create media packs to display on the Big Board.

The librarians also chose to put one of their members in charge of creating content for the board. The librarians agreed that it would not be necessary to have multiple logins for different librarian users. One login credential was enough. A 'librarian' user was created with a pre agreed password.

6.5 Reflect

6.5.1 System Refining

We addressed the users' concerns by building them in to the next iteration of the content management system. The first concern was confusion with the directory text box in the 'create new media pack' section of the system. We removed the separate directory text field and set the directory name to be the title.

The second area of concern was the ordering of the media packs that were not being used in the media pack database. We had set the packs to be displayed in alphabetical order, but the users preferred to list the most recent media packs first. We changed the SQL command to retrieve items from the database and sort by date created rather than title.

The third concern was adding more robust search functionality. Previously a user would have to scan all the media packs in order to find one for reuse. While this was not a problem at the time, the users felt that when more media packs were created it might be difficult to find a desired media pack. We added a search form to the pack database page where users could enter the title (or part of a title) of a media pack to see if it had previously been created. Figure 38 depicts this new function.

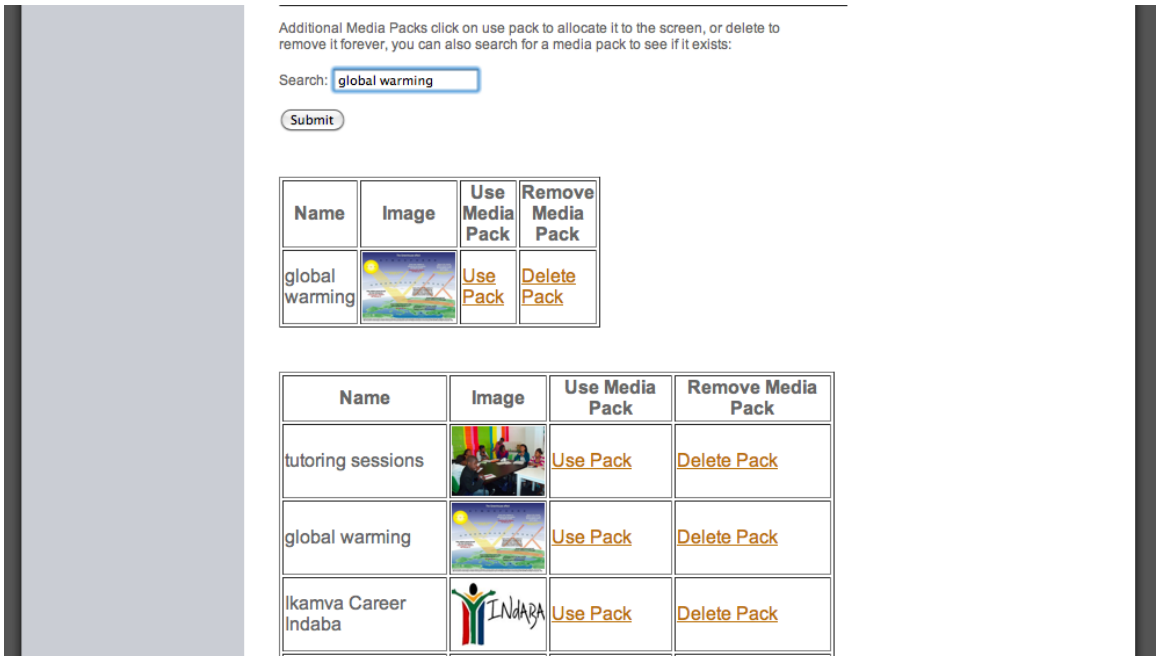


Figure 38 The Search Function

After making these adjustments we decided the system was ready for use by stakeholders in the environment.

6.5.2 The BBCMS Deployment

We presented the system to the stakeholders after the proposed changes had been implemented. The users were satisfied with the refinements and suggested we deploy the system for their use. We had satisfied their evaluation criteria, providing a system that they helped develop which would provide them with a portal for them to create content to be disseminated to the youth.

In order to deploy the system, a server needed to be created to host the web pages and store the uploaded content. The original architecture of the system planned for the situated display to act as the server, where all uploaded content would be directly available to the situated display once a user uploaded it. This architecture proved infeasible given the limitations of the library and the technical restrictions imposed by regulatory authorities. A static IP was not available for the server, and upload speeds would be very slow and unreliable in the environment. Instead of having the Big Board machine set up as the host for the web application, we hosted the content management system on the computers at the University of Cape Town.

In order for the Board to access the content created by the stakeholders, we used an open source program (Windows SCP) to access the files on the server and place them onto the Big Board machine. We decided in consultation with the stakeholders, that an administrator would update the Big Board on a weekly basis with new stakeholder content. The stakeholders deemed this time frame sufficient. During the ethnography and prototype evaluation phase of the project, the stakeholders

envisioned that a media pack's lifecycle would be 'longer than three weeks in order for the media packs to penetrate into the community'.

6.6 Conclusion

Both sets of stakeholders agreed that the system satisfied their requirement of being able to upload media for the community. As the users were involved in creating the system, they would not need to go through extensive training on how to use the system and thus expressed eagerness to adopt it for usage immediately. Our evaluation criterion to create a system with stakeholder inputs had been met.

Our second evaluation criterion was that the stakeholders use our system to upload media, and the community would access and use this content to confirm the value of contextualized content. After the system was made available to the stakeholders we would monitor the Big Board usage, to see if usage would increase after stakeholders had been empowered to create content. We would also determine if proposed screen-sharing plans were appropriate and if adjustments were required. The next chapter reports the results of this longitudinal study.

7. Longitudinal Study with The BBCMS and the Big Board

7.1 Introduction

To satisfy our evaluation criteria for providing media freely to teenagers and empower the stakeholders in a low-income urban environment, we created the BBCMS, a situated display content management system and deployed it for the stakeholders to use. We devised two treatment conditions in two phases where we varied the control the stakeholders had over the board to learn the value of contextualized content and to measure the impact of this empowerment.

In the first phase we gave control to the stakeholders over half the Board's content, and the other half remained with us. In the second phase we empowered the stakeholders with the screen-sharing plan that we highlighted in the previous chapter (i.e. give full control to the stakeholders regarding the content on the Board). This chapter describes the experimental conditions and highlights the results.

7.2 Hypothesis

After we developed the system we wanted to see the effects that using the system would have on the community. With two experimental conditions we would monitor the Big Board to see what different usage patterns emerge. We postulated that the main reason why usage patterns were low during the technology probe stage was due to the fact that the content used was not valuable to the community. We gradually empowered the stakeholders in the environment who understand the community more than we ever can, with the means to create content for the community. By empowering these community members, they would create more valuable content, with accompanying increased usage of the Big Board.

7.3 Phase 1

7.3.1 Plan

During the technology probe phase there was minimal use of the Big Board. During that time the content that was made available was completely created by us from insights acquired from interviewing and observing the youth. We wanted to see if the introduction of contextualized content would increase usage. If an increase in usage did occur, then the value of empowerment would be confirmed; if there would be no increase in usage, then the Big Board might not be a viable solution for media dissemination.

Thus the first treatment phase was to compare the desire for stakeholder created content with that of content we created. The proposed display-sharing plan was to give the librarians control over two of the media packs and the Ikamva youth control over another two of the media packs. The other four media packs contained content created by us, on topics that we felt might be useful such as career

information, current affairs, information about the University of Cape Town and information about local popular figures. The community had the power of uploading content via their phones to replace existing media packs when posted. We deployed this display-sharing plan for seven weeks. All relevant parties made use of the agreed content management system to create media packs for the Big Board. The stakeholders were informed of the timing of this phase of the experiment and how they would be given more control as prior arranged on the completion of the seven weeks.

The librarians desired to create media packs about school projects that were occurring at that time (evolution and about the significance of a timely public holiday). The Librarians requested training on how to find information on the Internet, and thus were shown how to make use of the Google search engine to locate information and pictures and also how to use Wikipedia, given the open source nature of the content. Two of the librarians developed initial media packs taking information from Wikipedia and uploading it to the board via the content management system.

The Ikamva staff appointed their staff member in charge of all social media in the branch to oversee and implement our system. While he was compiling the content for the Ikamva blocks, another member of the organization suggested posting an informational section about two new interns that were going to serve for two months. They directed the youth to the board to get information about these interns. Another media pack was created about an Ikamva Youth excursion that had taken place to share pictures about the event.

7.3.2 Do

Once all the relevant media packs were uploaded to the Board, our experiment commenced. The first phase lasted seven weeks. During that time the stakeholders were free to edit their respective media packs however they chose.

The librarians created another media pack on a topic requested by the students (a school project on dinosaurs), and swapped it with the evolution media pack roughly mid-way through the experiment.

The Ikamva Youth media packs remained unaltered throughout the first phase because our Human Access Point appointed by the NGO unfortunately passed away, which temporarily immobilized the NGO with respect to using our system.

We chose to update two of our media packs, uploading additional information about a variety of career paths to generate interest and providing wallpaper images for the youths' phones.

7.3.3 Observe

After the end of the first deployment phase, we tallied the Big Board usage statistics and interviewed the librarians on the use of the Board. Our hypothesis on the value of contextualized content was confirmed. The majority of the media packs that were downloaded were those that were created by the stakeholders. 26 distinct mobile devices accessed the screen and a total of 38 media packs were downloaded: 29 were the library/Ikamva media packs and 9 were our media packs. These results would suggest that the stakeholders would have a better insight into what the youth would want when compared to us researchers. We can also deduce that an enhanced Big Board system can be a tool for information dissemination, given the increase in usage when compared to our initial technology probe where only 10 mobile phones chose to download content.

The situated display in the environment fell victim to crime during the experiment. The device required a Bluetooth dongle to run and the display was rendered useless without it. The library has been subjected to ongoing petty crime and vandalism and a librarian was quoted as saying 'some people here have the urge to steal anything with no regard for the community'. The Bluetooth dongle was located in the back of the display and resembled a flash drive. The librarians suspected that the dongle was stolen as a result of this misinterpretation. A new dongle was purchased and glued into the USB port, essentially damaging the hardware of the screen, for security reasons. But unfortunately this did not deter theft and the second Bluetooth dongle was also stolen. After the second theft we replaced the dongle with a computer with built in Bluetooth capabilities (together with a security cable tied around a pillar to make sure that the computer does not get stolen).

Ikamva Youth was also a victim of tragedy during this first phase. A politically affiliated group mistakenly attacked the NGO office. After harassing the staff a petrol bomb was thrown into the office space. The NGO suffered property damage, equipment damage and data loss amongst other things; thankfully no members were physically harmed in the event. In addition to destroying the office, the attackers threw stones into the Nazeema Isaacs Library and torched the adjoining Zimele Pre-Primary School [Ikamva Interview, 2011]. The Ikamva operations were severely restricted by this misfortune and our system was understandably neglected as they turned their attention on rebuilding a new office. We thus had to work around the schedules and limitations that resulted. Figures 39 and 40 show some of the damage experienced by the NGO workers as a result of the attack.

Figure 39 The Ikamva office after the bombing [Ikamva Image repository, 2011]

Figure 40 Melted computer screens [Ikamva Image repository, 2011]

7.3.4 Reflect

The results obtained after the experiment would suggest that empowering the stakeholders does provide value to the community. There was an increase from 10 mobile devices to 26 unique devices, where the only variable factor that we changed was the empowering of the stakeholders to create content on four of the media packs on the Big Board. We also observed the difference in the community preference when choosing which content to download. The stakeholder created content was more popular than the content that we created, highlighting the value of contextualized content (29 stakeholder created media pack downloads compared to only 9 of our own downloads). We would expect usage to grow as youth get accustomed to its availability,

The most popular media pack during that time was the holiday significance media pack (Specifically it was June 16, otherwise known as the Soweto Uprising, which commemorates the day where a group of youth stood up to the oppressive Apartheid regime). The pack was downloaded 12 times throughout the seven

weeks, and underscores the value of empowering the individuals, as we would have never known that such a topic could be of value to the community.

We also monitored community uploads via their mobile devices. During the experiment, 16 mobile devices tried to upload content to the board, but only two people succeeded. This suggests that the current uploading process via the phone might not be the best option for community uploading without additional training. When analyzing the usage pattern it was noticed that, of the people who failed to upload content, the most frequent reason was that they did not submit a V-Card to create a media pack (which is needed by the Big Board system to distinguish uploads from downloads, and to create a label and space for the media pack). They would upload their media without a V-Card and the system would not be able to create a media pack as the system recognized it as a download request, thus failing to find a match via the photo recognition process. The user was informed that a match had not occurred. As a result we modified the Big Board. When a user sent media before sending a V-Card, the system would send back an instructional text informing the user that they must send their V-Card in order to create a media pack. This process for sending a V-Card was also highlighted on an instructional poster located next to the Big Board for prospective users to read as necessary.

The next phase was to confirm our hypothesis that empowering the users would increase Big Board usage, as contextualized content is the most appropriate content and a means to drive technology usage. We were looking for continued, increasing usage of the Board. If there were more contextualized content available, there should be an increase again in Board usage.

7.4 Phase 2

7.4.1 Plan

The second treatment condition gave the stakeholders complete control over the Board. We removed our media packs from the Board, and implemented the screen-sharing plan highlighted in the design stages of the project. The librarians and Ikamva Youth each would have control over three of the media packs and the community were also free to upload to the two remaining blocks. As there was only one media pack successfully uploaded by the community, each stakeholder was given space for one additional media pack in the interim time until a community member uploaded a new media pack.

Both groups of stakeholders were consulted again to inform them of the new empowerment scheme, and to gather their ideas on how they would utilize the Board. Both stakeholders had similar agendas; i.e. disperse more media to the local youth.

The librarians decided to continue with the creation of media packs based on the school projects. After being asked questions about a school project by the youth, the

librarians researched that topic on the Internet and then created a media pack to support the project. The librarians immediately created three more media packs at the beginning of phase 2: one about fertilizers, another about nitrogen cycles, and a third media pack about global warming. A forth pack about levers and gears was created later on in phase 2.

After the untimely death of the Human Access Point, the Ikamva youth NGO elected a committee of three individuals who were youth living in the community and were part of the Ikamva program to be in charge of the media sharing. The power over the board was given to these individuals. The committee immediately created four media packs. The coordinator of the branch requested a media pack announcing a meeting for all the committee members happening that week with the details of the meeting forming the contents of the media pack. The second media pack consisted of advertising for an upcoming careers fair that the NGO was promoting. The committee also created two more media packs with images taken from an excursion some of the Ikamva students attended at an aquarium and at a media workshop. The committee decided that two of the media packs would be Ikamva Youth announcement/ advertising packs and the other would be a pack by them for the youth i.e. something that would appeal to a young audience and was 'fun'. It was then decided that the next media pack to be created would be the sharing of lyrics to a popular song.

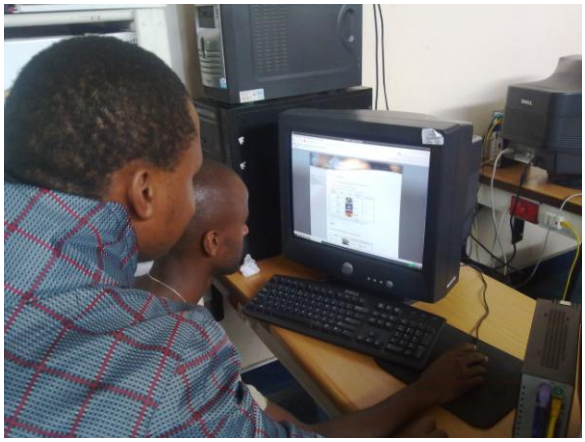


Figure 41 Ikamva Youth staff interacting with the System

7.4.2 Do

The Ikamva Youth media committee suggested holding an instructional session to introduce some of the youth that attend classes to using the Big Board. They suggested holding a workshop after one of the Saturday tutorial sessions (the main event at Ikamva Youth). After the tutorial session, they gathered 20 of the participants and trained them on how to use the Big Board system. They also informed the participants that if they had any requests that they could act as a mediator to put new content up. After they finished explaining how to make use of the system, some of the youth remained behind to download content. One of these students was part of the Ikamva Youth branch committee, and one of the media

packs contained information for branch committee members. He was particularly eager to download that media pack. The youth were encouraged by the committee to spread the word on how to use the system.

The Board was updated at irregular intervals during phase 2 of the experiment. The librarians uploaded two additional school project information packs to the Board after they felt some of the content needed to be updated. When questioned on the frequency of this updating, they said they felt that some of the content needed to be refreshed. Interestingly, one of the media packs (specifically the June 16th media pack) was never replaced. The librarians said that they frequently get requests for information regarding the holiday and felt that it should remain on the Board.

The Ikamva Youth committee updated their media packs on two separate occasions. The committee uploaded a media pack containing song lyrics to a recent music track that they felt would be popular. They also uploaded a number of other Ikamva event details. Two weeks before a block of exams for the more senior learners, the committee uploaded a media pack with tips to handle exam stress and how best to prepare for exams. After the exam period was over, the committee wanted to 'celebrate the upcoming holidays', and replaced the exam preparation media pack with that of a local music track.

7.4.3 Observe

After a period of ten weeks we gathered the Big Board statistics. Big Board usage increased when compared to the usage during the previous phase. The Big Board usage logs recorded 59 unique phones interacting with the Big Board. 105 media packs were downloaded. Of those 105, 62 were Ikamva Youth generated packs and 43 were library-generated packs. The most popular Ikamva Youth created media pack during the experiment was a media pack containing music lyrics, with 27 downloads. The most popular download from the Librarians was interestingly still the June 16 media pack (the librarians did not wish to remove this pack) with 19 more downloads. Other popular media packs included the local music artist pack and the exam stress information media pack.

The librarians reported an increased desire to use the Board during this time when compared to the previous experiment and the technology probe. They reported saying 'interest to use the Board is slowly increasing amongst the youth'. They also reported having more youth coming and asking them for help on how to use the Board and requesting various topics.

7.4.4 Reflect

Over the course of the longitudinal study the librarians wished to keep the June 16 media pack and not replace it. We questioned them about the logic behind this decision, and they said that the learners are always asking about the significance of public holidays and June 16 was a particularly important holiday for the community as it commemorated a significant event in South Africa's history pertaining to the

Youth. The media pack was found to be the most downloaded pack with a combined total of 31 downloads during both experiment periods.

Figure 42 Some Youth using the Big Board

The music lyric media pack was on the Board for a significantly shorter period (Five weeks) but was the second most downloaded object with 27 downloads from the Board. This suggests that these non-academic media packs are very popular with the teenagers in the community, but academic media packs are still desired. Ikamva's branch committee media packs targeted only a small number of members (There were nine members of the committee at the time). Though resulting in a relatively small number of downloads, these packs well served the target audience.

The upload statistics were, however, lower during the second experiment when compared to the first experiment. 11 devices attempted to upload content to the board, with only one succeeding, suggesting that another means of uploading content needs to be thought out. Our modification of sending instructions to a user's phone was not enough to motivate a user to send a V-Card to upload content.

7.5 Conclusion

From our intervention we can confirm our hypothesis that empowering the stakeholders in the environment will positively affect Big Board usage, and that Big Board can be used as a media dissemination tool in the environment. During the course of our study, 34 different media packs were created using the content management system that we prototyped. We created 18 media packs, and the stakeholders created 16 media packs. The first phase of our experiment highlighted the lack of desire for our media packs and the strong desire for the stakeholder created media packs, and the results of the second phase confirmed that a fully controlled stakeholder Board generated the most interest in content downloading. We also found that the current Big Board architecture for community uploading via a mobile phone might not be the best model in that environment, as we noticed a decrease in the number of upload attempts via the mobile phones, and a low success rate. This suggests that changes in Big Board architecture are needed and might lead to an increase in the community success rate.

8. Conclusions and Future Work

In this chapter, we summarize the research project, answer the research questions outlined in chapter one and review a number of lessons learnt while undertaking the project. Finally we suggest extensions for future.

8.1 Summary of the Project

We entered an environment (Khayelitsha Township, Cape Town) to better understand mobile technology practices amongst low-income urban teenagers and supplement these media sharing practices by providing a means of media dissemination. We allied ourselves with two stakeholders in Khayelitsha, the Ikamva Youth NGO and the Nazeema Isaacs local library staff. We carried out a survey, two formal interview sessions, and informal interviews in order to better understand the demographic prior to introducing new technology into the environment. From the results of these inquiries we concluded that using a situated display (specifically the Big Board) would enhance the dissemination of content to the youth. Both sets of stakeholders wished to make use of the Board to distribute content to the youth in the community. We used participatory design techniques to devise The Big Board Content Management System (BBCMS). We tested, modified and deployed the system allowing both partners and users to create media packs for the BBCMS. We monitored Big Board usage for more than 5 months after deploying the BBCMS. As we increased the level of empowerment, Big Board usage increased.

Our BBCMS system was a successful platform to disseminate media to the youth.

8.2 Discussion of the Research Questions

8.2.1 How is mobile technology currently being used for media creation and sharing?

The answers gathered from the interview sessions confirmed several findings from previously published literature. Mobile phone market penetration is extremely high in low-income urban environments generally and in Khayelitsha as predicted. Every one of the participants had at least some access to mobile technology. Bluetooth proficiency was also confirmed. All the subjects questioned knew how to use Bluetooth to some extent.

Phone sharing became a much-discussed topic. An implicit system of phone sharing exists, though not recognized as such by the youth. Most of the individuals do not report sharing their phones. However, common practice includes lending a phone to trusted friends (mainly to use a feature their phone does not have and to access media on the phones) for varying lengths of time (anything from a few minutes to a weekend).

Our investigation confirmed that media sharing is part of all observed low-income teenagers daily lives, and our findings are comparable to other research projects that have worked with this demographic.

8.2.2 How will the community interact with a technology probe of a situated display?

We introduced a situated display, the BBCMS, as a technology probe for co-realization of potential usage between the local stakeholders and us as outside researchers. The deployment took place in the Nazeema Isaacs public Library where the BBCMS was seeded with content we thought would be useful. From our observations, as from the reports of librarians observing the Board, the BBCMS generated much interest from the community members. Initial Big Board content (media packs) was found not to be intuitive to use, but after we trained a few individuals, and provided some instructions use of the system increased.

The system was first deployed over a two-month period and ten people downloaded content posted by the researchers to their phones, a small but positive start. The stakeholders wanted more control to use the Board as a portal to disseminate media to the community and a means to empower the stakeholders would need to be added. We observed that the content that we created did not generate much interest, and the stakeholders felt they could make use of the Big Board in a more efficient manner if an empowerment tool existed. As a result of this feedback and observations, we justified the creation of a content management system.

8.2.3 Is it possible to create a content management system to serve multiple user groups in the environment?

As there were two user groups, we established Human Access Points (HAP) to liaise with the two user groups to gather insights on how best to serve them. We used the relationship of the HAP to ascertain the requirements for a potential system. Using an iterative prototyping software design lifecycle, we created a content management system using the insights of both user groups. Both had the same success criteria – they wanted the ability to create their own media packs to be disseminated to the youth using a web-based system. Both stakeholders endorsed our design of the BBCMS, and expressed a desire to use that system to create media packs to be uploaded to the Big Board. We concluded that it is possible to create a generalized content management system that satisfies and serves multiple user groups in the low-income urban South African environment.

8.2.4 What is the impact of empowering the stakeholders to create content?

In order to determine the impact of the empowerment we compared download rates of community created media packs with media packs that we created. We divided the Big Board into two sections, half the Board containing stakeholder media packs and the other half containing media packs that we thought the community would use. We monitored the Big Board usage over seven weeks under this scheme and found that stakeholder created media packs were more desirable

based on the number of downloads by the community (29 stakeholder media packs were downloaded compared to 9 of our media packs). When total control was given to the stakeholders, Big Board usage further increased. Ten unique phones accessed the board over eight weeks during the initial deployment where the stakeholders had no control, compared with 26 unique devices over seven weeks when the stakeholders had partial control, and 59 devices over ten weeks when the stakeholders had total control over the Board. We concluded that as the level of empowerment for the stakeholders increased, youth access to the content through use of the situated display also increased.

8.3 Lessons learnt from the Project

8.3.1 The value of contextualized content and empowering the end users

One of the main findings of this research project is confirming the value of contextualized content in a low-income urban setting. We compared media pack download preference between content we deemed useful and posted, versus content created and posted by members of the community. Community created content was more popular. The most popular media packs (about the Soweto uprising) would never have been selected by us. The end users created this most popular pack. The Ikamva Youth made media packs that are even more contextually relevant than that of the librarians. 62 Ikamva media packs were downloaded compared to 43 created by the librarians during the second deployment phase when the stakeholders had complete control over the Board. The Ikamva Youth media committee that created the media packs consisted of Youth from within the community. We concluded that as more contextually relevant people are empowered, Big Board usage would increase as a result of the more relevant content being made available.

8.3.2 Work is important to the youth, and so is leisure

During the course of our studies we discovered by observations and interviews, that media such as music and pictures formed the majority of media sharing amongst teenagers. The Ikamva youth NGO and the librarians wanted to use the mobile platform as a medium to aid the students with their schoolwork and livelihoods and provide them with information about projects and other activities. The BBMCS results confirm that this could be accomplished. There was a continuing desire to download these media packs from the community. There was an even stronger desire to download media packs containing 'leisure' material such as song lyrics and mp3 tracks to store on their phones and share amongst their friends, as evidenced by some informal interviews asking some youth which media packs they prefer. These packs were the most downloaded in the shortest period of time.

8.3.3 The importance of having a human access point, and the impact of not having one

Our Human Access point for the Ikamva Youth changed 5 times during our study while the librarian HAP remained constant throughout the project. The Ikamva

HAPs had varying levels of enthusiasm regarding the project. The Ikamva media committee was enthusiastic about the concept of uploading content to the community and more media packs and feedback were received during that time. Other HAPs who left the project offered little feedback during the prototyping phases of the project. Not surprisingly, the success of the system was closely tied to the enthusiasm of key participants.

During the interim times when the HAP was changing, our project essentially halted until we identified and familiarized the new HAP with the project. Eventually we were assigned to work with a committee of Youth that was overseen by the Ikamva Youth branch coordinator. This arrangement proved successful and the committee went on to create some of the most popular media packs for the community.

Even though the librarians were not as familiar with technology, the prototyping process was more insightful and we received more comments on how to best create the BBCMS when compared to the sessions we had with the Ikamva Youth staff. This can be attributed to fact that the library members were consistent throughout the prototyping and deployment phases and the same human access point liaison had been involved in every session, which provided continuity.

8.3.4 Important to have flexibility in an ICT4D project

Future ICT4D projects can benefit from knowing some of the challenges we encountered and our response to them. They will face some of the same challenges, and undoubtedly others as well.

Patience and tactfulness are crucial when forming relationships with NGOs or people within the area. We must consider the thoughts and feelings of all those we work with in the field and make sure any technology introduction is not creating an unreasonable burden. Consultation throughout the design process is vital to understand colleagues' thought processes and comfort levels. We recommend using participatory design methodologies whenever feasible. Outside factors can have a large effect on the research. For example, after the petrol-bombing incident, we had to be mindful of the external pressures on the NGO workers, and make sure we were not putting too much of a burden on them because of our research constraints, as they already had a lot to cope with.

Foresight and careful planning are also important when deciding on when to go to certain areas. For example, visiting some neighborhoods late in the evening might become a safety hazard. We learned to avoid events such as political elections and rallies. Although a researcher might be there to try and help the community, it is easy for misunderstandings to occur and one should always be cautious when in areas where political violence might occur.

Physically securing equipment is important, often to a degree, which may seem unreasonable. We learned that items, which are, in fact, useless to a thief, still represent enticing targets.

When carrying out experiments, it is best to use equipment that is as close to what the participants are used to as is possible. Demos and walkthroughs should be done in a familiar environment, and the participants should be made to feel comfortable, encouraging them to express their concerns.

Creativity is required to overcome often-unexpected infrastructure; bandwidth and Internet speed restrictions might require unconventional means to solve a problem, or require the sacrifice of desired functionalities.

8.4 Future work

From the results and insights gathered from our research, we identified a number of areas that could be considered for future work in other research projects.

8.4.1 Specifying Specific Content Download Choices

Prospective users of the Big Board could only choose what media packs to download onto their phones. Stakeholders created media packs consisting of various forms of media, but they had to be downloaded onto a user's phone in one batch. Phone memory limitations make it desirable for a user to choose specifically what content he/she desires. Future extensions to the Big Board system could include this functionality giving a user the power to choose specifically which content to download from a media pack.

8.4.2 Upload Optimization

Uploads to the Big Board via a mobile phone had a low success rate. Only 3 out of 25 people succeeded in uploading content correctly. Users did not understand the requirement to upload a V-card to the system. We attempted to inform the users by providing instructional posters on how to correctly use the Big Board, as well as modifying the Board to send a text file with instructions on how to upload correctly after a failed upload. Neither of these interventions was successful. This would suggest that a new approach to uploading data via mobile phones must be found when targeting a low income teenage demographic. Or perhaps alternative training protocols might find success. Users would need to be surveyed and consulted to devise a successful method to upload user-generated media packs.

8.4.3 Adding Functionality to the Big Board to Interface with High End Smart Phones

Currently the Big Board Bluetooth libraries cannot handle media requests from high-end smart phones (specifically iPhone and Blackberry models). This was not a detriment to usage in our context, as these handsets were relatively scarce in the environment. During our tests only one person tried to use an iPhone to access data with no success. He used another phone to access the content after being informed

that the Big Board did not support the iPhone. However, research by Walton *et al.* suggests that high-end phones will eventually enter the low-income market [Walton *et al.*, 2009]. The Big Board would need to be updated to handle requests from these smart phones if a long-term deployment is to be considered.

8.4.4 Community Picture Sharing System

We analyzed the content that the users attempted to upload to the Board and found that more than 90% of the content was pictures of themselves, their friends or their families. There is a need to add functionality to share pictorial content. A Big Board focusing exclusively on providing a portal for the community to upload pictures could be very popular. The purpose could be purely for community support. User testing and participatory design could identify the level of enthusiasm for such a feature and what visualization effects are preferred.

8.4.5 Incentivizing Content Creators

Deploying a situated display is an expensive endeavor in a low-income context. The cost of the screen and the server driving the system is approximately $1300. Costs will continue to come down, but alternative-funding sources must be found if the benefits of these systems are to be made available on a large scale. Our research confirmed the value of contextualized content and how empowering the stakeholders from within the community causes an increased desire to use the Big Board. The Big Board may attract sponsors who can benefit both from the advertising exposure and recognition of corporate social responsibility. Advertising information can be presented side-by-side with the content that the community desires. Stakeholders can be incentivized to create media to help them achieve their missions or in other cases by paying them a stipulated fee per unique download by the community.

Incentivizing of the stakeholders is vital to ensure that timely, relevant content is always on the board thus encouraging high usage by the community. High usage and high market penetration would incentivize potential clients to sponsor the Board. Future work could include identifying the costing dynamics required for deploying and maintaining a Big Board system that is sustainable.

8.5 Conclusion

This project confirmed the importance of contextualized content and how empowering local stakeholders to identify and create their own content in a low-income urban environment increased usage. Working with two separate stakeholders proved to be successful, and a system that satisfied both parties was created. User centered design accomplished local empowerment within the community. Our librarian human access point stated that as a result of the system ‘We could take some ownership over the Board and better content could be created’. One of the Ikamva Youth committee members in charge of updating the Big Board stated that ‘We can create cool stuff for our friends and share them with the community, and Ikamva can also put stuff up to help the students’. Both groups of

stakeholders and users deemed the BBCMS deployment a success and started to take ownership over the system. Evidence of this ownership was seen by observing some of the stakeholders hold a meeting, that was done out of their own accord, to plan Big Board usage with the BBCMS. We also noticed a constant usage of the BBCMS during the deployment phase of the project.

Bibliography

AMIN, A. K., KERSTEN, B. T. A., KULYK, O. A., PELGRIM, P. H., WANG, C. M., AND MARKOPOULOS, P. (2005). SenseMS: a user-centered approach to enrich the messaging experience for teens by non-verbal means. In Proceedings of the 7th international conference on Human computer interaction with mobile devices & services. ACM, New York, NY, USA, pg. 161-166.

BAY, H., ESS, A., TUYTELAARS, T. AND VAN GOOL, L. (2008). SURF: Speeded Up Robust Features, Computer Vision and Image Understanding, Vol. 110, No. 3, pg. 346-359.

BELLOTTI, V. AND ROGERS, Y. (1997). From Web Press to Web Pressure: Multimedia Representations and Multimedia Publishing. In Proceedings of CHI, pg. 279-286.

BEYER, H.R. AND HOLTZBLATT, K. (1995). Apprenticing with the customer. Communications, ACM Vol.38, No. 5, pg. 45-52.

BLUETOOTH SIG. (2010). Bluetooth Basics. Acquired from: www.bluetooth.com (Accessed on: 10 November 2010)

CELL C. (2011). Acquired from: http://www.cellc.co.za/ (Accessed on: 20 June 2011)

CHEN, H. Y., TSE, T. H., CHAN, F. T. AND CHEN, T. Y. (1998). In black and white: an integrated approach to class-level testing of object-oriented programs. ACM Trans. Softw. Eng. Methodol. 7, 3, pg. 250-295.

CHEVERST, K., DIX, A., FITTON, D., KRAY, C., ROUNCEFIELD, M., SAS, C., SASLISLAGOUDAKIS, G. AND SHERIDAN, J.G. (2005). Exploring bluetooth based mobile phone interaction with the hermes photo display. In Proceedings of the 7th international conference on Human computer interaction with mobile devices & services, Anonymous ACM New York, NY, USA, pg. 47-54.

CHIGONA, W., CHIGONA, A., NGQOKELELA, B. AND MPOFU, S. (2009). MXIT: Uses, Perceptions and Self justifications. Journal of Information, Information Technology, and Organizations.

CHIGONA, W., DARRY B., JUNAID V. AND MAUREEN T. (2009). Can mobile Internet help alleviate social exclusion in developing countries? Electronic Journal on Information Systems in Developing Countries 36, 7, pg. 1-16.

CHURCHILL, E. F., NELSON, L., DENOUE, L., AND GIRGENSOHN, A. (2003). The Plasma Poster Network: Posting Multimedia Content in Public Places. Ninth IFIP TC13 International Conference on HumanComputer Interaction pg. 599-606.

CRABTREE, A. (2003). Designing Collaborative Systems: A Practical Guide to Ethnography, Heidlberg: Springer. Creating and sharing multi-media packages using large situated public displays and mobile phones. Proceedings of the 9th International Conference on Human Computer Interaction with Mobile Devices and Services.

DEUMERT, A. (2009). Supporting Indigenous Literacies in the Digital Space. To be published.

DONNER, J. (2009). Blurring livelihoods and lives: The social uses of mobile phones and socioeconomic development. Innovations: Technology, Governance, Globalization vol. 4 pg. 91-101.

DONNER, J., AND GITAU, S. (2009). New paths: exploring mobile-centric internet use in South Africa. Paper presented at the Pre-Conference on Mobile Communication at the Annual Meeting of the International Communication Association.

ECKERSON, W. (2000). Three Tier Client/Server Architecture: Achieving Scalability, Performance, and Efficiency in Client Server Applications, available at http://www.sei.cmu.edu/str/descriptions/threetier.html (Accessed on: 20 October 2011)

FORD, M. AND ADELE B. (2007). MobilED – An accessible mobile learning platform for Africa? In Proceedings of the IST-Africa conference, Maputo, Mozambique, edited by P.Cunningham and M. Cunningham.

GITAU, S. (2010). ICT Aided Citizenry Participation. University of Cape Town, MSc thesis.

GITAU, S. AND MARSDEN, G. (2009). Working with NGOs through Fair Partnerships. In the proceedings of Interact 2009, Sweden, pg. 704-707.

GOULD J. D. AND LEWIS, C. (1983). Designing for usability — key principles and what designers think. In Proceedings of the SIGCHI conference on Human Factors in Computing Systems (CHI '83), Ann Janda (Ed.). ACM, New York, NY, USA, pg. 50-53.

GULLIKSEN, J., GÖRANSSON, B., BOIVIE, I., BLOMKVIST, S., PERSSON, J. AND CAJANDER, Å. (2003). Key principles for user-centered systems design. Behavior & Information Technology 22, No. 6, pg. 397-409.

HEATH, C., KNOBLAUCH, H. AND LUFF, P. (2000). Technology and social interaction: The emergence of "workplace studies". British Journal of Sociology, 51(2), pg. 299-320.

HEEKS, R. (2002). Information Systems and Developing Countries: Failure, Success, and Local Improvisations. The Information Society, 18(2), pg. 101–112.

HOLTZBLATT, K. AND JONES, S. (1993). Contextual Inquiry: A participatory technique for systems design. In D. Schuler and A. Namioka (eds), Participatory Design: Principles and Practice. Lawerence Erlbaum Associates, Hillsdale, NJ, pg. 177-210

HOUDE, S., BELLAMY, R. AND LEAHY, L. (1998). In Search of Design Principles for Tools and Practices to Support Communication within a Learning Community. ACM SIGCHI Bulletin, 30(2) pg. 113-118.

HUGH, W. AND LANE, D. (2004). Web Database Applications with PHP & Mysql, 2nd Edition. O'Reilly & Associates, Inc., Sebastopol, CA, USA.

HUGHES, J., KING, V., RODDEN, T. AND ANDERSEN, H. (1994). Moving out from the control room: ethnography in system design. In Proceedings of the 1994 ACM conference on Computer supported cooperative work.

HUTCHINSON, H., MACKAY, W., WESTERLUND, B., BEDERSON, B. B., DRUIN, A., PLAISANT, C., BEAUDOUIN-LAFON, M., CONVERSY, S., EVANS, H., HANSEN, H., ROUSSEL, N. AND EIDERBÄCK (2003). Technology probes: inspiring design for and with families. In Proceedings of CHI 2003, ACM Press, pg. 17-24.

IKAMVA INTERVIEW (2011). Interview acquired from: http://ikamvayouth.org/blog/2011/04/28/headquarters-khayelitsha-petrol-bombed-freedom-day (Accessed on: 15 October 2011)

IKAMVA IMAGES (2011). Images acquired from: http://www.flickr.com/photos/ikamvayouth/sets/72157626473166565/with/5664817500/ (Accessed on: 15 October 2011)

ITU. (2009). Online statistics, ICT eye acquired from: http://www.itu.int/ITUD/icteye/Indicators/Indicators.aspx (Accessed on: June 24, 2010)

ITU. (2010). Key Global Telecom Indicators for the World Telecommunication Service Sector.

JENSON, S. (2002). The Simplicity Shift. Cambridge University Press.

JONES, M. AND MARSDEN, G. (2006). Mobile interaction design. John Wiley & Sons Ltd, London. ISBN: 0470090898.

KANGAS, E. AND KINNUNEN, T. (2005). Applying user-centered design to mobile application development Communications of the ACM, vol. 48□□ (7□), pg. 55□□–59.

KENNEDY, B. & MUSCIANO, C. (2007). HTML: The Definitive Guide, Second Edition O'Reilly Media.

KREUTZER, T. (2009). Generation mobile: online and digital media usage on mobile phones among low-income urban youth in South Africa. University of Cape Town, Cape Town.

MARSDEN, G., MAUNDER, A. AND PARKER, M. (2008). People are People, but Technology is not Technology Philosophical Transactions of the Royal Society, October 2008, pg. 1-10.

MAUNDER, A., MARSDEN, G. AND HARPER, R. (2007). Creating and sharing multi-media packages using large situated public displays and mobile phones. In Proceedings of the 9th international conference on Human computer interaction with mobile devices and services, Singapore, MobileHCI '07, Vol. 309, pg. 222-225.

MILLEN, D. (2000). Rapid ethnography: time deepening strategies for HCI field research. In Proceedings of the 3rd conference on Designing interactive systems: processes, practices, methods, and techniques (DIS '00), Daniel Boyarski and Wendy A. Kellogg (Eds.). ACM, New York, NY, USA, pg. 280-286.

MIZUKO, I., HORST, H. A., BITTANTI, M., BOYD, D., HERR-STEPHENSON B., LANGE, P. G., PASCOE, C.J. AND ROBINSON, L. (WITH BAUMER, S., CODY, R., MAHENDRAN, D., MARTÍNEZ, K., PERKEL, D., SIMS, C. AND TRIPP, L.) (2008). Living and Learning with New Media: Summary of Findings from the Digital Youth Project. The John D. and Catherine T. MacArthur Foundation Reports on Digital Media and Learning.

MOLOI, M. AND STRAUSS, J. (2005). The SACMEQ II project in South Africa: A study of the conditions of schooling and the quality of education. Harare, SACMQ.

MONK, A., NARDI, B., GILBERT, N., MANTEI, M., AND MCCARTHY, J. (1993). Mixing oil and water?: Ethnography versus experimental psychology in the study of computer-mediated communication. In Proceedings of the INTERACT '93 and CHI '93 conference on Human factors in computing systems. ACM, New York, NY, USA, pg. 3-6.

MTN. (2011). Acquired from: http://www.mtn.co.za (Accessed on: 20 June 2011)

O'HARA, K., PERRY, M., CHURCHILL, E., RUSSEL, D. (2003). Public and Situated Displays, Social and Interactional Aspects of Shared Display Technologies. ISBN 1-4020-1677-8 Kluwer Academic Publishers.

PELTONEN, P., KURVINEN, E., SALOVAARA, A., JACUCCI, G., ILMONEN, T., EVANS, J., OULASVIRTA, A. AND SAARIKKO, P. (2008). It's Mine, Don't Touch!: interactions at a large multitouch display in a city centre.

SELWYN, N. (2004). Reconsidering political and popular understandings of the digital divide. New Media & Society Vol. 6, No. 3, pg. 341-362.

SHARP, H., ROGERS, Y. AND PREECE, J. (2007). Interaction design: Beyond human computer interaction. John Wiley & Sons, West Sussex. ISBN: 0470018666

SMITH, G (2011). Mobile Media Distribution in Developing Contexts. University of Cape Town MSC Thesis.

SOUTH AFRICAN POPULATION SUB-DIRECTORATE (2007). Population Development in the Research and Population Directorate. Department of Social Services and Poverty Alleviation. The Population Register Update: Khayelitsha.

TACCHI, J., SLATER, D. AND HEARN, G. (2003). Ethnographic Action Research: A Handbook. New Delhi: UNESCO.

THURLOW, C. AND POF, M. (2009). The language of text-messaging. In Thurlow, S. C. Herring, D. Stein & T.Virtanen (eds), Handbook of the Pragmatics of CMC.

VODACOM. (2011). Acquired from: http://www.vodacom.co.za/personal (Accessed on: 20 June 2011)

WALTON, M. (2010). Mobile literacies & South African teens: Leisure reading, writing, and MXit chatting for teens in Langa and Gugulethu. Research report prepared for the Shuttleworth Foundation m4Lit project.

WALTON, M. AND T. KREUTZER. (2009). A phone that has life has Internet: Mobile-only Internet access and media use by teens in Khayelitsha, South Africa. Annual Conference of the International Association for Media and Communication Research.

WATKINS, D., HAMMOND, M. AND ABRAMS, B. (2003). Programming in the .Net Environment. Addison-Wesley, Boston. ISBN: 0201770180

Appendices:

Appendix A

Board Management Prototype Walkthrough Task sheet.

Thank you for your time, this walkthrough is intended to test out the ease of use of the interface of the prospected system. Please complete the given tasks, if at any time you do not understand the task or feel you cannot accomplish it, please move on to the next objective.

Library Staff

1. Please log into the system with the username: **library** password:**123456**
2. Observe the home page, is it clear which block you would have control over? Please circle.
   Yes No
3. You wish to edit/change the Nelson Mandela Block, click on where you think you would do this.
4. You wish to add an additional file to the block, please click on where you think you would do this.
5. You wish to change the block completely, please click on where you think you would do this.
6. Replace the block with any other block of your choice.
7. Go back to the homepage.
8. You wish to change one of the blocks made by the students, Click on the block "User Content 1"
9. Exchange the block with another block of your choice.
10. Log Out of the system.

Ikamva Staff

1. Please log into the system with the username: **ikamva** password:**123456**
2. Observe the home page, is it clear which block you would have control over? Please circle.
   Yes No
3. Click on one of the blocks you have control over.
4. You wish to add an additional file to the block, please click on where you think you would do this.
5. You wish to change the block completely, please click on where you think you would do this.
6. Replace the block with any other block of your choice.
7. Go back to the homepage.
8. You wish to change one of the blocks made by the students, Click on the block "User Content 1"
9. Exchange the block with another block of your choice.
10. Log Out of the system.

Appendix B

System Walkthrough Task sheet 2.

Thank you for your time, this walkthrough is intended to test out the ease of use of the interface of the prospected system. Please complete the given tasks, if at any time you do not understand the task or feel you cannot accomplish it, please move on to the next objective.

Library Staff

1. Please log into the system with the username: **lib** password:**lib**
2. Read The homepage descriptions
3. You wish to add a block to the board click on where you would do this. Assume you have found some information on evolution, use the provided file to set as an image for the board.
4. You wish to see what the board looks like currently. Click on where you think this would be.
5. You wish to see the blocks you have control over, click on where you think you would do this
6. You wish to change the block completely, please click on where you think you would do this.
7. Replace the block with any other block of your choice.
8. You wish to add an additional file to the block, please click on where you think you would do this.
9. Go back to the homepage.
10. Log Out of the system.

Ikamva Staff

1. Please log into the system with the username: **ikamva** password:**ikamva**
2. Read The homepage descriptions
3. You wish to add a block to the board click on where you would do this. Assume you have found some information on Ikamva, use the provided file to set as an image for the board.
4. You wish to see what the board looks like currently. Click on where you think this would be.
5. You wish to see the blocks you have control over, click on where you think you would do this
6. You wish to change the block completely, please click on where you think you would do this.
7. Replace the block with any other block of your choice.
8. You wish to add an additional file to the block, please click on where you think you would do this.
9. Go back to the homepage.
10. Log Out of the system.

Appendix C

Interview Questions

My mobile phone and me

Interview Questions

Please bring your laptop to the interview to collect the photos/videos from the Ikamva learner's mobile phone.
Please ask Silke for:

- Sweets, Airtime, Drinks and Cups for the interview partner. ☺
- Every interview partner receives 5 Rand airtime per interview

1. Date: Name of Interviewer:

2. Name of Ikamva Learner:

3. Age:

4. Gender: 0 male 0 female

5. Own mobile phone: 0 yes 0 no

6. Brand of mobile phone:

7. Ikamva learner is living together with:

Name	Relationship	Mobile phone (yes/no)

8. Do you exchange phones within the family or with friends? If yes, why and how does this work?

GENERAL MOBILE PHONE USAGE

1. What does your phone mean to you?
2. For what do you use your mobile phone mostly?
3. What do you miss on your mobile phone? Why?
4. Do you use you mobile phone in connection with the computer? In what ways?

INTERNET

1. To what extent and for what do you use Internet on your phone?

PHOTOS

1. What do you like about photos in general?
2. Do you/ does your family have/has a photo camera back home? If yes, what type? (brand & type of camera, e.g. digital or analogue photo camera)
3. What do you take photos of?
4. What kind of photos do you have back home? (Content?)
5. What do you do with these photos?
    a. Where do you store them?
    b. How often do you look at them?
    c. Why do you look at them?
    d. Do you show them to others?
    e. Do you bring them with you to school, etc.
6. What do you like about taking photos yourself?
7. What do you think why other people take photos? What can you do with photos?

PHOTO FUNCTION ON PHONE

If the phone of the Ikamva learner has a photo function, PLEASE ASK THEM TO GIVE YOU THEIR PHOTOS FROM THEIR PHONES. Please include ALL picture files, also little poems, etc. they took themselves and received from other people.

- please store them in a folder on your laptop with the name of the Ikamva learner
- If the Ikamva learner does feel uncomfortable with this, please ask the Ikamva learner to give you the photos he/she feels comfortable with. **Please ask why she/he is uncomfortable with this.**
- Please observe and note down how the learner is dealing with the transfer of the photos from the mobile phone to your laptop (how does he/she deal with the technical aspects, like bluetoothing)

If the Ikamva learner does not have a photo function on their phone, please ask them the following questions as well, but then change "your phone" into "the phone you borrow from other people" and ask especially how they store their own photos

then? Do they leave them on the phone of the other person or do they have a way to take them with them?

1. How do you make use of the photo function of your phone?
2. What do you like about the possibility to make photos with your phone?
3. When and why do you make photos?
4. What do you do with the photos?
5. Please discuss the last 10 photos the Ikamva learner took or received in detail
    a. Photo taken by learner:
        i. What is this photo about? Let the Ikamva learner tell the story around this photo.
        ii. Who is on this photo?
        iii. Where did you take this photo?
        iv. Why did you take this photo?
        v. What does this photo mean to you?
        vi. What did you do with this photo (exchanged it? With whom? Why? Facebook? Etc.)
    b. Photo received by other person:
        i. Where did you get this photo from?
        ii. Why did you get this photo?
        iii. Let the Ikamva learner tell the story around the photo.
        iv. What does this photo mean to you?
        v. What does it mean to you that this person sent you this photo?

VIDEOS

1. What kind of videos, made by non-professionals – shared via mobile phone or online social network site, do you like to watch? (Funny, fiction, mini documentaries, etc.)
2. What do you like about these videos?
3. How many of these videos to you have on your phone or any other medium stored? How often do you watch them? Where? When? Why? With whom?
4. What is for you the difference between photos and videos? What do you prefer?
5. In what situations do you prefer to make a video instead of a photo?

VIDEO FUNCTION ON PHONE

If the phone of the Ikamva learner has a video function, PLEASE ASK THEM TO GIVE YOU THEIR VIDEOS FROM THEIR PHONES. Please include ALL video files they took themselves and received from other people and downloaded from the net.

- please store them in a folder on your laptop with the name of the Ikamva learner
- If the Ikamva learner does feel uncomfortable with this, please ask the Ikamva learner to give you the videos he/she feels comfortable with. **Please ask why she/he is uncomfortable with this.**

- Please observe and note down how the Ikamva learner is dealing with the transfer of the videos from the mobile phone to your laptop (how does he/she deal with the technical aspects, like bluetoothing)

If the Ikamva learner does not have a video function on their phone, please ask them the following questions as well, but then change "your phone" into "the phone you borrow from other people" and ask especially how they store their own videos then? Do they leave them on the phone of the other person or do they have a way to take them with them?

1. How do you make use of the video function of your phone?
2. What do you like about the possibility to make videos with your phone?
3. What kind of videos do you make with your phone?
4. Do you edit these videos? How and why?
5. What do you do with the videos? How do you store them?
6. Do you share them? How? Why?
7. Please discuss at least one video the Ikamva learner took or received in detail
   c. Video taken by learner:
      i. What is this video about? Let the Ikamva learner tell the story around this video.
      ii. Who is on this video?
      iii. Where did you take this video?
      iv. What does this video mean to you?
      v. Why did you take this photo?
      vi. What did you do with this photo (exchanged it? With whom? Why? Facebook? Etc.)
   d. Photo received by other person:
      i. Where did you get this photo from?
      ii. Why did you get this photo?
      iii. Let the Ikamva learner tell the story around the photo.
      iv. What does this photo mean to you?
      v. What does it mean to you that this person sent you this photo?

CIVIC ENGAGEMENT/AWARENESS

1. You as a teenager - what do you PERSONALLY like most about living in Khayelitsha?
2. You as a teenager – what do you PERSONALLY dislike about living in Khayelitsha? (Please try do go beyond the typical things like unemployment, poverty. I would like to know more about issues of social concern that are not constantly taught in school, etc. Like for example the issue about homosexuality vs. religion that one girl started to talk about. I want to know what they are concerned about regarding living in their community.)
3. Do you discuss these topics? If yes, where and how do you discuss these topics? Back home? With friends? At school? In church?
4. How do you like talking about these issues?
5. How well are you informed about what is going on in your community?

6. How are you engaged in your community? Also in church, etc.
7. Do teenagers help each other out in Khayelitsha? How?
8. What possibilities do young people in Khayelitsha have to change things that you are concerned about?
9. Who should in your eyes solve these problems? (People from the community or people from outside?)
10. Would you like to have more to say/more possibilities to be engaged?
11. What would you say to a politician if you could talk to a politician about your situation?

12. Are you going to church? To what church?
    a. What does the church community mean to you?
    b. In what ways does the church community help you in your life, solving your problems? (Not only through spiritual "problems", also others – I would like to see if the teens' civic engagement happens in church/through church)
    c. In what ways do you help other church community members resolving their problems?

13. Do you think with taking photos or making videos you could help changing things in your community? Why?

Appendix D

Survey Questions

UNIVERSITY OF CAPE TOWN
IYUNIVESITHI YASEKAPA • UNIVERSITEIT VAN KAAPSTAD

QUESTIONNAIRE

UNIVERSITY of the WESTERN CAPE

Place where interview took place _____ Date_____

A. Demographics

Age _____

Gender ☐ M ☐ F

Population group ☐ Black ☐ Coloured ☐ Indian ☐ White ☐ Other

Name of school _____

Main language(s) spoken to (family/friends) _____

Main language(s) of primary school _____

Main language(s) of high school _____

Which language(s) do you prefer for reading? _____

Which language(s) do you prefer for writing? _____

B. Costs and airtime

In your opinion, how affordable are the following ways of sharing photos:

Bluetooth	☐very expensive ☐ quite expensive ☐ not expensive or cheap ☐ quite cheap ☐ very cheap or free
MMS	☐very expensive ☐ quite expensive ☐ not expensive or cheap ☐ quite cheap ☐ very cheap or free
Facebook (on cellphone)	☐very expensive ☐ quite expensive ☐ not expensive or cheap ☐ quite cheap ☐ very cheap or free
MXit	☐very expensive ☐ quite expensive ☐ not expensive or cheap ☐ quite cheap ☐ very cheap or free

Three teenagers, Xolile, Jacob and Mpumi, all want to download the same picture from the internet onto their phones. Which one will use least airtime to download the picture:

☐ Jacob bought R5 airtime on Vodacom. Vodacom charges R2 per MB of data.

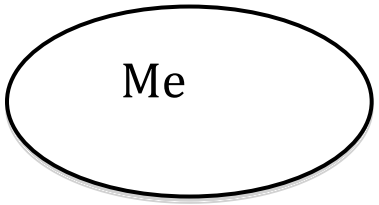
☐ Mpumi bought R20 airtime on MTN. MTN charges R1 per MB of data.

☐ Xolile bought R12 airtime on Vodacom and a data bundle which means he can get 8 MB of data for R9,25.

C. Family and peer group

We'd like to chat to you a little about the people who are close to you.

1. This first question is more of an exercise – On this page you find a circle with the word "me" in it. Please list each of the people who you are closest to (best friend, boyfriend/girlfriend, mother, etc.) around this circle -- up to seven people. For each person, please indicate their age, your relationships to them and where you see them most of the time (for example, home, school, neighbourhood, church group, etc.). Please link all of these people with lines to yourself.



2. What do you share with these people?

Name: _____ *Relationship to you:* _____

Does the person own cell phone? □ yes □ no □ don't know

What do you share with him/her?	What does she/he share with you?
□ Money □ Airtime □ Sim card □ Cellphone □ Printed photos □ Camera on my phone □ He/She can look at my cellphone photos □ He/She can look at my romantic and sexy cellphone photos □ Cellphone photos or videos by MMS □ Cellphone photos by bluetooth □ Pictures of brand logos, e. g. Gucci, D&G, Nike or pictures by bluetooth □ Pictures of things I like, e. g. cars, shoes, clothes by bluetooth □ Pictures or videos of celebrities by bluetooth □ Photos on Facebook □ Photos on Mxit □ Cellphone videos by bluetooth □ He/She can listen to my cellphone music □ Cellphone music by bluetooth □ He/She can play my cellphone games □ Cellphone games by Bluetooth □ He/She can look at my message photos □ Message photos by bluetooth □ Cellphone pin □ MXit or Facebook login (or other chat) □ SMS Messages □ Other _____	□ Money □ Airtime □ Sim card □ Cellphone □ Printed photos □ Camera on my phone □ I can look at her/his cellphone photos □ I can look at her/his romantic and sexy cellphone photos □ Cellphone photos or videos by MMS □ Cellphone photos by bluetooth □ Pictures of brand logos, e. g. Gucci, D&G, Nike or pictures by bluetooth □ Pictures of things I like, e. g. cars, shoes, clothes by bluetooth □ Pictures or videos of celebrities by bluetooth □ Photos on Facebook □ Photos on Mxit □ Cellphone videos by bluetooth □ I can listen to her/his cellphone music □ Cellphone music by bluetooth □ I can play his/her cellphone games □ Cellphone games by Bluetooth □ I can look at his/her message photos □ Message photos by bluetooth □ Cellphone pin □ MXit or Facebook login (or other chat) □ SMS Messages □ Other _____

Name: _____ Relationship to you: _____
Does the person own cell phone? □ yes □ no □ don't know

What do you share with him/her?	What does she/he share with you?
□ Money □ Airtime □ Sim card □ Cellphone □ Printed photos □ Camera on my phone □ He/She can look at my cellphone photos □ He/She can look at my romantic and sexy cellphone photos □ Cellphone photos or videos by MMS □ Cellphone photos by bluetooth □ Pictures of brand logos, e. g. Gucci, D&G, Nike or pictures by bluetooth □ Pictures of things I like, e. g. cars, shoes, clothes by bluetooth □ Pictures or videos of celebrities by bluetooth □ Photos on Facebook □ Photos on Mxit □ Cellphone videos by bluetooth □ He/She can listen to my cellphone music □ Cellphone music by bluetooth □ He/She can play my cellphone games □ Cellphone games by Bluetooth □ He/She can look at my message photos □ Message photos by bluetooth □ Cellphone pin □ MXit or Facebook login (or other chat) □ SMS Messages □ Other _____	□ Money □ Airtime □ Sim card □ Cellphone □ Printed photos □ Camera on my phone □ I can look at her/his cellphone photos □ I can look at her/his romantic and sexy cellphone photos □ Cellphone photos or videos by MMS □ Cellphone photos by bluetooth □ Pictures of brand logos, e. g. Gucci, D&G, Nike or pictures by bluetooth □ Pictures of things I like, e. g. cars, shoes, clothes by bluetooth □ Pictures or videos of celebrities by bluetooth □ Photos on Facebook □ Photos on Mxit □ Cellphone videos by bluetooth □ I can listen to her/his cellphone music □ Cellphone music by bluetooth □ I can play his/her cellphone games □ Cellphone games by Bluetooth □ I can look at his/her message photos □ Message photos by bluetooth □ Cellphone pin □ MXit or Facebook login (or other chat) □ SMS Messages □ Other _____

Name: _____ *Relationship to you:* _____
Does the person own cell phone? □ yes □ no □ don't know

What do you share with them?	What do they share with you?
□ Money □ Airtime □ Sim card □ Cellphone □ Printed photos □ Camera on my phone □ He/She can look at my cellphone photos □ He/She can look at my romantic and sexy cellphone photos □ Cellphone photos or videos by MMS □ Cellphone photos by bluetooth □ Pictures of brand logos, e. g. Gucci, D&G, Nike or pictures by bluetooth □ Pictures of things I like, e. g. cars, shoes, clothes by bluetooth □ Pictures or videos of celebrities by bluetooth □ Photos on Facebook □ Photos on Mxit □ Cellphone videos by bluetooth □ He/She can listen to my cellphone music □ Cellphone music by bluetooth □ He/She can play my cellphone games □ Cellphone games by Bluetooth □ He/She can look at my message photos □ Message photos by bluetooth □ Cellphone pin □ MXit or Facebook login (or other chat) □ SMS Messages □ Other _____	□ Money □ Airtime □ Sim card □ Cellphone □ Printed photos □ Camera on my phone □ I can look at her/his cellphone photos □ I can look at her/his romantic and sexy cellphone photos □ Cellphone photos or videos by MMS □ Cellphone photos by bluetooth □ Pictures of brand logos, e. g. Gucci, D&G, Nike or pictures by bluetooth □ Pictures of things I like, e. g. cars, shoes, clothes by bluetooth □ Pictures or videos of celebrities by bluetooth □ Photos on Facebook □ Photos on Mxit □ Cellphone videos by bluetooth □ I can listen to her/his cellphone music □ Cellphone music by bluetooth □ I can play his/her cellphone games □ Cellphone games by Bluetooth □ I can look at his/her message photos □ Message photos by bluetooth □ Cellphone pin □ MXit or Facebook login (or other chat) □ SMS Messages □ Other _____

Name: _____ *Relationship to you:* _____
Does the person own cell phone? □ yes □ no □ don't know

What do you share with him/her?	What does she/he share with you?
□ Money □ Airtime □ Sim card □ Cellphone □ Printed photos □ Camera on my phone □ He/She can look at my cellphone photos □ He/She can look at my romantic and sexy cellphone photos □ Cellphone photos or videos by MMS □ Cellphone photos by bluetooth □ Pictures of brand logos, e. g. Gucci, D&G, Nike or pictures by bluetooth □ Pictures of things I like, e. g. cars, shoes, clothes by bluetooth □ Pictures or videos of celebrities by bluetooth □ Photos on Facebook □ Photos on Mxit □ Cellphone videos by bluetooth □ He/She can listen to my cellphone music □ Cellphone music by bluetooth □ He/She can play my cellphone games □ Cellphone games by Bluetooth □ He/She can look at my message photos □ Message photos by bluetooth □ Cellphone pin □ MXit or Facebook login (or other chat) □ SMS Messages □ Other _____	□ Money □ Airtime □ Sim card □ Cellphone □ Printed photos □ Camera on my phone □ I can look at her/his cellphone photos □ I can look at her/his romantic and sexy cellphone photos □ Cellphone photos or videos by MMS □ Cellphone photos by bluetooth □ Pictures of brand logos, e. g. Gucci, D&G, Nike or pictures by bluetooth □ Pictures of things I like, e. g. cars, shoes, clothes by bluetooth □ Pictures or videos of celebrities by bluetooth □ Photos on Facebook □ Photos on Mxit □ Cellphone videos by bluetooth □ I can listen to her/his cellphone music □ Cellphone music by bluetooth □ I can play his/her cellphone games □ Cellphone games by Bluetooth □ I can look at his/her message photos □ Message photos by bluetooth □ Cellphone pin □ MXit or Facebook login (or other chat) □ SMS Messages □ Other _____

Name: _____ Relationship to you: _____
Does the person own cell phone? □ yes □ no □ don't know

What do you share with him/her?	What does she/he share with you?
□ Money □ Airtime □ Sim card □ Cellphone □ Printed photos □ Camera on my phone □ He/She can look at my cellphone photos □ He/She can look at my romantic and sexy cellphone photos □ Cellphone photos or videos by MMS □ Cellphone photos by bluetooth □ Pictures of brand logos, e. g. Gucci, D&G, Nike or pictures by bluetooth □ Pictures of things I like, e. g. cars, shoes, clothes by bluetooth □ Pictures or videos of celebrities by bluetooth □ Photos on Facebook □ Photos on Mxit □ Cellphone videos by bluetooth □ He/She can listen to my cellphone music □ Cellphone music by bluetooth □ He/She can play my cellphone games □ Cellphone games by Bluetooth □ He/She can look at my message photos □ Message photos by bluetooth □ Cellphone pin □ MXit or Facebook login (or other chat) □ SMS Messages □ Other _____	□ Money □ Airtime □ Sim card □ Cellphone □ Printed photos □ Camera on my phone □ I can look at her/his cellphone photos □ I can look at her/his romantic and sexy cellphone photos □ Cellphone photos or videos by MMS □ Cellphone photos by bluetooth □ Pictures of brand logos, e. g. Gucci, D&G, Nike or pictures by bluetooth □ Pictures of things I like, e. g. cars, shoes, clothes by bluetooth □ Pictures or videos of celebrities by bluetooth □ Photos on Facebook □ Photos on Mxit □ Cellphone videos by bluetooth □ I can listen to her/his cellphone music □ Cellphone music by bluetooth □ I can play his/her cellphone games □ Cellphone games by Bluetooth □ I can look at his/her message photos □ Message photos by bluetooth □ Cellphone pin □ MXit or Facebook login (or other chat) □ SMS Messages □ Other _____

Name: _____ Relationship to you: _____
Does the person own cell phone? □ yes □ no □ don't know

What do you share with him/her?	What does she/he share with you?
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Name: _____ *Relationship to you:* _____
Does the person own cell phone? □ yes □ no □ don't know

What do you share with him/her?	What does she/he share with you?
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3. What does it mean if friends do not want to share media with you?

4. What does it mean if friends do share media with you?

5. What does it mean if your boyfriend/girlfriend do not want to share airtime with you?

6. What does it mean if your boyfriend/girlfriend wants to share airtime with you?

C. Technology access

	Have my own	Shared with others, but easy access, e. g. owned by brother.	Very limited access, e.g. library, Ikamva	Can access the internet on this device	No access at all	Any comments?
Desktop	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no	
Laptop	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no	
Cell phone	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no	

How do you browse the internet most of the time? ☐ computer ☐ phone ☐ both ☐ don't search the internet
How do you send emails most of the time? ☐ computer ☐ phone ☐ both ☐ don't send emails
How old were you when you first used a computer? _____ years
How old were you when you first used a mobile phone? _____ years
How old were you when you first owned a mobile phone? _____ years
What model of mobile phone do you have now? _____
How much do you spend per week on airtime (estimate)? _____Rand ☐ am on contract

D. Using phones

Is your predictive text (T9) switched on or off? ☐ always off ☐ on, always (language _____)

 ☐ on, sometimes (language _____)

How often do you make voice calls? ☐ several times a day ☐ at least once a day ☐ every few days ☐ rarely ☐ never

Do you use 'PleaseCallMe's? ☐ several times a day ☐ at least once a day ☐ every few days ☐ rarely ☐ never

For what purposes do you use 'Please Call Me's'? _____

Do you ever 'buzz' people? ☐ several times a day ☐ at least once a day ☐ every few days ☐ rarely ☐ never

For what purposes do you buzz people? _____

How often do you SMS? ☐ several times a day ☐ at least once a day ☐ every few days ☐ rarely ☐ never

In which language(s) do you SMS? _____

Who do you contact usually by phone? (voice) ☐ parents ☐ other family ☐ friends ☐ b/g friend ☐ employer/lecturer

Who do you contact usually by phone? (text) ☐ parents ☐ other family ☐ friends ☐ b/g friend ☐ employer/lecturer

Where do you feel safe using your phone? ☐ home ☐ school ☐ Ikamva ☐ on the street ☐ shopping mall ☐ taxi, minibus ☐ train

E. Norms and conventions

Do you use abbreviations (e.g. 'lol') and other features of textspeak/MXit language?

When sending an SMS ☐ always ☐ usually ☐ hardly ever ☐ never ☐ n/a

When chatting on MXit ☐ always ☐ usually ☐ hardly ever ☐ never ☐ n/a

When updating your Facebook status ☐ always ☐ usually ☐ hardly ever ☐ never ☐ n/a

When writing an email ☐ always ☐ usually ☐ hardly ever ☐ never ☐ n/a

When writing a note on paper ☐ always ☐ usually ☐ hardly ever ☐ never ☐ n/a

Which languages do you abbreviate? ☐ English ☐Afrikaans ☐ isiXhosa ☐

_____

If there are some languages which you don't abbreviate? Why don't you abbreviate them?

_____

With whom do you use abbreviations? ☐ parents ☐ other family ☐ friends ☐ b/g friend ☐ employer/lecturer

How did you learn these abbreviations? ☐ parents ☐ other family ☐ friends ☐ b/g friend ☐ media

Do you ever have a problem understanding abbreviations? ☐ never ☐ sometimes ☐ often

Is yes, can you give an example of an abbreviation which you had/have problems understanding?

_____

Do you ever make up your own abbreviations? ☐ never ☐ sometimes ☐ often

If yes, can you give an example? _____

What are your favourite abbreviations and what do they mean?

_____

_____

F. Social networking

Which of the following programmes have you ever used?

	Have used	Use it more than once a week. For how many min/hrs per day	If not used any more – why?	Number of FRIENDS (roughly)	How many of them do you meet regularly face to face?	Language(s) most commonly used with the application	How did you find out about it?	Usual mode of access
MXit	☐ yes ☐ no	--------- min ---------hrs	☐		☐		☐ parents ☐ other family ☐ friends ☐ b/g friend ☐ media ☐ other	☐ computer ☐ phone

							_____	
Twitter	☐ yes ☐ no	--------- min ---------hrs	☐		☐		☐ parents ☐ other family ☐ friends ☐ b/g friend ☐ media ☐ other _____	☐ computer ☐ phone
Facebook	☐ yes ☐ no	--------- min ---------hrs	☐		☐		☐ parents ☐ other family ☐ friends ☐ b/g friend ☐ media ☐ other _____	☐ computer ☐ phone
Other _____	☐ yes ☐ no	--------- min ---------hrs	☐		☐		☐ parents ☐ other family ☐ friends ☐ b/g friend ☐ media ☐ other _____	☐ computer ☐ phone

If you use MXit - What is your name on MXit? _____

Do you have a MXit profile picture? ☐ yes ☐ no

If so, what does your profile picture look like? Please get a detailed description.

Do you group your MXit contacts? For example, separate male and female, close friends and acquaintances into groups? ☐ yes ☐ no

If yes – would you please give us the names of the groups which you created?

_____

_____

If you use Facebook - What is your name on Facebook? _____

Do you have a Facebook profile picture? ☐ yes ☐ no

If so, what does your profile picture look like? Please get a detailed description.

How many photos do you have on Facebook? _____

Do you group your Facebook contacts? For example, separate male and female, close friends and acquaintances into groups? ☐ yes ☐ no yes – would you please give us the names of the groups which you created? _____

G. Literacy practices

How often do you **READ** the following?

	Daily	Every few days	Rarely	Never	Language(s) commonly used for the activity
Book	☐	☐	☐	☐	
Newspaper	☐	☐	☐	☐	
Facebook	☐	☐	☐	☐	
Online news	☐	☐	☐	☐	
MXit chat	☐	☐	☐	☐	
SMS	☐	☐	☐	☐	
Email	☐	☐	☐	☐	
Other _____	☐	☐	☐	☐	

Are you the kind of person who likes to stay informed about what is going on around you, especially in terms of social and political issues?
☐ Very informed ☐ Somewhat informed ☐Not informed ☐ Don't know
When you meet with your family, friends, teachers, and other people that you know, do you discuss social or political issues?
☐ never ☐ sometimes ☐ often
Do you discuss social or political issues when you use Facebook, MXit or other online sites?
☐ never ☐ sometimes ☐ often

How often do you **WRITE** the following?

	Daily	Every few days	Rarely	Never	Language(s) commonly used for the activity
Notes, personal	☐	☐	☐	☐	
Facebook update	☐	☐	☐	☐	
MXit chat	☐	☐	☐	☐	
SMS	☐	☐	☐	☐	
Email	☐	☐	☐	☐	
Letter	☐	☐	☐	☐	
Other _____	☐	☐	☐	☐	

H. Taking pictures, making movies

We would like to know more about how you use cellphones / computers

YESTERDAY Did you…	Yes	Not yesterday, but sometimes	Hardly ever or never do that
...take a photo or a video with a cellphone?	☐	☐	☐
... use bluetooth to share a photo, video or music with a cellphone?	☐	☐	☐
... download a photo, video or music from a computer	☐	☐	☐
... transfer a photo, video or music from a phone to a computer?	☐	☐	☐
... transfer a photo, video or music from a computer to a phone?	☐	☐	☐
... wrote a Word or other text document on a computer?	☐	☐	☐

We would like to know more about how you use computers

Where do you store the following things?	**A computer**	**My phone memory**	**My phone's memory card**	**Friend/family memory card**	**I print them**	**Some other storage e.g. CD, flash drive**	**Online e.g. Gmail, Facebook**	**I don't store them anywhere**
Photos	☐	☐	☐	☐	☐	☐	☐	☐
Videos	☐	☐	☐	☐		☐	☐	☐
Music	☐	☐	☐	☐		☐	☐	☐
Text messages	☐	☐	☐	☐	☐	☐	☐	☐