Frontrunners in ICTL: Kenyan runners' improvement in training, informal learning and economic opportunities using smartphones

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ABSTRACT

The primary aim of this research was to study how mobile technology shapes, changes, and develops informal learning outside the classroom and school environment. In this study we provided each of the 30 Kenyan elite runners with a simple Android smartphone and free Internet for one year. This research project was a developmental intervention with a participatory action research approach, and aimed to facilitate innovation and examine how the runners developed their training, informal learning, and economic opportunities using a smartphone. Logs and tracking of smartphone usage recorded quantitative data, and interviews and participatory observations gathered qualitative data. Key findings were that the smartphone improved the runners' training and race performance and created business opportunities. Second, a smartphone with an Internet connection empowered marginalized groups and augmented informal learning opportunities. Third, that a smartphone was not a significant technological hurdle for impoverished or uneducated individuals. Fourth, the participants were able to learn with little or no guidance or scaffolding. Fifth, the tracking log data indicated both a breadth and depth to individual learning. This participatory action research made a significant impact on the participants' lives and the most common statement from the interviews was the statement "it helps us a lot".

Keywords: Mobile learning; informal learning; smartphones; Kenyan runners; ICT4D; M4D

INTRODUCTION

Kenya is one of the poorest countries in the world. Kenya is ranked 143 (of 187 countries) on the Human Development Index (UNDP, 2012) with a life expectancy rate of 57 years and an average of 7 years of schooling, despite a government subsidy that makes primary school free. Approximately 67% of the population actually graduate from secondary school (UNICEF, 2008). The GNI per capita is 1,492 USD while 20 % of the population lives under the poverty line (UNDP, 2012). These facts highlight the extreme poverty and high dropout rates in Kenya and place Kenyans at the bottom of various world-ranking lists. However, mobile use and technology in Kenya move in opposite directions. Kenya has more than 29 million mobile subscribers and mobile penetration is at around 75% (Communications Commission of Kenya, 2012). Furthermore, Kenyans are avid users of mobile banking due to the ubiquitous use of Safaricom's M-Pesa text message payment system (Donner, 2010). Mobile web usage is on the rise and email and social media such as Facebook dominate current web use (Jensen, 2012). Further, smartphone adoption, especially of less expensive Android handsets, is increasing rapidly (Adam, Butcher, Tusubira and Sibthorpe, 2011).

All the aforementioned trends with mobile penetration and smartphone adoption in Kenya create an optimal environment and opportunity to study the effects of how mobile technology and m-learning can affect lives with little costs. Furthermore, as Kinuthia (2009) concludes, ICT plays an important role for leveling the playing field for marginalized groups and communities, but these groups lack the necessary technology. Moreover, Traxler (2013) argues for an analysis of evidence in research projects of mobile learning in Africa. This research project provides the technology and attempts to understand the smartphone usage of Kenyan runners and analyze how such mobile technology impacts and affects their daily lives. Therefore, the research question is: How can an inexpensive smartphone and simple native/web apps affect Kenyan runners' training, informal learning, and economic opportunities?

RELATED STUDIES

Johnson, Smith, Willis, Levine, and Haywood (2011) state that mobile devices with Internet access will soon outnumber computers because of the wide range of activities feasible when using mobile devices. Access to inexpensive, powerful mobile devices as well as the Internet is important in an African context, especially in remote areas. The impact of mobile phones is immense, and "mobile phones for development" (M4D) or "ICT for development" (ICT4D) are concepts that focus on small scale projects in developing countries by implementing mobile technology with the purpose to improve social and economic development and inclusiveness (Hellström, 2010). There are many examples of benefits such as: basic health information (m-health) with mobile applications (Chang et al., 2012), SMS requesting to test HIV-status, mobile money transfer (M-Pesa in East Africa), and mobile education (m-literacy) in South Africa that improving youth literacy using m-novels (Vosloo, 2010). Another local solution was provided in the post-election violence in Kenya in 2008, and modern technology was used to report crime, abuse, and insecure areas (Ushahidi, 2012). A number of studies exist that deal with informal learning and mobile technology. They range from educational games on mobile phones (Kukulska-Hulme et al., 2009), audiovisual support for visitors in going through the museum (Naismith and Smith, 2009; Vavoula and Sharples, 2009), m-fishing to improve fish harvests and access to fresh fish at a low price, increasing income for fishermen (Greenberg, 2012), and peasants in rural areas by communicating with urban businessmen on commodity prices and market opportunities (m-agriculture). These studies of mobile devices and informal learning show that, with increased information, more efficient agriculture and higher incomes for peasants develop (Hellström, 2010; Kala, 2012).

Pupils in schools may use mobile phones for language training, math calculations, answering teachers' questions through quizzes, or searching for geographic information and GPS coordinates. Several studies (Shih, Chuang and Hwang, 2010) indicate that students cooperation increases with the use of mobile phones in learning, which in turn develops students' ability to identify problems and think critically. Mobile phones in education are perceived as motivational, and more importantly the student (and teacher) have familiar relationships with their personal mobile phones (Kukulska-Hulme, 2007). Teachers can even provide rapid feedback on the students' learning by using text messages.

Edwards (2000) discusses the pedagogical effects of globalization and technology. A school teacher is no longer an undisputed authority. This fact reshapes learning from formal learning with formal instructors and objectives to more informal learning with modern technology. ICT changes the perspectives on learning to a learner-centered approach that focuses on individual learning and collaborative learning (Sharples, Taylor and Vavoula, 2007; Thomas and Brown, 2011). This perspective provides increased student motivation and higher learning engagement because the student monitors himself/herself and sets his/her own goals. Additionally, Edwards and Usher (2000) argue that, in a virtual classroom, the focus moves from the instructor as the

principal expert for transmitting knowledge and validating input to the learner who pursues an assortment of locally defined educational goals in a variety of ways.

The starting point is what the learner considers as essential, and it is not limited to a classroom or other physical environments for learning. Learners can access content from the Internet and communicate with a teacher anywhere in the world (Unwin, 2012), wherever the learner has access to the technology and the Internet. However, studies in India found that children with limited skills gain more from teacher-centered education, and another project in Asia found that the use of mobile phones in an educational setting was not effective (Valk, Rashid and Elder, 2010). The students learned more from printed materials and peer feedback (Valk, Rashid and Elder, 2010). However, the mobile phones in these cases were simple and perhaps not able to support appropriate educational needs.

Formal, non-formal, informal and m-learning

The distinction between formal, non-formal, and informal learning is not as distinct as it may appear. In short, it is a matter of control of the learning process and the aims of learning (Clough, Jones, McAndrew and Scanlon, 2008). Formal learning has explicitly expressed aims, and the instructor defines the process. Informal learning, which can be divided into intentional and unintentional, has in it the aims and processes defined by the learner (Clough et al., 2008). Unintentional, informal learning has a non-prescribed process and aims are unspecified. Non-formal learning lies in between formal and informal learning. Non-formal learning involves people who voluntarily and intentionally plan learning, outside of a formal institution, in order to develop essential competence. On the other hand, informal learning is learning that takes place in daily activities and, in this research project, the type of learning involved is on the threshold between non-formal and informal learning.

Keegan(2005) gives his definition of mobile learning as learning on devices with what a lady can carry in a handbag or a gentleman in his pocket. Such a definition excludes a laptop, but perhaps includes, for example, tablets. However, mobile learning is not just combining mobile with learning, but results in e-learning via mobile technology (Traxler, 2009). One needs to focus on learning that can reach remote parts of the world (geographically or socio-economically) with mobile tools and wireless technology and therewith enhance learning. In this study, mobile devices (smartphones) are regarded as tools to support learning anywhere and at any time (ubiquitous learning). A learner is continuously on the move and always able to gather information through the smartphone based on his/her current context. With traditional e-learning a learner is stationary and uses a fixed learning structure. The approach of mobile learning is that a learner, to a greater extent, "owns" the framework due to its spontaneity and informality. Learning is embedded in the daily activity and based on needs, which allows learning to take place in an appropriate and meaningful social context. Mobile technology enables people to gain and share information wherever and whenever they have a need. Thus, the usage of mobile phones challenges the formal educational setting, not only because the technology is new, interesting, and fun to use, but also due to its significant learning contribution. With increased connectivity in a mobile age learning frequently takes place more often from mobile devices than from ordinary books (Traxler, 2009). Opportunities and possibilities exist of using many of the inexpensive, smart devices with Internet connectivity in developing countries but are yet to be evaluated (Donner, 2008; Duncombe, 2011).

THEORETICAL APPROACH

Clough et al. (2008) claim that mobile phones used by adult students and experienced mobile users support both informal as well as collaborative learning, though the latter is more complex to

analyze. However, Koole (2009) contributes with a comprehensive framework (The Framework of Rational Analysis of Mobile Education or the FRAME-model) that analyzes the interactions between a mobile device, a learner, and social aspects. Koole (2009) uses a Venn diagram (Figure 1) that shows the relationships between the learner aspect (L), the social aspect (S), and the device aspect (D).
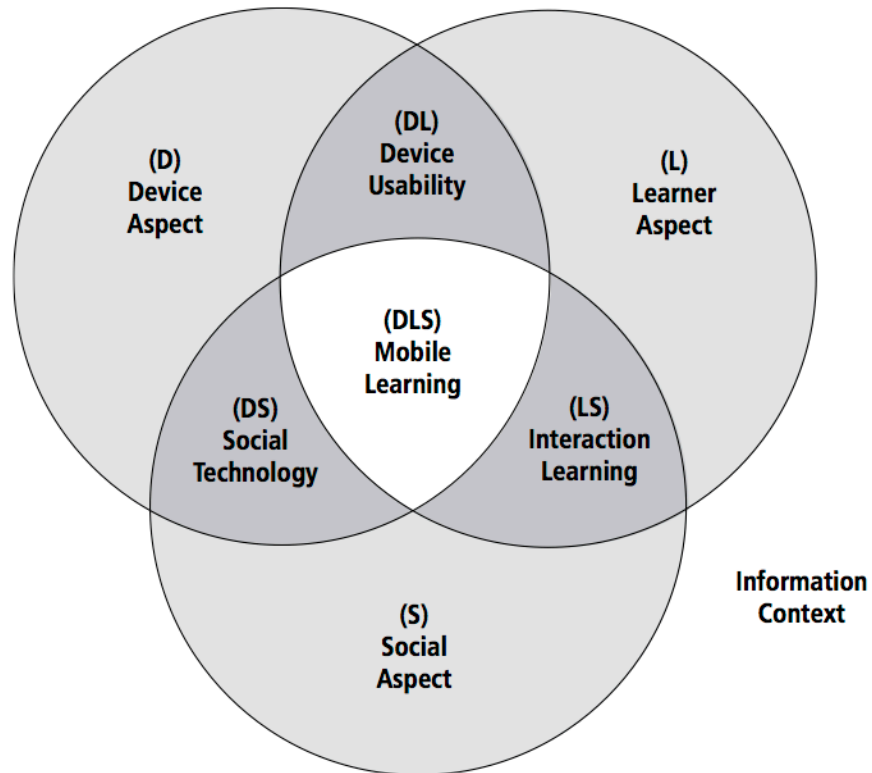
Figure 1: *The FRAME model (Koole, 2009, p.27)*

The core of the model is mobile learning (DLS), but the three aspects overlap each other. Koole (2009) defines each aspect and intersect, viz., device aspect (D), learner aspect (L), social aspect (S), device usability (DL), interaction learning (LS), social technology (DS), and mobile learning (DLS).

   i) The device aspect refers to the physical characteristics of the hardware such as size, weight, touchscreen, and storage as well as the usability of the software.
   ii) The learner aspect describes how learners use previous understanding, and how they develop skills and concepts.
   iii) The social aspect addresses communication, cooperation, and interaction.
   iv) The device usability (DL) intersect consists of both the device and learner aspects. This intersect combines the physical characteristics of the mobile device with a learner's mobility, access to information on the move, and comfort, which are all significant for usability.
   v) The social technology (DS) intersect describes information exchange and communication collaboration between multiple users of a mobile device. This intersect also considers the connectivity of a system (e.g. WiFi and Bluetooth) and collaborative tools.

vi) The interaction learning (LS) intersect refers to individual, collaborative, and socio-cultural learning. This intersect relates to Vygotsky's (1978, 1986) zone of proximal development, which is what a learner is initially able to learn in an environment together with peers, adults, or other experts, and later able to perform individually. This process is a learner-centered approach where the learner is not a passive recipient in learning activities, but rather an active participant. Authentic learning tasks are the key and, through technology, the learner can cooperate and collaborate with others in problem solving activities. By assessing the utilization of all components in a mobile learning setting, the effectiveness of learning experiences can be discussed. Smartphones support the learning process, and in this study they are tools used for learning and social processes.

However, there are shortcomings regarding the effectiveness of mobile phones for learning. For instance, what happens when the learner does not find what he/she is looking for and there is no tutor to assist? This may happen even in a formal school environment, but in such cases there are teachers, supervisors, and peers to assist with an assignment. However, Koole (2009) argues that mobile learners can gain immediate and ongoing access to information, peers, and experts (not necessarily teachers) to validate the relevance and importance of online information because mobile learning is a process defined by social, cognitive, environmental, and technical factors.

This leads to an exploration of what acquired skills and tools are required to navigate in "knowledge-rich environments". One can consider the Internet to be such an environment, if the learner is able to identify relevant and accurate information. Bransford and Schwartz (1999) claim it is not enough to reproduce "knowing that" or apply "knowing how". Instead one must be capable of "knowing with". This capacity can be explained as one associates, interprets, or judges situations based on previous experiences, which affect what learners notice in subsequent events. It is nevertheless important in a changing society that learners first generate their own ideas about phenomena, and contrast their own thinking with others to enable critical thinking and create diverse viewpoints about issues.

CASE STUDY AND KENYAN RUNNING

The FrontRunner project had a target group that consisted of Kenyan runners from the slum of Kibera in Nairobi (East Africa's largest slum) and from Ngong town (20 km outside Nairobi). The runners were chosen as the primary target group because they had little formal education, and they were a close-knit social group with no previous experience with smartphones. They were also highly motivated to try new technology in order to improve their training and income earning potential. In total there were 30 runners (21 men and 9 women) in the 19-34 age level, and the majority had not completed secondary school. All the selected runners were part of a larger training group but for this particular project their coach chose them. The runners were chosen based on their performance and attendance in training. The runners were semi-elite (in terms of racing results just below the elite level), elite on the national level, or world-class elite (competing professionally in international races). The vast majority of the target group concentrated on running the marathon (because there is more prize money in the marathon) and trained 2-3 times per day/6 days a week, to realize their potential and fulfill their goals. The runners were committed and proud to be athletes, and strove to make their country proud of them. All the runners came from poor backgrounds, and running was their chance to earn money. Some of the runners succeeded in the struggle to be a top athlete and earn a significant income, while others did not succeed.

All the runners in the target group already had a simple mobile phone, but they had never used a smartphone. The target group had limited computer skills (computer skills are not taught on a

regular basis in schools and students are instead instructed to go to Internet cafes) ranging from nothing at all to sending an email or doing simple searches on the Internet. Hence, it was important to keep the technology as simple as possible. Therefore, at the start of the project only the standard Android apps were available. The reasons for this were: a) pedagogical because the technology should facilitate the project rather than dictate outcomes b) practical, as too advanced smartphones could become a serious barrier to engaging with a mobile learning activity, c) security because a simple smartphone minimized the attraction value for others and reduced the risk of theft.

All 30 Kenyan runners were provided with a simple Android smartphone (Huawei Ideos costing $80 USD) and free Internet time (1.5 GB traffic/month). The research institutions backing this research effort paid for the smartphones and Internet time. Attempts were made to gather corporate sponsorship, but all efforts failed. The lack of corporate sponsorship prohibited the purchase of more expensive and advanced smartphones, but allowed the study to proceed without being beholden to partners with vested interests. In total, 29 of the 30 smartphones were tracked, and all aspects of telephone usage were recorded by a locally installed app and sent to servers when a data connection was available. The one smartphone that was not tracked had hardware issues that prevented tracking, despite numerous attempts to repair it. Due to a variety of technical issues, all the activities were not successfully logged for the entire year. However, the tracking for all 29 smartphones was for at least 4-6 months of the entire period, and 3 smartphones were tracked for the entire time period. This tracking meant that the number of text messages, calls, GPS-locations, applications used, and web pages accessed were recorded and stored for each runner. The tracking log data even provided the specific dates and times of use. This concrete data supplied important, objective information that balanced the subjective images that emerged in the formal interviews, as well as provided security measures if the telephone were lost or stolen. The participants were well aware of the tracking, and it was thoroughly discussed both within the groups and with the researchers. Permission from each runner was given in a written, informed consent letter.

Naturally tracking and logging personal information creates an ethical discussion of the research design, and it was continuously discussed during workshops, meetings, and interviews. Our educational institutions approved the informed consent forms in October 2011. In November 2011, at the start of the study followed by the distribution of the smartphones, the runners first read the consent letter themselves. They then had the consent forms read aloud and thoroughly explained to them in both English and Kiswahili prior to signing. In addition, the exit strategy for this study was that after the research period expired (Nov. 2012), the participants would be allowed to keep the smartphones for use as they wished.

This study was an exploratory case study (Yin, 2009). The method used was participatory action research (PAR) that aimed at deeply delving into a phenomenon and exploring the details of a situation in order to understand and empower participants (McTaggart, 1997). It was an intervention (with the target group receiving the smartphones to learn and achieve something with it, so it had a specific purpose. The runners' use of and learning with the smartphones during daily activities was analyzed in order to enhance educational opportunities outside the formal sector. Furthermore, specific informal and non-formal learning activities were planned and completed, however, it was difficult to know to what extent the participants were empowered by the research process (Simonson and Bushaw, 1993), although new ideas arose during discussions/workshops (five visits to Nairobi during the project) with researchers and other participants. Initially, the researchers assisted with the basics of smartphone usage and suggested different learning activities. However, inspiration and guidance for other activities came from peer collaboration.

Participatory action research requires fieldwork, though the researchers' time in the field was not continuous. The researchers chose to follow the project on site in different periods and not as permanent participants in the field, and were in Kenya five times in order to perform workshops, interviews, and address any hardware issues with the smartphones. However, further data collection was made possible in addition to the fieldwork and interviews (individual and group) by using e-mail, web surveys, and the continuous logging of the smartphones. The qualitative data were reviewed and categorized several times and the mobile log data were thoroughly checked to see that they were in sync with the categorizations. Furthermore, both a within-case analysis and a cross-case analysis were used to examine different perspectives on the same issues (Patton, 2002). By grouping together data from different participants to themes or patterns both evidence and rival explanations of the research design and its findings were investigated. The analyses of all the interview data and log data were broadened and strengthened because one researcher focused on the technical aspects of smartphone usage while another focused on the learning aspects.

RESULTS

The results are presented below within the FRAME theoretical framework discussed earlier. The empirical data are presented according to the device, learner, and social aspects. All quotes from participants' interviews use pseudonyms to hide actual identities. The data sometimes overlap, but the interactions and intersects presented previously in Figure 1 are also discussed in order to take this into account.

Device aspect and usability

Results from this study indicated that smartphones could support learning and had an important role to play in informal settings. Many of the runners lacked computer skills and the telephone tracking log data supported this fact because the fourth most commonly used application on the smartphone was the "settings" application. This fact indicates the participants' need to frequently access the settings on the phone to determine how some aspect of the telephone functioned. However, they did not express anxiety about getting started with the device. Instead they showed enthusiasm and motivation to understand their smartphone and frequently assisted each other. In a very short time, all the runners had an e-mail and Facebook account, downloaded different apps for training, took and shared pictures, listened to music, and browsed the Internet. One runner (Eric, personal interview) claimed he learned by exploration- "You do it yourself, when you not busy you sit down and click on a program and you are following things." In several cases, the runners even taught family members the capabilities of a smartphone.

The runners developed skills on how to use the smartphone and established areas for further exploration. They exchanged ideas with each other about different applications, which ranged from games and other leisure applications to technical and educational applications. The telephone tracking log data showed a great diversity in websites and applications. For example, the participants surfed over 1800 unique URLs (website addresses) and used 182 unique applications during the course of the study. The most frequented websites were Yahoo, Google, and Facebook. The most frequently used applications were the "contacts", "telephone dialer" and "application launcher". A list of the most 10 frequented websites and used applications along with total usage statistics can be seen in Table 1 below. Many of the runners also downloaded the Bible, so that they could read it whenever they had time. Frequently, they read the Bible (220 distinct uses recorded) on their phones while attending church services on Sundays. Web searches were mostly done in English, though some runners translated to Kiswahili with "Google translate" before searching.

Table 1. *Summary of the top 10 websites visited and applications used along with total usage statistics for the successfully tracked time periods for all 29 smartphones.*

Top 10 most visited sites (1800 unique sites visited in total)	Number of unique visits	Top 10 most used phone applications (182 different apps used in total)	Number of distinct uses
Yahoo sites	28,483	Contacts	73,560
Google sites	19,803	Phone dialer	72,764
Facebook	11,634	Application launcher	69,483
www.safaricom.com (Telephone company)	2,598	Phone settings	18,164
YouTube	2,456	Web browser	16,219
www.standardmedia.co.ke (News site)	2,246	MMS	16,192
Twitter	1,731	Photo Gallery	8,739
www.netlog.com (Dating site)	1,708	Music player	6,918
Wikipedia	1,282	Facebook	5,663
www.nation.co.ke (News site)	1,279	Google search	5,161
Total number of visits for all sites	**180,728**	**Total number of distinct uses of all applications**	**346,831**

The runners were asked about their learning and when they used their mobile devices. According to them, learning happened all the time, and their "in-between time" was used unintentionally. By filling the space between ordinary activities like training, eating, and meetings, the smartphone afforded opportunities to be informed and stay connected. They were connected with family and friends as well as the Internet around the clock. The runners updated their statuses, and increased their communication with others. Their communication was mostly by phone and chat in the local community. They also assisted each other with technical and language problems, and shared advice on new applications. The runners communicated with the outside world mostly by Facebook and email and some even used Twitter. The smartphone became a part of their daily activities and was always with them. Internet cafés (Cyber in Kenya) were no longer necessary for the runners to access the web, thereby saving money. A runner (Eric) stated in the web inquiry: "On a typical day, I wake up and read inspirational quotes from the Internet. Then all day long I do send e-mails and receive them at my time and place. No more Cyber cafes now."

Learner aspect and interaction learning

The low cost associated with learning with a smartphone was especially beneficial in a developing country such as Kenya. Education in Kenya is costly after the primary school level and even has pedagogical challenges. Pupils mainly memorize information and reiterate it in national examinations. The runners realized that to learn with a smartphone it was not possible to memorize knowledge as in formal schooling. Instead, they had to explore and experiment themselves in order to understand the smartphone. Technical support for the smartphone and applications was a challenge, but the participants realized that they needed minimal instruction to work with the smartphone. One runner (Emmanuel, personal interview) said, "I have not learned anything about computer so this phone is the first teacher to teach me about computer."

Other common tasks and skills that the runners developed were, for example,
   (i)   searching for races in foreign countries;
   (ii) getting inspiration online from other Kenyan runners;

    (iii) watching races on YouTube;
    (iv) finding advice to prevent injuries, finding health related issues (such as diet and exercise);
    (v) reading news, and
    (vi) watching videos.

Within three months, the runners were watching TV on their smartphones and one runner said (Susan, personal interview) that she did not have a TV and "before the smartphone I could go to the neighbor, we watch the television from there or sometimes I heard from other people what is going on".

The runners initially indicated (interviews in the initial phase of the project) that their main interest was running and that they were not interested in political issues, "We don't follow politics". One reason was that politicians were seen as corrupt and liars. Nevertheless, we could see that the runners gradually showed an increased interest in their surrounding world. For example, the telephone tracking log data (Table 1) showed that the runners frequented many news sites from their smartphones, with the website *www.standardmedia.co.ke* being the 6th most visited web site overall, with over 1600 individual visits. The runners not only followed headline and sports news mostly within East Africa, but also worldwide. When the runners gathered for training (they nearly always train in groups), they discussed the latest news. One runner even claimed (Benjamin), "I'm now reading the Washington Post", which was completely new to him. Before, during, and after training sessions the runners not only discussed the latest news, which they of course even did before, but now they did so with increased knowledge and accuracy of current events. Increased access to a variety of news sources was very critical considering the violence that took place in Nairobi and Kenya's ongoing war with Al-shabab in Somalia.

As Maurice stated, "From now I'm well updated. Whatever, we are used to books that were written some many years ago, but currently we have this. You just click and then you are well updated". Curiosity stimulated their learning and one runner (Eric) argued: "Like on Sunday. The pastor was talking and gave us education, and he gave us a story of a fight between Muhammad Ali and Frazier. You see when he was talking, it was very short, and it was something you like to find out more, so immediately after church I went out to my car and read the whole story. Very entertaining. So it is quite helpful. You cannot imagine life without these phones now".

Furthermore, the runners improved their skills in English and were eager to learn more, and the smartphone satisfied their curiosity. Some participants translated phrases from other languages (for example Spanish) and thereby widened communication with people they could not have communicated with before. The runners improved on their basic computer skills and explicitly expressed a desire to further develop their computer skills and even improve their Human Rights awareness. Another learning outcome was location awareness. The runners used the GPS during training sessions (4914 separate application were recorded), and after training they explored details in connection with the map and route generated from their run. Some of the participants even used their smartphones and GPS to find and visit new locations in Nairobi.
This learning and new knowledge spawned new ideas, which ultimately resulted in even more e-mail, Facebook messages, web searching, and sharing of training routes. One runner (Dennis) wrote in an e-mail before a planned workshop in Kenya: "You are welcome in Kenya. Come having it in mind that you have the burden of initiating the awareness forums." One trend that emerged from the participatory action research was that the availability of ICT had a social impact and empowered the runners.

Social aspect and social technology

The participants incorporated the smartphones as per their sociocultural context, and found new ways to exploit this technology. However, the main advantages highlighted by the participants during both group and individual interviews were the effects of training. The runners' own training improved with the use of the smartphone with running apps such as RunKeeper and MyTracks in their daily training. They had better access to data from their training and could view it afterwards in order to analyze and make necessary adjustments. The runners' speed and endurance increased because information such as pace, total time, and distance were continuously available during the training session, and several of the runners reached the Kenya national championships in track and field for the first time. One runner (Nicholas) argued, "Since I got the smartphone I became so motivated and nowadays I train twice a day to increase my speed. I'm faster than I used to be with the help of the timing." Before using the smartphone, the runners claimed, "we just used to run" without tracking the distance or speed of a run. Now they were better prepared and informed before, during, and after training.

Another reason for increased race performance was access to detailed information about races that was previously not possible. Before road races the runners searched for course details such as course profile, course record, average temperature, and altitude in order to better prepare for a race. If the race was an international race, the runners also searched for general information about the culture and city where the race took place. Additionally, the runners also stated that their long training runs (30-40 km run) were not as monotonous when you could listen to music at the same time. Usually one of the runners in the group acted as a DJ and played music through the speakers of his/her smartphone.

An example of increased personal expression and access to an extended social network with the smartphone came from the first interview. One of the female runners (Patricia) said,
> *"For me, I was going to Cyber café. To click and write for races that I wanted to run. But for now, I'm very happy, for having this phone that has meant a lot of change in my life. Because now, when I want to Google something, finding it, even if it is in midnight, it is no problem."*

A few months later, the same runner informed that she was soon leaving for a foreign country. The reason was that she had been browsing on her phone and came in contact with a race organizer in that country, and they had arranged several races for her. Previously, only agents arranged international races. Now the runners could create, collaborate, explore and control the process themselves by using a smartphone.

The smartphone also provided some basic tools for creating business opportunities for a better life. Some of the runners used the camera in the smartphone to do business. By taking pictures of ceremonial contexts or solemn occasions, they were able to print the pictures and sell them to the guests. The majority of the runners also started doing business through their running. They organized urban tourism called "slum runs", where tourists could safely run with elite Kenyan runners through local slums. Tourists in Nairobi were paying for "slum walks", which were guided walks through the slums of Nairobi. In Nairobi the visitors gained safe access to local people through a NGO to visit homes and projects in the slum. The "slum run" had the same theme and access, but instead explored the slum while running with local runners. The smartphone was used to book and manage planned runs as well as track the actual route, and all contact with the customers was managed through the devices. These "slum runs" not only generated income, but also created learning opportunities and enhanced interaction between tourists and citizens. These runs generated income for the runners and even enhanced language skills and knowledge of their surroundings because they stopped frequently to explain local points of interest. The

runners, tourists, and even local inhabitants learned from one other through dialogue while interacting in their native surroundings and sharing aspects of each other's culture.

The "slum runs" revealed that runners in the project were confident using the smartphone and ready to seize business opportunities. The runners also expanded their horizons and envisioned alternative opportunities to their running "careers". With increased information and knowledge they anticipated other possible careers, such as physiotherapy or business, for additional income beyond just running.

A short summary of the primary implications for the runners' smartphone usage on economic opportunities, informal learning and running performance is shown in Table 2.

Table 2. A summary of implications the smartphones have had on the runners' training, economic opportunities and informal learning

Economic opportunities	Performed "slum runs" for income. Sold pictures taken with their smartphones Rented the smartphone to other runners who did not have one. Charged fees for using the smartphone as a tool to learn skills/gather information.
Informal Learning	Increased awareness of their surroundings. Increased awareness of current events. Improved English language skills. Improved navigation. Improved online banking. Improved digital literacy. Learned to create and maintain a digital presence.
Running performance	One male runner has 2 wins and 2 top 10 finishes in international races and now has a manager Two female runners are living and running internationally in Denmark and Mexico respectively. One male runner has won races in Scandinavia and now has a manager. Four runners have participated in the Kenyan national championships.

Understandably, a direct correlation between smartphone usage and increased running performance is difficult to prove. However, according to the runners themselves in interviews, the smartphones helped immensely by improving their ability to time runs, measure total mileage per week and search the web for training and diet advice when training for races. Therefore the runners were better prepared for races using the newly acquired data from the smartphone instead of their previous "we just run" approach. The smartphones also assisted in planning for races by searching for and studying the race profile and competitors. Finally, the smartphone gave the runners the key ability to find and contact race managers (for example in Denmark and Mexico), who are vital for a Kenyan runner to compete internationally. The assumption is that the combination of all these factors contributed significantly to the runners' overall performance and subsequently their running achievements.

ANALYSIS

The process in participant action research is initiated by the researcher, but designed together with the participants, and aims to action implications (Whyte, 1991). Thus, the participatory action research method in this case impacted the outcome. However, the impact of these acquired new skills and knowledge from intensive usage of the smartphones was not intentionally preplanned or designed. It was instead a result of the collaboration or dialogue between researchers and participants to improve life conditions. Hence, this process was greatly influenced by the participants and new ideas arose during the fieldwork. Some of these ideas were implemented in reality as a Human Rights education platform and slum runs. Regarding increased confidence and faith in the researchers and collaboration, the Kenyan runners developed a higher self-esteem concerning the usage of technology. Therefore, the mobile log data showed significant use of the smartphones, and interviews verified increased learning and knowledge.

The target groups in this project had a limited, formal school background, but exhibited an increased interest in education and learning. This research project contributed to new ways in using smartphones in mainstream school education and to achieve a more blended approach between formal and informal learning. Learning with the smartphone was not planned, sometimes unintentional, and not intervened by teachers. Additionally, it was individualized and diverse and consisted of real life learning, which was relevant, interesting, and significant for the learner. Learning could be delivered "just-in-time" or "just-for-me" and many of the runners remarked that the smartphone kept them busy and entertained (Traxler, 2009). Furthermore, the device aspect had a significant impact on usability (Koole, 2009). The smartphone reduced boredom and facilitated relaxation with music, reading, and/or surfing the web between training sessions. In order to enhance knowledge and select relevant and reliable information, some kind of support or scaffolding was needed. This support was either guidance from a friend or relative, or support from the application itself, one that did not require high-level skills. Additionally, the participants in this case study had an active, self-motivated learning process and they were not simply passive recipients of the researchers' objectives or intentions.

The core of Koole's (2009) FRAME-model is the integration of mobile technology, learning capacity and social interaction. This case study showed the smartphone was a significant and appropriate tool for learning and collaboration. The device itself had significant impact on the usability. The Kenyan runners were comfortable with their smartphones. The participants operated and interacted with the smartphone easily, and the existing screen size and speed of the Internet was acceptable. In order to deepen knowledge and select relevant and reliable information, some kind of support or scaffolding was needed. This support was either guidance from a friend or relative, or support from the application itself, which did not require high-level skills. Additionally, the participants in this case study had an active, self-motivated learning process, and they were not simply passive recipients of the researchers' objectives or intentions. The participants learned by discovery, intrinsic motivation, and prior knowledge. They stimulated understanding with multimedia and had a willingness to adopt new information whenever possible.

However, conveying the concepts was difficult because of the social processes that dominated the running community. The smartphone created a bridge between learning and increased social interaction. Though the learning interaction was generally learner to content and action-oriented, there was a need to utilize a variety of learning situations and interactions in order to select relevant information. There is a distinction between knowledge production, where a teacher determines what should be learned, and what we encountered in this project, which was knowledge navigation where someone who knew more assisted the learner (Koole, 2009). Koole (2009, p.39) notes, "In knowledge navigation, learners acquire skills to appropriately select, manipulate, and apply information to their own unique situations and needs." Bransford and

Schwartz (1999) also describe this behavior referring to "knowing with". The usage of a smartphone coupled with Internet access challenged the runners to question their own assumptions, and they actively sought out others' opinions in the pursuit of learning and increased understanding.

Pupils in schools, particularly those in developing countries, are not frequently exposed to ICT, and therefore a smartphone could be one tool for those with limited technical knowledge to improve digital literacy. With the introduction of new technologies such as smartphones, a more flexible learning environment was available and the smartphone with suitable mobile applications worked as a catalyst for immediate learning. A majority of the runners had only a primary school educational background and limited academic skills in English. In the observations it was noted that if they did not properly translate something, then they probably did not understand the content. This fact minimized the learning effect in the sense that the learner just did what they used to do without utilizing the smartphone. The deciding factor was that the learner interpreted and understood information with the goal of creating knowledge. From the interviews and observation emerged a concern that a critical view of Internet content was not instinctive for the majority of the runners. This inclination is inline with by an Italian study of adolescents that found a lack of critical thinking regarding Internet information (Calvani, Fini, Ranieri and Picci, 2012).

As previously stated, the runners frequently searched for information, read online news, and generally created an online presence to a great extent. However, Internet access was costly and in this project the researchers provided the participants with free Internet during the project period to alleviate this issue. Wi-Fi hot spots existed in the Nairobi area, but only in the more sophisticated locations like hotels and coffee shops. Therefore, it was not a feasible long-term option for our target group. Another negative device aspect of this project was the battery life of the smartphone, which did not last long, especially if a mobile data connection, GPS, and other energy consuming applications such as video were used. The issue of poor battery life was compounded in this case because some participants did not have electricity and were forced to pay to charge their smartphones at charging stations. The poor battery life and high power usage of a mobile data connection and videos increased the runners' need to charge their smartphones more often than with a simpler mobile phone. This increased cost might also have reduced their usage of power hungry applications.

Finally, in spite of the roadblocks, the participants were convinced that the smartphone not only assisted them in information seeking and training, but also reduced corruption and cheating. Money transfers, banking, and bookings using the smartphone minimized opportunities for corruption. Smartphone transactions reduced cash transactions and thus reduced the risk for traditional bribery. Thus, technology was used by young adults within sociocultural circumstances in which technologies existed and through which they attained their meaning (Rangaswamy and Cutrell, 2012). The participants relied heavily on the technology and less on institutional entities. The runners developed skills as informed citizens, and they did not only master the tool, but even maneuvered more independently in society.

CONCLUDING REMARKS

Nowadays many people access the Internet with a mobile device and this fact is transforming learning. A smartphone in the hands of Kenyan runners, or any Kenyan citizen, has a strong potential for changing life conditions and increasing both informal and non-formal learning. The use of a smartphone was a part and parcel of the daily activity of the runners, and it enriched their everyday lives. The smartphones created increased awareness and the most common statement in the interviews was "so it helps us a lot". The runners' motivation to use modern technology to

improve their own training and racing as well as learn new skills via the smartphone increased dramatically and their self-esteem grew.

From the findings and analysis of this study the following five major conclusions are
1. the smartphone improved the runners' training and race performance and created business opportunities;
2. a smartphone with an Internet connection empowered marginalized groups and augmented informal learning opportunities;
3. a smartphone was not a significant technological hurdle for impoverished or uneducated individuals, and most issues were solved locally;
4. the participants were able to learn with little or no guidance or scaffolding;
5. the tracking log data indicated both a breadth and depth to individual learning due to the diversity and number of web sites and applications used.

In short, this project showed that mobile technology with an inexpensive smartphone could support poor people in their learning with little need for intervention or training. It was the equivalent of giving them a computer connected to the Internet around the clock.

Some limitations to advanced learning that still remain are
i) A lack of computer skills and language, although the learners mostly solved such issues by consulting a friend who knew a bit more, so-called peer tutoring.
ii) Physical limitations like the cost and access to the Internet and electricity.

These ubiquitous technologies in developed countries were too expensive and unstable to maximize the effects of a smartphone and need to be addressed by future interventions. Finally, runners are icons in Kenyan society, and even in this project their competitive spirit motivated them to succeed regardless of hurdles. Now the runners are even motivated to be role models outside of principal activities, in the form of frontrunners in ICT and development.

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