THE USE OF MOBILE PHONES TO ADDRESS AN UNEMPLOYMENT CRISIS:
AN EXAMINATION OF SOUTH AFRICA

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ABSTRACT

The deficiencies in the South African education system lead to a populace unprepared for the workforce. This paper proposes that the use of mobile phones – a technology already owned by the vast majority of citizens – can offer an add-on to the education system, ultimately improving its dismal quality and providing tools for adult education at a relatively low cost. To make this argument, this research pays particular attention to the mobile-based tutoring program, Dr. Math, and the MoMaths mobile study guide. The paper then suggests that, once properly trained, South Africans can use their phones to connect with future employers, something that is made possible by mobile applications such as Ummeli. This paper acknowledges the difficulties in finding an easy solution for such a serious problem but maintains that the potential afforded through mobile phone technology coupled with the ability to take advantage of already available resources make this technology a viable option worth further consideration.
The research and writing of this thesis

is dedicated to my parents,

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Executive Report

On February 9, 2012, the South African President, Jacob Zuma, stood in front of his country to deliver the annual State of the Nation address. In this speech, he acknowledged the lingering question on the minds of his constituents: Where are our jobs? In his 2011 address, Zuma had promised the creation of 500,000 new jobs, but today, 25% unemployment rates still plague the country, and more than 4.2 million South African adults looking for employment continue to return home empty-handed.

Critics blame Zuma for not fulfilling his promise of job creation. A more in-depth look, however, reveals that, while the unemployment rates do hold the country back from its economic potential, the issue of available jobs affects South Africa less than the lack of qualified workers. With 800,000 open vacancies - the majority of which are in the management, engineering, law, and finance fields – it is the lack of proper education and training available to potential workers that ultimately results in the high unemployment. Rather than spin rhetoric and spend money to create infrastructure projects in hopes of creating temporary jobs, the government should instead focus on the place which offers the potential for more permanent change: the education system.

The problems with the education system clearly deserve attention. This report proposes that the most effective way to reach students and enhance their education is to reach them through a medium to which they already have access and which they enjoy using: their mobile phones. By relying on a pre-existing technology, this investment sidesteps many of the costs of other initiatives that require the provision of new
technology or infrastructure and also creates a program more likely to appeal to students.

Examining Dr. Math, the MXit-based math-tutoring program that by 2012 has assisted more than 30,000 South African high school students with their math homework, this paper recommends increasing investment in the program to reach a greater number of students. The leaders behind the program dream of one day reaching more than one million students, and this paper provides a justification of the program’s merits as well as ways to address potential scalability concerns.

Beyond tutoring, programs such as Nokia’s Mobile Mathematics (MoMaths) offer South African students math content and exercises over their mobile phones. The program takes the mathematics curriculum and creates additional resources, including practice tests and games, and encourages students to compete with themselves to learn math anytime, anywhere, over a platform which they already enjoy using. Like Dr. Math, the students do not incur any additional charges.

After addressing the deficiencies in the education system, this report then examines the ways in which South Africans typically find employment – word-of-mouth, hand delivery of CVs, and clippings from newspaper classifieds. With professional networking sites such as LinkedIn hosting more than 11,000 employers, citizens would benefit from online access to such resources. Based on a 2011 study conducted by Microsoft, this paper puts forth the suggestion that citizens are not realizing the capabilities of their mobile devices to address the job search process. As only 10% of the country’s population ever accesses the Internet via a computer, many citizens may otherwise not have the chance to use to such tools.
Training citizens to use their phones in this capacity requires only a small initial investment, as the mobile phone job search training has already demonstrated high levels of skill retention as well as the inclination of participants to share their new skills with friends and family. This paper recommends devoting further attention to Ummeli, the mobile program that allows users not only to search for jobs but also both to create and distribute their CVs and to find related skill-building courses. Since this program is currently only in its beta stage, only Vodacom subscribers can access the application, but with expansion it has the ability to address many of the ongoing challenges contributing to South Africa’s unemployment crisis.

Ultimately, this paper proposes an investment in the South African people and their knowledge, skills, and capabilities over temporary job creation programs. While the implementation will require some funding, particularly to deliver the aforementioned solutions on a much larger scale, using the mobile phone – a device already owned by the majority of South Africans – significantly reduces the magnitude of the funding and more effectively reaches a larger portion of the population.
Introduction

The use of mobile phones – a technology already owned by the vast majority of citizens in South Africa – can act as a supplement to the education system there, ultimately improving the dismal quality of the system as well as providing tools for adult education at a relatively low cost, and a way to connect people with available job opportunities. Once properly trained, South Africans can then use their phones to connect with future employers. This paper acknowledges the difficulties in finding an easy solution to such serious problems but expresses the opinion that the potential afforded through mobile phone technology coupled with the ability to take advantage of already available resources make this technology a viable option worth further consideration.

To make this argument, this paper first looks at the importance of a quality education system in maintaining a nation’s economic competitiveness followed by an examination of the flaws in South Africa’s schooling. In order to discuss the potential for mobile phones to address these flaws, the paper then describes the mobile technology and capabilities available within the country. Using this information, the paper then examines pre-existing mobile-based educational tools in South Africa, paying particular attention to Math on MXit and MoMaths. Lastly, by examining programs such as Ummeli, it suggests that this same technology can address the immediate need for skilled labor amongst the adult population, allowing adults not only to receive workforce-related training via their mobile phones but also to connect with future employers by way of mobile-based job search engines.
In a globalized world emerging from the deepest economic recession since the 1930s, international unemployment has reached alarming heights. Traditional and contemporary theories postulate that an increase in human capital can bolster a struggling economy by cultivating a more productive workforce. This paper expresses the author’s belief that access to both quality education and to information and communication technology (ICT) increases the availability of human capital, and that subsequently results in economic growth. It further presents the argument that, as the availability of ICT increases, so, too, can the availability of quality education. For the sake of this study, South Africa serves as an example of a state where technology can simultaneously address an inadequate educational system and reduce unemployment rates.
Chapter I:
The South African Economy

South Africa’s high unemployment rates come as a result of the nation’s overall economy. At the same time, more than 800,000 jobs that employers cannot fill due to the lack of qualified applicants exist in the country (Adcorp, 2012). This chapter demonstrates that, though the country exhibits many factors that should lead to a much stronger job market, without a properly trained workforce it will continue to fail to fulfill its potential. Until South Africa addresses the inadequacies in its education system, the problem will persist. Given this situation, a failing education system should be a problem not just for educators but for economic policy advisers as well.

Economic Competitiveness

In terms of global competitiveness, South Africa ranks quite high. The nation ranks third in the world in terms of the accountability of private institutions and fourth in the world in terms of its financial market development, both of which demonstrate “high confidence in South Africa’s financial markets at a time when trust is returning only slowly in many other parts of the world” (Schwab, 2011). The country also boasts a sophisticated financial market, investor protections, strong reporting standards, efficacy of corporate boards, soundness of its banks, and the regulation of its securities and exchange system.
At the same time, it still only ranks 50th in the global economy. Economists frequently cite the country’s labor market inefficiency, lack of quality education, and low university enrollment rates as explanatory factors in the country’s failure to realize its full potential. In fact, South Africa ranks amongst the lowest when it comes to its labor market, math and science education, and availability of engineers. In the World Economic Forum’s Global Competitiveness Report, South Africa’s school system ranks 130th out of 139 countries, coming in dead last in terms of math and science education (Poorer African States, 2011). In the 2003 Trends in International Maths and Sciences Study (TIMSS), South Africa also ranked last, as it did in the 2006 Progress in International Reading and Literacy Study, from which the country has since withdrawn.

**Education and Economic Growth**

The highest-performing economies rely on workers with math and physical science knowledge at every level of the supply chain, particularly as technology use becomes ubiquitous. An inability to utilize technology only further sets back citizens and companies. The global economy has witnessed a rapid, skill-biased technological change, and, without a fundamental working knowledge of math and science, South African workers cannot compete or expect to find suitable employment. Similarly, South African businesses cannot survive in such a market without properly trained employees.

A country’s competitiveness also depends on a quality university system. Countries like the United States, for instance, are marked by “highly sophisticated and innovative” companies that are “supported by an excellent university system that
collaborates admirably with the business sector in R&D” (Schwab, 2011). Further, in many economies workers without bachelor’s or higher degrees face substantially higher-than-average unemployment rates.

Of the nearly 500,000 South African high school class of 2011 students who sat for their National Senior Certifications exam, only 70% passed (Matric pass rate, 2011). Even more alarming, for many of these exams a passing grade meant that students answered only one-third of the questions correctly. In addition to these low figures, up to 50% of students drop out shortly before taking the exam (E for Education, 2012). Of this same group of seniors, only 23% of grade 12 students qualified for university (Matric pass rate improves, 2011).

At first glance, the South African education system deserves praise. Adult literacy rates, for instance, rose from 76% in 1980 to nearly 90% by 2007. School enrollment numbers within South Africa impress as well; gross primary school enrollment ratios soar above 100 for both males and females, and the corresponding net ratios nearly reach 90 (UNICEF South Africa). In essence, these ratios mean that while not every child is attending the grade designed for his / her age level, nearly all children do in fact attend school. The issue most severely plaguing South Africa education, however, is the lack of preparation it provides for its students as they enter the job force. Many of those South Africans who do receive a university degree find themselves unemployable.

Even when the country deploys projects to stimulate employment, the private sector has difficulty filling those jobs that it creates. In an effort to stimulate the economy and make the country more globally competitive, President Zuma announced a plan to invest in a large-scale infrastructure project to construct dams, schools, and a high-tech
rail system (SA eyes up, 2011). This project will add approximately 50,000 to 100,000 jobs to the construction sector, but without trained workers it may not have a significant impact on the unemployment rates. The government can pour money into revamping its employment opportunities, but it needs to recognize that the education system does not adequately prepare students with the skills critical to the South African economy.

A quality education – from the primary school level up through post-graduate and adult education – enhances a country’s competitiveness, which leads to a stronger economy. In order to achieve economic relevance in this increasingly globalized world, a nation requires an educated workforce that can contribute high levels of productivity and efficiency to the market. The African continent as a whole “is home to seven of the top ten fastest-growing major economies for the coming five years” but desperately needs a skilled and properly trained workforce to drive this growth (Minney, 2011). According to UNESCO Director-General Irina Bokova, “Education is Africa’s most powerful antidote to poverty” (Minney, 2011). This chapter argues that South Africa has many attributes that would otherwise lead to a more competitive economy with lower unemployment rates but that the country cannot achieve its full potential without first addressing the dismal state of its education system.
Chapter II:
Technology in South Africa

To argue that mobile phones can address South Africa’s unemployment crisis, this chapter examines the vast improvement in ICT within the country. Demonstrating that mobile phones have reached nearly universal penetration rates and that citizens are comfortable using these devices, it concludes that mobile phones can deliver an educational add-on to students. By utilizing a device that, as noted above, students already own and enjoy using, this approach requires considerably less funding than a project with infrastructure needs and is also more likely to see participation from the students. Thus, by providing students with a quality supplement to the education they already receive, mobile phone technology could pave the way toward a decrease in South African unemployment rates.

Mobile Phones for Education

Many education initiatives examine computer-based education. In South Africa, however, policy makers should instead place more emphasis on the utilization of the mobile phone for such projects. The technology of the devices has seen such improvements over recent years that it could easily support programs that act as a supplement to the current education system.

The PC-based education model does not have much potential impact on South Africa, as computer-penetration rates remain low. Given the 100% mobile phone penetration compared to less than 2% broadband penetration, providing educational opportunities via mobile phones just makes more sense (ICT Data and Statistics, 2011).
Additionally, because most students in South Africa already use cell phones on a daily basis, the idea of using the devices for educational purposes may seem like less of a requirement to students, which will in turn boost the popularity of initiatives based on that technology. Even low-income areas report that 97% of high school students now own SIM cards and have access to mobile phones (Kreutzer, 2009). As these students carry mobile phones without even thinking, any education initiative should focus on the technology available, mobile phones.

While PC- and laptop-based online education and distance learning programs have received increasing attention and international focus, South Africa’s low fixed-Internet rates would severely limit the audience that could benefit from such initiatives. Even as South Africa dedicates more funding to increased computer access within the school system, these projects have largely been deemed failures in large part due to incoordination, lack of ICT-literacy amongst teachers, and student-teacher ratios that are too high (Ford, 2010). When teachers did not demonstrate a mastery of the technology themselves, they tended not to promote its use amongst their students. Further, the country’s high burglary rate affects the schools as well, with many institutions reporting that new computers are stolen with days of their arrival.

**The Growth of Mobile Phone Use in South Africa**

A look at the use of communication technology indicates that the mobile phone dominates the market. More citizens reported using a cell phone than they did a radio, a television, a computer, or the Internet (Hutton, 2011). Only a small percent of South
Africans own a computer, largely because the cost makes it unaffordable. Even the lowest priced of the desktops start at R 4000 ($520), making them nearly 7 times costlier than a phone capable of transmitting data (Shopbot). By 2010, less than 25% of the population had ever even used a computer (Czerniewicz, 2010).

In contrast, South Africa’s mobile phone penetration rate surpasses 100 percent, meaning that more mobile devices and SIM cards are used than there are people in the country. 4.7 million South Africans have fixed-line connections while 19 million have mobile phone subscriptions, making computer-based Internet access less popular than mobile access. Unlike in the fixed-line market, where there is only one provider – Telkom, the mobile market has five providers that must compete with each other to provide customers with lower prices and better service and features (Rasool, 2010).
By the mid-2000s, the 3G smartphone had arrived, creating a means not only to communicate via call or text but also bringing with it an extensive list of additional features, including media players, cameras, and Internet browsers among other capabilities. By 2010 these phones had caught on with South Africans as well, and, by the end of 2011, the number of smartphones used in the country had doubled from 6 million to 12 million in less than one year (Tarrant, 2011). South Africans no longer view their phones simply as devices for voice communication.
At R500 ($70) per handset, feature phones have seen increasing popularity. Almost all new mobile phones come GPRS-enabled and capable of transmitting data; each of the South African providers offers plans to activate this technology. In most cases, they charge by the data transferred – with some plans as low as .01 Rand / megabyte - without requiring connection fees or contracts. The total cost usually amounts to less than the monthly fee charged for dial-up connections and comes with faster data transfer (Low cost internet, 2010). For this reason many of the South Africans who access the Internet will do so over their mobile devices without ever using a PC to connect.

**Mobile Phone Functions**

Functionality and phone features have replaced the standard phone call. Smartphones and feature phones can now provide access to Internet-based services previously reserved for those citizens who owned a computer and had the training needed to use it properly. These types of services – with some creativity and innovation – can help a larger portion of the population benefit from educational supplements and services, all through devices that the people already own.

Beyond education, other sectors have demonstrated the ability for smartphones to transform aspects of everyday life in South Africa. In much the same way that mobile applications have changed the financial system in South Africa in recent years, mobile-based education initiatives could do the same. South Africans already appear open to
using their phones for matters that are important to them, suggesting that they would be likely to use their phones also to improve their education.

The same factors negatively affecting traditional forms of finance – such as the cost and the urban/rural bias – have the same influence on traditional forms of education as well. Further, the education system would benefit from an increase in quality and standardization that could come as a result of pooled resources. Mobile-learning also offers more potential for students who (1) are always on the move or working odd hours that conflict with the school day, (2) live in rural areas and have difficulty accessing the physical schools or materials, and (3) cannot afford PC-based learning options.

The previous lack of basic banking services created a niche market for this new way of doing business. Of South Africa’s total population, approximately 40 percent were unbanked or under banked in 2005, meaning that they did not have even basic checking and/or savings accounts (Kitten, 2005). With banks typically only located in metropolitan areas and nearly 40% of the population living in rural regions, lack of access largely explained this deficiency (Rural population in South Africa, 2012). At the same time, financial institutions targeted and catered to the country’s upper class, which comprised only 15% of the population.

As mobile phone penetration grew to nearly 100% and mobile-banking, or m-banking, services became more prevalent, physical access no longer served as a barrier to financial services. Further, m-banking doesn’t require customers to pay the fees needed to cover the costs of having a physical infrastructure or working with cash. With the elimination of these fees – as well as of minimum income requirements and numeracy standards – a larger percentage of the population can use financial services to their
benefit rather than relying on the practice of saving money in their mattresses, as more than 15% of South Africans still do (Millions keep money under the mattress, 2011). Mobile access to financial services allows the banks to reach customers anywhere, anytime, and offers customers “immediacy, security, and efficiency” (Ondiege, 2010).

**Social Media in South Africa**

To understand why education-related programs delivered via mobile phones could gain such a following, it is important to realize the popularity of social media.

In 2011 more than 1 million South Africans logged into the microblogging site, Twitter, 20-times higher than the number reported in 2010 (Social media goes mainstream in SA, 2011). With 10 million users in the country generating 250 million messages per day, however, MXit dominates the social network market. MXit, a free instant messaging service, runs on both mobile and PC-based platforms and can connect to other sites and applications like Yahoo, Facebook, Google Talk, and others. Beyond instant messaging, MXit also allows users to enter chat rooms, share files, and access open-source content. Further, at less than two cents apiece, MXit messages cost only a fraction of the price of SMS messages, the traditional means of sending text messages over the phone. (MXit Mobile Chat, 2011).
Figure 2.
MXit vs. Facebook vs. Twitter in South Africa

Mxit vs Facebook vs Twitter in South Africa

SOURCES:
en.wikipedia.org/wiki/MXit
mybroadband.co.za

MORE COOLNESS?
#ODMACT
afrographique.tumblr.com
Infographic designed by @iganisaawesome
Figure 3.
MXit in South Africa Demographic
Chapter III:

Case Study: Math on MXit

With 10 million South Africans – 45% of whom are between the ages of 12 and 18 – using MXit, any mobile-based educational program should consider reaching students and delivering information on this platform. What began as a means for a mother to tutor her son and his friends in mathematics, Math On MXit (commonly referred to by students as Dr. Math) allows students to connect with university student volunteers to receive real-time help on their math homework.

Math on MXit

Launching their program in 2007, Math on MXit researchers initially found that 60% of respondents said MXit “was useful to exchange information between peers and lecturers” and that 50% of the students said that MXit “could be used to manage tutorials” (Vosloo, 2008). At the same time, almost none of the educators surveyed reported using the application to connect with students.

Laura Butgereit, the inspiration behind Math on MXit, said, “if you want to reach teenagers and children, you have to reach them using their own medium” (Butgereit, 2007). Sure enough, in the first year alone, Math on MXit went from a means by which to tutor her son in mathematics to a program with 1,000 students logging in between 2pm and 8pm on weeknights. Until this point, the user growth of Math on MXit came solely via “pupils telling fellow pupils.” When discussing future growth potential, Butgereit
mentioned that the “big push, however, is going to be done in conjunction with a government department with information being passed out in classrooms” (Butgereit, 2012).

As students became more comfortable utilizing this mobile phone service for homework help, the tutors also began using other online media – like Wikipedia - to enhance the experience (Butgereit, 2007). The students also began to see Dr. Math as a social experience, logging in just to say hello, at which point the tutors could use the opportunity to ask math-related questions and start a new conversation about topics covered in the classroom. Students – whose names, gender, identifying information were kept hidden by design – would also ask questions about other subjects or their personal lives. While tutors would not answer questions that did not relate to mathematics, they did direct students to the appropriate resources to address those extraneous issues.

Sample conversations documented by Butgereit and her research team showed students asking questions that only required simple answers such as this four-minute interchange:

(14:30:32) speedy: hw do u
(14:30:46) dr.math: Hi, do
(14:32:06) dr.math: If you is pi times radius squared
(14:32:08) speedy: 8 mm
(14:32:41) dr.math: so pi x 8 x 8the result will be in mm squared
(14:34:12) speedy: okay thanks

work out the area of a circle you have the radius of the circle? have the radius of the circle, then the area.
The exchanges also involved more complex interactions that required much more conversation and instruction, as demonstrated in this 20-minute session:

(14:32:09) Farmer: how can i get n easy whey to simplify big numbers white out n calculator

(14:32:51) dr.math: Do you mean find the prime factors of a number?

(14:33:32) Farmer: yes bat easy whey

(14:34:19) dr.math: You have to get your fingers dirty. If the number is even, then 2 is a prime factor. Then divide the number by two and try again.

(14:34:43) dr.math: If the number ends in a 5 or 0, then 5 is a prime factor. Then divide the number by five and try again.

(14:35:32) Farmer: okey

(14:35:32) dr.math: There are "tricks" for lots of numbers. If all the digits of the number add up to 3, then 3 is a prime factor. Divide by 3 and try again.

(14:36:09) Farmer: okey

(14:36:25) dr.math: Do you want to try one? What are the prime factors of 90? (14:39:48) Farmer: 45

(14:40:11) dr.math: Ok, now 4+5 = 9 and that is divisible by 3. Keep going, divide it by 3 and see what you get.

(14:40:20) Farmer: 2

(14:40:49) Farmer: 15

(14:41:10) dr.math: Good now does 15 end with a 5 or 0? yes, so it is divisible by 5. keep going

(14:41:38) Farmer: 3

(14:43:19) dr.math: Somehwere we lost something, I would work it out likethis 90/2=45 45/5=9 9/3=3 3/3=1 prime factors are 2 5 3 3

(14:44:19) Farmer: okey i thoth souw to
By the end of the study, Math on MXit demonstrated that mobile-based technology initiatives could reach a large number of students at a very low cost. While this program only covered math topics, researchers concluded that it could also cover science, history, and religion and that other organizations could utilize similar programs to reach students in need of counseling or support. In just four years Dr. Math has grown into a program that, as of 2012, works with 30,000 South African students. Its success is due in no small part to the ease of access over a familiar device and platform.

In an email exchange in April 2012 with Matthew Chetty, the manager overseeing the Math on MXit program, he declared his dream of “increasing the number of registered users on Dr. Math to 1 million!” (Chetty, 2012). He felt that Dr. Math could expand within South Africa and across the continent but acknowledged the challenges “related to sourcing and management of adequate tutors and figuring out an appropriate
sustainability model.” As of April 2012, however, the program continued to ramp up its reach within the Eastern Cape, an area within South Africa that has historically suffered from high levels of poverty and lack of infrastructure due to apartheid-era planning (Eastern Cape, 2004).

To embark on a “directed scaling-up effort in the Eastern Cape,” Math on MXit has received support from the Department of Science and Technology, one of the ministries within the South African government. Through this support the organization will see additional funding to “re-work the underlying technology platform so that it can handle the increased demand, and to ‘advertise’ the service in the Eastern Cape to attract additional users and tutors” (Chetty, 2012).

**Evaluation of Math on MXit**

As Butgereit responded via email, she and her team cannot “prove that the project helps increase pass rates or test scores” because of the nature of the ethics approval. By “dealing with minor children WITHOUT parental permission,” both tutors and students must remain completely anonymous, which makes the tracking of student scores impossible. Butgereit hesitated to make claims on the program’s pedagogy or offer an analysis from an educationalist’s perspective.

Because the researchers did not ask for test scores or other results that evaluated performance, the study did not measure the efficacy of the program in improving the overall quality of the educational system in South Africa in quantifiable terms. That said, despite the inability to track the progress of students, volunteers many times received
messages like “Thank you – I got 90%” (Willemse, 2011). Within his email exchange, Chetty noted that Meraka “regularly receive[s] news about how Dr. Math has made a difference in the Math marks of our learners, and thereby created new education opportunities for them” (Chetty, 2012). Based on criteria used to evaluate similar programs – including time efficiency, ethics, content available, consistency, and appropriate medium – Math on MXit hits the mark (Traxler, 2007).

**MXit Concerns**

Unfortunately, MXit and other forms of mobile device messaging have been under fire in South Africa, particularly from concerned parents. While the Dr. Math experiment demonstrated the ways in which the application could enhance students’ educational experience, parents have alleged that the distractions their children find on MXit have a negative impact on the amount of time spent on homework and subsequent exam scores (James, 2006). Teachers have also complained that their students frequently use their phones to chat with each other rather than pay attention to lectures, leading many schools to ban mobile devices in the classroom. Many of these fears come from parents’ lack of understanding of the mobile chat phenomenon, leading to the release of publications such as *The Parents’ Guide to MXit.*

With the majority of MXit users falling into the 12 – 24 year-old age group, critics also worry that its chat rooms attract pedophiles, providing them with easy access to young children. Undercover police have used MXit chat rooms to catch men allegedly sending inappropriate images and content to users who they assume to be minors. As
with anything else in today’s era of technology, MXit parents should know what their children do with their technology but also be open to the positive possibilities that MXit offers. When this author spoke with Jonathan Donner, researcher at Microsoft’s Technology for Emerging Markets Group, he conceded that many South Africans have a “common fear” of mobile phone use. Programs like Math on MXit and MoMaths, which is discussed in the following chapter, should serve as an example of the positive impact that the devices can have on the youth of the country, and this potential should receive further promotion and publicity (Donner, 2012).
Chapter IV:
Case Study: MoMaths

While the South African government has increased educational expenditures in recent years, economist Kevin Lings asserted, “it does not help to have a great education policy if you can't get the textbooks to the schools before the first day of school,” a point he made to demonstrate South Africa’s inability to move beyond education policy to practice (Baumann, 2010). In order for the education system to improve, students need better access to high quality materials. In conjunction with the South African government and various sponsors, Nokia initiated the MoMaths program in 2009. Unlike Dr. Math, which offers personalized instruction and requires students to have pre-existing questions for the tutors, MoMaths delivers mathematics study packages to students via their mobile devices. The program also affords a higher level of interaction, encouraging students to take practice exams, complete self-assessments, and even compete with each other in mathematics drills (Mobile Learning for Mathematics, 2011).

MoMaths

Like Dr. Math, MoMaths recognizes the need for improved mathematics education for South African students, as well as the fact that many of those students do not have access to a computer. It also works on the MXit platform, though non-MXit users can also use the program via its IP address. By using mobile phones, “the initiative
gives Grade 10 learners the opportunity to study mathematics anywhere and anytime which in turn gives them the chance to empower themselves” (McCormack, 2010).

The program offers approximately 10,000 quiz questions for students. These questions can range from basic True/False questions to more detailed problems with visuals and graphs, all of which can be displayed on most low-end devices (Kerryn, 2011). The developers and programmers work with a team of education experts to incorporate items from the curriculum with activities that encourage interaction “to ensure that learners have their lights on when they are studying.”
A sample question for Grade 10 learners can look like the following:

Figure 4.
A Sample MoMaths Question

Factorise fully:
\[144a^2 - 121b^2\]

- (72a-11b)(2a-11b)
- (12a-11b)(12a-11b)
- (144a-121b)(a+b)
- (12a-11b)(12a+11b)

Hints:
This is a difference of squares
\[144a^2 - 121b^2\]
\[= (12a)^2 - (11b)^2\]

Regardless of the student’s answer, a short hint will appear at the bottom of the screen to ensure that the student has not merely guessed the correct answer. As the student completes more questions, he can then view his progress and compare his best scores:
Figure 5.
A Representative MoMaths Practice Summary

The program creators have cited its competitive nature as one of the reasons why it has become so successful amongst students. By allowing them to compete with
themselves, however, it encourages participation amongst all levels of students and not just the students at the top of the class. Also, like Dr. Math, it recognizes the popularity of MXit amongst high school students and realizes that the best way to reach them is through a platform with which they are comfortable. While MoMaths advocates have recognized that the other features of MXit – particularly the general chat - may distract students, they have asserted that it also teaches students how to multi-task.

**The Cost of Learning**

Though students must pay for any additional chatting on their own, they can use MXit to reach out to their peers, if they get stuck on a problem. At present, developers at Nokia are considering expanding the program to make it cross-platformed so that students can also connect with their friends and family members on Facebook and Google’s g-chat (Kerryn, 2011).

By allowing use via a mobile-accessible IP address, the program insures that the students incur zero data costs. The mobile operators MTN and Cell C sponsor the program and incur the applicable costs. If students do not have their own mobile phone, participating schools have so-called mobi-kit phones available (United Nations ECOSOC Fair, 2011).

In phase one (October 2008 – June 2009), the program worked with 280 students in six schools. By the end of 2010, MoMaths saw 4000 students and 72 teachers from 30 schools participating in the program. Of the registered users, approximately 66% used the service and 54% used it regularly (United Nations ECOSOC Fair, 2011).
Evaluation of MoMaths

The teachers involved with the program have responded positively; not only can they incorporate these questions into their curriculum, but they also “can immediately see where their class’s weak points lie” (McCormack, 2010). Because students can work at their own speed and choose questions from differing levels, the program allows students to learn at a more individual pace rather than being either held back by other students or forced to keep up without retaining the information.

An examination of the year-end mathematics exams of students participating in the program, suggested that MoMaths improved the participants’ math skills (Mobile Learning for Mathematics, 2011). Compared to non-users at the same schools, MoMaths students scored approximately 7% higher on their exams (United Nations ECOSOC Fair, 2011).

Plans for Expansion

In 2011 the South African government announced its intent to expand the program to reach 18,000 students through further government funding as well as private sector support (United Nations ECOSOC Fair, 2011). A similar trial is now being conducted in Finland, where mobile phone use is as ubiquitous amongst high school students as it is in South Africa. In the same year the Commonwealth of Learning (CoL) – an intergovernmental organization committed to expanding distance- and open-learning
– announced its plans to work with Nokia to bring MoMaths to more countries across the African continent as early as 2012 (Partners, 2012).

As the program grows, Nokia encourages local ownership of the program. The South African Department of Education has expressed interest in increased funding, and organizations like the Pearson Foundation have offered to provide the program with curriculum and content (Kerryn, 2011). MTN and Cell C have both committed to providing funding by way of incurring all data costs, and both providers have also expressed interest in supporting content development.

Though interactive, the service is automated and requires considerably less manpower than Dr. Math, thus presenting fewer scalability concerns. Growth of the program will not require a large increase in financial support, as only fixed costs will be necessary to cover increased content and programming regardless of the number of students whom the program attracts.
Chapter V:

Case Study: The South African Job Search

As discussed in prior chapters, South Africa has consistently faced astonishingly high unemployment rates; with more than one-quarter of the population unemployed, something needs to change. The unfilled jobs in the country are found predominately in the engineering, management, and accounting fields, further supporting the need for quality mathematics skills among job seekers. As the educational system in South Africa continues to improve and the possibility of the use of mobile phone for education gains traction, citizens will presumably become more employable in future years as a result. Unfortunately, however, a gradual improvement in primary and secondary education will not affect the 4.2 million South African adults who cannot find a job at present.

Using the Internet for Job Searches

As the South African population receives the training necessary to complement the needs of the workplace, the country will benefit from a more efficient means of linking employers with employees. A Google search of “job search South Africa” produced more than 259,000,000 results. Sites such as Best Jobs, Jobs.co, Career Junction, and Careers 24 all link the job seeker with a database of available positions in South Africa, with each site promising a constant update of this information and providing users with the ability to upload their information so that employers can, it is hoped, connect with them. Even Facebook features a career page, Job Search South
Africa. With so few South Africans having access to a computer, however, these sites could only serve their purpose to the fullest if the general population could easily access them via their cell phones.

Unfortunately, only a handful of these sites are designed for mobile access (Donner, 2011). This access further stratifies the economy, making those citizens who already have Internet access more able to search for open positions. Further, the jobs that are announced on these websites tend to be more professional and lucrative than the types of jobs that are advertised via word-of-mouth (Donner, 2011). People with access, thus, are more likely to find the available professional service-sector jobs in the formal economy than their counterparts who do not have access to such services.

**LinkedIn**

The search for jobs in South Africa on LinkedIn – the professional take on social networking sites that now boasts an impressive 150 million members worldwide - has grown 57% year-on-year over the last four years, and more than 1 million South Africans now have LinkedIn accounts (Kruger, 2011). Additionally, nearly 12,000 South African businesses have LinkedIn pages (LinkedIn Stats for South Africa, 2011).

Not surprisingly, Information Technology constitutes the most represented industry, followed by Marketing, Management Consulting, and Financial Services. Again, these sectors typically house the more lucrative positions. Further, most users tend to have positions such as CEO, Director, or Senior Manager. Without access to a computer, many citizens further suffer from the divide in opportunity. Sectors like
agriculture, however, have experienced substantial growth in presence, however, signaling that perhaps this trend may soon change.

Figure 6.
South African LinkedIn Statistics

(Saunders, 2011)
Training Citizens to Conduct Mobile Job Searches

In a 2011 study Donner and his team of researchers from the University of Cape Town attempted to see how a sample of urban South African women would respond to mobile phone training that focused on the job search process. Much information on cell phone use focuses on the numbers - for example, a country’s number of mobile subscriptions or the number of smartphones shipped to the country. This study provides a better look at the behavior of the people using these devices, contributing a qualitative aspect to a large body of information that focuses on the quantitative (Donner, 2011).

The participants in the study had never used a PC, and thus accessing the Internet on their mobile devices was not an alternative experience but rather the only opportunity they have had to log on. As part of their training, the participants were exposed to the everyday uses of the Internet as well as to search engines. Researchers also created email addresses for them. After learning how to use the search engines on their phones, the women began searching for terms such as “job in Cape Town,” at which point they were directed to sites like Gumtree, a network of online classified ads owned by eBay. Other searches like “home based care training” directed the women to company websites that provided them with the email addresses of potential employers. In both cases, having an email address proved not only beneficial but also necessary. The women could then leave their resumes and contact information on the website or contact the employers directly to start a conversation.
While the study took place over the course of six months, follow-up interviews as well as informal conversations with participants showed that people generally had high rates of mobile phone skill retention. Six of the seven women in the study could access and utilize the Internet on their own without assistance six months after the end of the trial. Further, those people with mobile Internet know-how tended to train their friends, family, and other members of the community. The high levels of retention and the skill level that subsequently spread to others within the trainees’ social circles demonstrated that an initial investment in mobile phone training would result in continuous returns, though researchers may first consider conducting a similar study on a larger scale.
Chapter VI:

Case Study: Ummeli

When looking at the most common and severe sources of suffering and poverty amongst the bottom of the economic and social pyramid in South Africa, PhD candidate Shikoh Gitau consistently found three challenges: (1) Violence against women, (2) education and health, and (3) employment (Gitau, 2012). Speaking with South African women, Gitau found that on a day-to-day basis, they most feared not having the means to feed their children, a situation that they could most likely avoid with gainful employment. This chapter discusses Gitau’s experiences in creating a mobile-based application, Ummeli, which assists users in the job search process.

Employment

Many of the women with whom Gitau crossed paths expressed the inability to find jobs in large part because they did not know where to begin looking for such opportunities. Traditionally, job openings have been only advertised by word of mouth, and no real-time, formal information has existed. Even when citizens learned of a potential job, they would either deliver their paper CVs in person or send them via fax machine.

Gitau found that, as women became more informed of the possibilities provided by the mobile Internet, they began to teach each other how to perform such searches. Even when provided access to the Internet, however, users found that most resources –
like the website Gumtree – offered only temporary, low-paying jobs such as babysitting or shuttle bus driving. Further, without access to a computer, the women had to type out their entire CVs on their mobile devices and then manually write down the URL’s of jobs of interest on paper. Ultimately, Gitau concluded that these women and others in their situation needed something to “make their lives easier.”

While Internet programs allowed users to create formal CVs by entering in their skills, they required PC access to do so. In response, Gitau created a mobile-centric application to perform the same function designed with the text field and device capacity in mind which she called Ummeli, the Nguni word for “mediator” (Learn More About Ummeli, 2012). The program then converted these CVs from HTML to PDFs, which with a cloud computing system platform were stored and easily delivered to potential employers. By Gitau’s calculations, when using this service, users went from spending $10 to access a computer and print relevant information in an Internet café to a cost of about 2 cents. Beyond saving money, a mobile-based service was more reliable because, as Gitau noted, “the Internet is always on.”

**Using Ummeli to Get Hired**

While this application initially solved the CV issue, however, it did not address the skill mismatch between employers and employees. Once users flagged the jobs for which they wanted to apply, the program would scan their CVs and the position listings to see where the user lacked necessary skills. The application would then direct users to relevant skill development courses – many times offered for low or no cost through
NGOs and non-profits in the area – that would make workers more attractive to employers and more likely to land jobs of their dreams. Gitau created this application with South Africa – where unemployment is so widespread – in mind, but she theorized that developing countries facing similar crises and with similarly limited technological capabilities like her native Kenya could easily deploy such a program.

Admittedly, the job search process requires a skill set of its own. Fine tuning any Internet-based search is not an innate skill. The financial cost of and amount of time need for training citizens to perform such searches is low, however, especially when compared to the potential return. Further, the initial investment extends beyond the immediate training group; many trainees taught other members of their communities to perform the same searches.
Chapter VII:

Literature Review

Workplace Productivity

UNESCO links education to higher levels of productivity, better wages in the workplace, and more involvement in political decision-making amongst other factors, all of which ultimately have an impact on economic opportunities (Achieve Universal Primary Education). Workers with formal education show more workplace efficiency and are better equipped to complete more advanced tasks beyond basic labor. Businesses that do not have skilled employees thus find it difficult “to move up the value chain by producing more sophisticated or value-intensive products (Schwab, 2011).”

In this day and age higher education further increases a country’s economic competitiveness by creating a workforce that can more easily adapt to a “changing environment and the evolving needs of the production system” (Schwab, 2011). Maximizing the potential of new technology requires a certain skill set, and such skills typically come through a process of education. Uneducated workers can only tackle basic manual tasks and demonstrate difficulty “adapting to more advanced production processes and techniques” (Schwab, 2011). When this lack of basic education constrains business opportunities, firms then find themselves unable to “produce more sophisticated or value-intensive products.”

Human capital theory suggests that investment in education by the government and private sector lead to future productivity amongst the workforce. As the International Finance Corporation, based in South Africa, asserts, “primary and secondary education
are relatively low-risk businesses because the business model is fairly straightforward and capital intensity in the infrastructure is comparatively low.” From a social science perspective, government and private sector investment in education “boost[s] future productivity and improve[s] living standards.” These returns are highest in less-developed countries – like South Africa – particularly at the primary school level (Minney, 2011).

**Successful Mobile Learning Programs**

An examination of the potential and feasibility of any technology-based educational program requires consideration of the following (Traxler, 2007):

- Infrastructure (power supply, postal services, Internet connectivity)
- Sparsity (face-to-face contact, available technical support)
- Education policy agenda (inclusion of rural areas, access, promotion of lifelong learning, participation, and similar factors).

Because these features differ so much on a country-by-country basis, the use of mobile phones for education can affect students differently and can contribute to solving many of the following challenges of education: technology training, connection to the classroom, collaborative learning, personalized tutoring, real-time on-the-job assistance, and education in rural areas where access to traditional education may be difficult. Ultimately, mobile education has the potential to merge mobile technologies, human learning capacities, and social interaction into a meaningful, effective, and engaging
educational experience (Koole, 2006). As shown in the figure below, developers and practitioners should consider the FRAME model (below), taking into account the technical characteristics of the device as well as the personal and social aspects of learning, allowing them all to interact in the optimal mobile learning situation.

Figure 7.
The FRAME Model

(Koole, 2006)

Mobile learning programs work best when designed for mobile phones rather than for Internet programs that users can log into via their phones, as access speed tends to decrease when switching from the computer to the mobile device (Rekkedal, 2007). Until course content is developed specifically for mobile learning, utilizing other features of
the phone – such as messaging or chat rooms – as supplements to the pre-existing educational system may work best for now.

Students emphasize flexibility and personalization, qualities afforded by the personal nature of messaging. Educators have also found that – regardless of the medium – students tend to demonstrate more engagement in the topic when learning in a community that encourages social interaction. Practitioners can achieve this by creating a chat room or forum accessible by mobile phone. When conducting interviews with students in Norway, for example, researchers found that students who could access their classroom content on their phones also appreciated the ability to receive feedback from tutors, submit assignments, and communicate with classmates on their phones as well. At the end of the day, students logged in more frequently when they found the experience fun (Rekkedal, 2007).

**Mobile Learning By Subject**

Subjects that already have available resources online and that students can learn by use of flashcards, quizzes, or audio lessons – such as foreign languages - make more sense than subjects that ideally involve hands-on training. In the case of learning a foreign language, much research demonstrates that mobile learning, or m-learning, works because it allows users to tap into a large amount of information at any time. While this information is also available when a person uses a computer, Thornton and Houser found that students saw better results in vocabulary retention when using a mobile phone than when using a computer (Thornton & Houser, 2003). Students learned
an average of twice as many English words when using the SMS method, compared with three words when using the PC. They concluded that by receiving SMS messages, students in effect studied more regularly and received more manageable chunks of content than when they sat down with a list of vocabulary for a set amount of time. Further, the push of the message forces engagement that may otherwise not occur when a person stares at a computer screen or a piece of paper.

A study in Taiwan invited vocational high school students to work with researchers in determining the efficacy of the m-learning method. All of these students used SMS messaging regularly but had no foreign language training via this technology. At the end of the trial, students reported that Learning Vocabulary via Mobile Phone (LVMP) was “convenient and interesting” and that they had an easier time memorizing vocabulary when using SMS (Lu, 2008). By encouraging interaction, the push of the SMS showed more engagement with the material among users, though students seemed to care more about convenience than the actual process of learning the subject. As Thornton and Houser concluded in subsequent studies, when students have limited time in the classroom and would benefit from additional tutorial, mobile phones can provide the necessary supplement.

This supplement can come in many forms, encouraging as much or as little interaction as is appropriate (Moura, 2010). Teachers can utilize the technology to send materials or feedback to students, students can benefit from quizzes and activities, and all students can collaborate with each other and their teachers in extracurricular activities. Researchers also observed that, beyond enhanced learning of material, students also
learned to solve problems independent of formal instruction and learned from each other as a result.

As reinforcement, teachers would use text messages to send the highlights of their classes to students, which some students then used to verify their own notes or to re-write them when studying. As confirmed in the aforementioned studies, nearly all students enjoyed SMS activities (94%) and felt as though the activities enriched their vocabulary (90%). A much smaller percentage felt as though receiving stories on their phone encouraged them to read more (60%).

While considerably more research has looked at the advantages of mobile phones for teaching foreign languages, the same methods could be applied to teaching basic mathematics, particularly in a country like South Africa, where students so desperately need improved numeracy skills. In fact, the University of the Philippines Open University has already developed formal courses in English, math, and sciences based on the SMS platform. Graduate students in Bangkok, where more than 90% of students owned their own mobile phones in 2005, used the devices to take tests, submitting their answers to the in-class questions via SMS.

Looking specifically at math-based programs, researchers found that, when used for mathematics education, even PDAs, the predecessors to the smart and feature phones of today, showed the following (Attewell, 2004):

- Assist students’ motivation
- Help organizational skills
- Encourage a sense of responsibility
- Help support both independent and collaborative learning
- Act as reference tools.
- Track students’ progress
- Deliver assessments.

**Mobile Phones Enhancing Other Aspects of Education**

A 2002 pilot project at the University of Pretoria tested the ability of the use of SMS messaging to affect the experience of the university’s 1725 students of education, where 99% already owned a mobile phone, yet less than 1% had email access (Brown, 2003). While teachers did not use the messages to teach the material, the messages did provide basic support such as registration reminders and assignment notifications. The study showed that, as a result of this supplement to the traditional process, more students registered for classes and exams on time, nearly all of those students who registered for meetings actually attended, and students responded more quickly to messages sent via SMS.

Further, this method of distributing information saved the university substantial amounts of money. The cost of sending SMS messages to students en masse was twenty times less than that of sending print materials via the postal service. Furthermore, print material took up to 18 days to reach students in remote areas but arrived nearly instantaneously when sent via mobile phone.

In 2005 researchers concluded that, as few students continued to lack access to email and mobile phone ownership was nearly universal, SMS services could extend
beyond the administrative to the interactive. As seen in the aforementioned studies, researchers suggested that South Africa adopt a model of SMS supplementary education that would allow students to interact with each other and their teachers/tutors, access study material, and perform other tasks immediately outside of the classroom regardless of their location or the time of day. In addition, this technology bridges the educational gap between the urban and the rural and the high and the low-income communities by providing a nearly free, universally accessible service.

**Adult Education**

Horng and Horng argued that implementation of mobile use for education could include “cultivating training, technical training, in service training, job transition training and training for workers with physical and psychological problems” (Horng & Horng, 2009). Adults also reported that they had interest in informal, seemingly recreational learning that would enhance both their vocational skills and their general knowledge (Abfalter, 2004).

The appeal of education through SMS messaging does not stop with the younger generations, either. In Mongolia, for example, where an understanding of English correlates with better, higher-paying jobs in the services and finance sectors, 94% of learners polled reported that they would use SMS to learn English, and two-thirds were willing to spend up to 50% of their SMS units to do so (Batchuluun, 2007). As many South African adults grew up during apartheid, many workers in this generation did not
have equal access to quality education. The mobile phone platform can help to remedy this situation.

**On The Job**

The argument in favor of on-the-job training has long existed, with early research finding that “investment in on-the-job training … is as important as formal education” and that “the rate of return to on-the-job training investment is of the same order of magnitude as the return to investment in conventional schooling” (Mincer, 1962). The 2011-2012 Global Competitiveness Report emphasizes not only the need for secondary and tertiary education but also the importance of training employees. The “importance of vocational and continuous on-the-job training,” it asserted, ensures a “constant upgrading of workers’ skills,” though many economies tend to ignore this fact (Schwab, 2011).

In much the same way that m-learning has been praised for its push and pull features that encourage engagement amongst students, corporations anticipate that mobile phones will offer the same potential to deliver learning as needed by employees (Brown, 2008). That said, mobile-based corporate learning programs have only just now gained traction.
Chapter VIII:
Methodology

In an effort to understand better the dynamics at play within South Africa as well as the details of the aforementioned projects, the author conducted interviews with subjects involved in each of the case studies described.

Math on MXit

For this researcher to learn more about Math on MXit, South Africa-based Laurie Butgereit, the creator behind the program, seemed the logical first step. Butgereit listed her email address in the “How to Tutor for ‘Dr. Math’” guide, accessible and readily available to the public from a Google search. The author emailed her and received a response immediately. The interview process took place over the span of a month and involved a series of emails. The author initiated the conversation to evaluate the efficacy of the program, hoping Butgereit could provide more concrete information in terms of the percentage of students who, following tutoring sessions with Dr. Math, subsequently passed their exams, saw their grades improve, or contacted the program with praise or heightened enthusiasm for math.

When asked for more details behind the history of the program, Butgereit referred the author to her 2007 Masters dissertation from the Nelson Mandela Metropolitan University entitled, “C3TO: A Scalable Architecture for Mobile Chat Based Tutoring.” The paper acknowledges the dismal state of the South African education system as well
as the near-universal mobile phone penetration rates within the country. Beyond the history and trajectory, it also provides an in-depth analysis of the hardware scalability, workload, and technical issues that were present at the time of the document’s composition.

Butgereit invited the author to serve as a tutor in the program. Because tutors use computer monitors to connect with students on their phones, the author’s location and United States-based phone (that cannot access the MXit application) did not pose a problem. With this invitation, Butgereit attached the aforementioned “How to Tutor for Dr. Math” training guide (Butgereit). The guide, published by the Meraka Institute (for which Butgereit works) and protected under Creative Commons licensing, included detailed instructions on the login process and tutoring conduct and also addressed potential technical issues.

Registration first required completion of the Dr. Math “Code of Conduct” agreement and a signature page that indicated consent to participation. It also required a copy of photo identification. These forms were scanned and emailed to Butgereit, who then processed them at the Meraka Institute. The final step involved the creation of a username and password and submission of first name, last name, organization, and email address.

While most Dr. Math students ask for help with subjects at the 9th grade level or above, the author chose to tutor in the “Mathlete” category, designed for students under grade nine. The author hopes to spend more time with the program in the future to work more closely with the students. The process did, however, give her a sense of the platform as well as the ease of registering and signing into the system. Further,
Butgereit’s dissertation provided sample conversations, which this author then analyzed in Chapter Three.

When asked about the potential expansion of the Dr. Math program and the ways in which it has generated publicity, Butgereit referred the author to her boss, Matthew Chetty, and provided his email address. Like Butgereit, Chetty responded very quickly to the author’s inquiry. He provided information on expansion and funding plans as well as enthusiasm for the success of the program based on feedback received from students, as discussed in the case study.

The Mobile Job Search

When looking for scholarly work demonstrating the practical application of mobile phones in South Africa, the author found that one name in particular consistently appeared associated with this work: Jonathan Donner, researcher at Microsoft’s Technology for Emerging Markets Group. His articles dealt with the mobile-for-development field, including topics ranging from the mobile banking phenomenon to the use of mobile phones within developing-country-based organizations. The most relevant information, however, came from an article found on his Microsoft website. Entitled, “Exploring mobile-only internet use: results of a training study in urban South Africa,” the article details the experience Donner and his team had in training South African women to use their mobile phones to search for employment opportunities.

Donner included his email address on his website, and the author contacted him this way, requesting an interview. The interview took place over the phone and provided
this author with information on his findings as an outsider observing the culture and the perception of the available technology within the country.

Ummeli

In the discussion, Donner referred the author to University of Cape Town PhD student Shikoh Gitau. Gitau worked with Donner on the aforementioned mobile training study as well as other research projects related to mobile phones and professional development. As part of her PhD work, as noted above, Gitau created Ummeli, a mobile-based program designed to help users create CVs, find jobs, and connect with employers.

Connecting with Gitau proved difficult; beyond time zone differences, technology posed an issue. On the scheduled date of their interview, Kenya (where Gitau was based) experienced a nation-wide power outage. On the rescheduled day, the author and Gitau attempted to speak via Google Video Chat, but the slow connection speeds and time-outs made this option nearly impossible. The interview then took place over Google Voice, a free, real-time service available to Google users. Gitau provided a human perspective to a problem many times only viewed as numbers and percentages, discussing the daily struggles faced by the South African women whom she met. Despite such concerns as sexually transmitted diseases and gender-based violence, these women consistently expressed their number one desire: find employment so that they could feed their children.

From this point, Gitau realized that her focus on development could in no way ignore the unemployment situation within the country. When working more closely with
many of the women, she noticed that while they were applying for jobs, the majority of these jobs were temporary and the women only heard of them by word of mouth. Submitting their CVs proved difficult as well and typically required hiring someone to type it out for them at which point they would either hand-deliver the document or fax it to the employer. Combining her background in computer science with her passion for development-related projects, she created Ummeli, the mobile app that helps users through every step of the job application process.

**MXit**

To gain first-hand experience with MXit, the author performed a search for MXit in the App Store on her personal iPhone. When the “MXit Lifestyle” application appeared, it came with the below description:
Before downloading this application, the iPhone asked for the phone password on two separate occasions and also required answers to security questions. Alternatively, when clicking on the Apple icon on MXit’s homepage, the following message appeared, “Work in progress. Making the magic happen often takes a bit more time. Please check back soon for details on our amazing new iPhone app” (Hello Welcome to MXit, 2012).
The response from Technical Support relating to the MXit forums suggested using the Internet version, found at http://mxit.im, but, after creating a username, password, and verifying her gender and date of birth, the author received error messages (MXit Forum, 2012). She repeated the process and had the same problem, concluding that downloading MXit onto her iPhone was not a feasible option.

**MoMaths**

To access the MoMaths program, the author first went to Nokia’s website http://projects.developer.nokia.com/MoMaths on her computer. This website offered instructions on how to access the Mathematics Demo and a link to http://MoMaths.org/m. After logging in (using username: learner1 and password: math) on her iPhone, the author found a menu allowing her to choose from topics, scores, messages, and competitions as well as access to “My Class” and help.
Using the program did not pose any connectivity problems, nor did the author experience any technical issues.
Chapter IX:

Work Plan

Based on the evidence presented, this paper suggests expanding the Dr. Math and MoMaths programs and applications like Ummeli. Admittedly, the initiatives have different needs and challenges in terms of expansion. Ultimately, however, they have the same end result: reducing the high unemployment rates in South Africa. Further, because they all operate on a mobile phone platform, the user incurs the cost of the device and the connectivity. Unlike other proposals that require an investment in infrastructure like classrooms or computers, Dr. Math, MoMaths, and Ummeli do not have the burden of large capital expenditures and require considerably less funding.

Dr. Math

As Dr. Math grows from a program that currently works with 30,000 students to one that reaches 1 million students, the system will have an increased need for an administration capable of maintaining it. Creating and managing this administration requires a time and financial commitment. Functions within this administration will include a technical team, a billing department, and tutor management. All of these added employees will require compensation.

Most critically, as the number of students increases, so too does the number of tutors required. This paper surmises that only 25% of all students will sign in to Dr. Math within the same time frame and that each tutor can handle 25 students per evening.
Applying these assumptions, a student base of 1 million will necessitate a base of approximately 10,000 tutors.

Because South African university students are required to complete unpaid community service, they are the ideal tutors. Not only will they not require a salary, but they also will have access to university computers and workspace, thereby not increasing Dr. Math’s expenditures for space and equipment. Furthermore, to have qualified to attend university, they will have passed the same exams for which the high school students are studying.

As the number of tutors grows, so does the need for supervisors to ensure that the tutors are qualified, professional, and supported. Every 50 tutors will require a supervisor, which will result in a need for 200 supervisors. Employing recent college graduates who are without jobs will not only help the program, but it will also in its own right make a contribution to decreasing South African employment. Additionally, the average South African teacher works an approximate 25 hours per week, and interested teachers could serve as supervisors during their off hours, as the program is only live when school is not in session. The average South African teacher earns R 10,000 ($1288) per month and works 100 hours per month. These salaries equate to an approximate $13 per hour. If the supervisors were to earn $8 per hour and work 4 hours for 4 days per week, they will require $128 per week or $512 per month. Compensation of all supervisors will require approximately $100,000 per month once the student base reaches one million.

The management of the tutors will also be an issue. As discussed in the methodology section of this paper, at the very minimum tutors must submit signed documents to the program and create a username and password to begin tutoring. All of
these steps required administrative management. As the tutors and their supervisors begin to request and edit their schedules and sign in to the time sheet, the administrative burden will increase. While the supervisors should be able to handle many of these issues, the administrative may need to grow to handle these increased needs.

While the original scalability issues observed in the growth in the number of students from 2007 to 2009 were addressed, the platform will presumably require larger and faster hardware if the program grows exponentially as its managers hope. Improvements in technology will require reevaluation as the program grows.

The early stages of the program required tutors to utilize software available only in the physical office of the Meraka Institute. Because the software is now accessible remotely, tutors no longer need to be in the same country (see methodology) let alone in the same office. This fact means that the costs of physical infrastructure – office space, electricity, computers, tables, and chairs – will not increase with expansion.

MoMaths

Ideally, Dr. Math and MoMaths will combine forces to create a one-stop-shop for students. When students log in to MXit, they will do so not only to chat with their friends but also to find math help. If, for instance, they have a question on the work they have completed on MoMaths, they could easily work with an available tutor instantaneously. Similarly, Dr. Math tutors could refer students to related problem sets on MoMaths following a tutoring session.
The largest cost to MoMaths is the content building, which has largely taken place. The program will see an increase in cost if it expands to include other grade levels, but assuming it continues to target high school math students, the cost of content will not grow. The program does incur costs in terms of hosting and data transfer, which are currently sponsored, and a growth in popularity may require additional capacity. If the program continues to provide select schools with “mobile kits,” the costs will also increase incrementally. These costs could be offset by using refurbished, donated phones, and, as mobile phone penetration rates continue to climb, the need for these kits will decline, thus reducing the need for additional funding in this area.

Unlike Dr. Math, MoMaths does not have the same manpower requirements. Its services are based on content, not on individual and personalized services. As it encourages more teachers to work with the program, presumably it will need more training programs and support staff, but these costs will be one-time expenditures and non-recurring.

It is important to note that a large hindrance to the growth of both Dr. Math and MoMaths is the common fear of having children on a system like MXit unsupervised. While this fear may be sensationalized, there are still issues that, at the least, MXit may distract students from their homework. On a more serious note, newspaper reports within the country have suggested that predators use the chat-based service to prey on children. No matter how rare these occurrences are, the possibility understandably makes many parents hesitant to allow their children to access MXit. As the program grows, Dr. Math may consider operating under a separate subscription or offering, a feature that would allow parents to turn off the rest of MXit as they see fit.
Dr. Math’s largest expense comes from its manpower needs. Ummeli, however, is an automated program that does not require personalization. For this reason, as the number of users grows, the program will not require increased labor. While the program will scale easily, it will still require promotion. As the technology continues to develop, Ummeli will not mean anything or contribute to solving the problem at hand unless it is properly promoted.

By using a mobile phone platform, Ummeli’s business plan operates as a free, value-added service. Unlike Dr. Math, however, as the number of Ummeli users grows, the costs will not necessarily follow the same trajectory. Ummeli is a content-based, automated program and does not require personalized services for its users. If users feel as though they require more specialized attention, Ummeli may consider offering such services as individual resumé editing and career consulting to generate revenue to support its more philanthropic arm.

The smartphone serves as the ideal medium for promotion and advertising, as the messages will reach people who already own the mobile phones on which Ummeli runs. In a similar vein, once Ummeli becomes popular, it can generate its own revenue to cover the costs of administration and programming by allowing companies to advertise on the system. For instance, each unique user of LinkedIn, which serves a similar function, generates $1.60 in revenue.
Conclusion

This paper recognizes that no quick fix will solve South Africa’s unemployment crisis. Based on the evidence presented, it maintains that the dysfunctions of the nation’s school system lead to a populace unprepared for the workforce. By improving the quality of education, the nation can expect to see highly-trained, skilled workers ready to contribute to sectors of the economy such as finance, engineering, and management – all sectors with open positions requiring manpower in order to maintain global relevance. Once trained, potential employees need to connect with those corporations with open positions, and South Africa’s current word-of-mouth, informal marketplace will not suffice.

Three mobile-based programs – Dr. Math, MoMaths, and Ummeli – have the potential to address both of these issues without the high cost of infrastructure expenses. Dr. Math and MoMaths act as add-ons to the current education system, providing students with access to free, quality math content and instruction outside of the classroom. Ummeli offers a service that creates personalized CVs that users can then submit to employers.

These programs will not see their full potential without the time and financial commitments required for expansion. These costs are worthwhile, however, and come at a reasonably low cost when the potential benefits and the price of alternative means to combat high unemployment are considered. By delivering programs to improve the dysfunctional mathematics program and then provide a means for employees and employers to connect via technology which is already available and with which the
population is already comfortable, mobile phones can thus contribute to a decrease in unemployment within South Africa.


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