PROMOTING ICT CAREERS USING A MOBILE ICT CAREER APPLICATION

*Ferreira D.B. and Calitz A.P.
Department of Computing Sciences,
Nelson Mandela Metropolitan University
Port Elizabeth, South Africa
E-mail: Darren.Ferreira@nmmu.ac.za (*Corresponding Author*)

Abstract: In South Africa, it is currently estimated that there are more than 70 000 vacancies for Information and Communication Technology (ICT) practitioners. One reason for the ICT skill shortage is that the number of ICT vacancies, over a range of career paths, outnumbers the number of ICT students graduating from tertiary education institutions. This situation is exacerbated by the fact that an insufficient number of secondary school scholars select ICT related studies as a career option. Scholars are generally unaware of the ICT career possibilities and employment opportunities available in the ICT industry.

In order to address the challenge of knowledge about suitable ICT careers, a mobile application that provides information on ICT qualifications and ICT careers to scholars and students was developed. The native, single user mobile application assists scholars with the calculation of Admission Point Scores to determine if they qualify for specific ICT tertiary qualifications. It further provides information on ICT qualifications and careers in the ICT industry. The evaluation of the mobile application by scholars and students revealed that the majority of the scholars and students reacted positively to the functionality offered and the way in which the career guidance and information were presented. The application can be adapted and utilised in other countries to assist in creating ICT career awareness at school level.

Keywords: Mobile application development, mobile devices, ICT career sector, Mobile career application.

1.   Introduction

The shortage of skilled Information Communication Technology (ICT) employees in South African businesses is of great concern and requires various initiatives in order to reignite interest in the field of ICT (Isele & Bizer, 2012). At present there is a lack of necessary ICT skilled workers in the ICT industry and there is a critical   shortage of qualified staff (Calitz, 2010; Rogers, Sharp, & Preece, 2012). Over the past years the number of students enrolling for ICT related qualifications has decreased and according to studies conducted by Calitz (2010), the main reasons for this decrease are the negative perceptions

about the ICT field, the lack of sufficient ICT career information and the limited knowledge of the job opportunities available in the ICT industry. The Internet and ICT are vital components in the daily operation of many businesses; these businesses rely on employees with sufficient knowledge and ICT skills to complete tasks and processes in the business.

The Internet is universally utilised to obtain and disseminate information to users. Generally users connect to the Internet with the objective of searching for specific sites or terms. Users often access web portals for specific information as portals provide users with a way of identifying related information (Telang, 2004).The use of mobile devices to browse the Internet has increased tenfold over the past years (Waverman, Meschi, & Fuss, 2005; Goldstuck, 2012). Six out of ten Americans are now wireless users or regularly connect to wireless networks. This has seen mobile data applications becoming increasingly popular amongst all age groups (Smith, 2010).

The problem faced by South Africans is that data access using mobile technologies is expensive and at times unreliable in terms of signal strength and connectivity. Network providers are charging high data costs that often cannot be afforded by scholars and students. The combination of the lack of ICT skills, the massive global usage of the Internet and global usage of web portals and mobile development has shown that there is a need for a South African ICT career portal. Currently, online users are able to access career portals but these portals tend to focus more on the recruitment opportunities rather than focus on education and skills required within the ICT industry and specific job opportunities (Kubalik & Matousek, 2011).

The Department of Computing Sciences at Nelson Mandela Metropolitan University (NMMU) developed an ICT Career Portal to assist scholars and students with ICT career information, access to tertiary programs and industry career opportunities. The problem in developing countries is that often students and scholars are not able to access portals because of unstable Internet connections and the affordability. The problem has created a need for the development of a mobile ICT application (app) that will enable users to use the mobile application offline, which requires no data usage, only an initial download.

This paper consists of a literature review which discusses the current ICT skill shortage, the significant growth of mobile application development and various mobile application specifications. The literature also provides an in-depth comparison of current mobile ICT career applications and the importance of these mobile applications in the development of the ICT career application. A discussion on the development of various prototypes is followed by

ausability evaluation of the mobile application by scholars and students. The results are presented with conclusions and future research possibilities.

2.   Literature review

In this section, the limited supply of ICT skills to businesses is discussed and how it poses a threat to the current ICT industry. By examining this threat and its consequences, a solution is proposed with the focus on the importance and growth of mobile application development. Extensive mobile development has led to an increased number of mobile applications available to users. A discussion on current mobile career applications is includedbecause various types of mobile applications are available.

2.1   ICT Skill Shortage

The low enrolment of students into ICT courses has had an effect on the ICT industry. This has created a scarcity of skilled ICT employees in nearly every computer related field. One problem experienced is that there is a difference between the skills that ICT people have and the skills required in business at different levels and in different industries(Calitz, 2010; Hall, 2012). With the current rise in technology such as cloud computing, mobile computing and location based services, the need for skilled ICT professionals is predicted to grow. The continuous growth in information technology has made the jobs of Information Technology (IT) managers increasingly difficult to fill as finding suitably qualified ICT employees is challenging(Isele & Bizer, 2012; Melchor, 2010).

One of the main problems faced by the South African ICT industry is the lack of understanding of the numerous ICT career paths available. There are also misconceptions regarding ICT qualifications and employment opportunities. These misconceptions affect the career choices of both scholars and students. The problem is further exaggerated by a lack of information provided to scholars at a secondary school level about the ICT field and possible careers in ICT (Calitz, 2010). Misconceptions about ICT often involve the thinking that working in ICT results in sitting behind a computer desk all day coding and not interacting with staff. Scholars also assume that computers are for "geeks" or "nerds" only.

The Internet has a part to play in the field of ICT and in computer related jobs. The use of the Internet has increased and according to studies conducted by Pingdom (2014) in 2012, the studies have shown that there has been a significant growth in the number of people using the Internet globally over the past ten years.

The number of Internet users has grown significantly during 2000 to 2010 (Figure 2-1).In developing countries, the Internet has paved a way for an increased number of ICT careers.

The number of people and businesses using the Internet has increased tenfold. The Internet and career portals have also made the task of finding jobs easier and less burdensome which helps both prospective employees and employers (Celik et al., 2013).
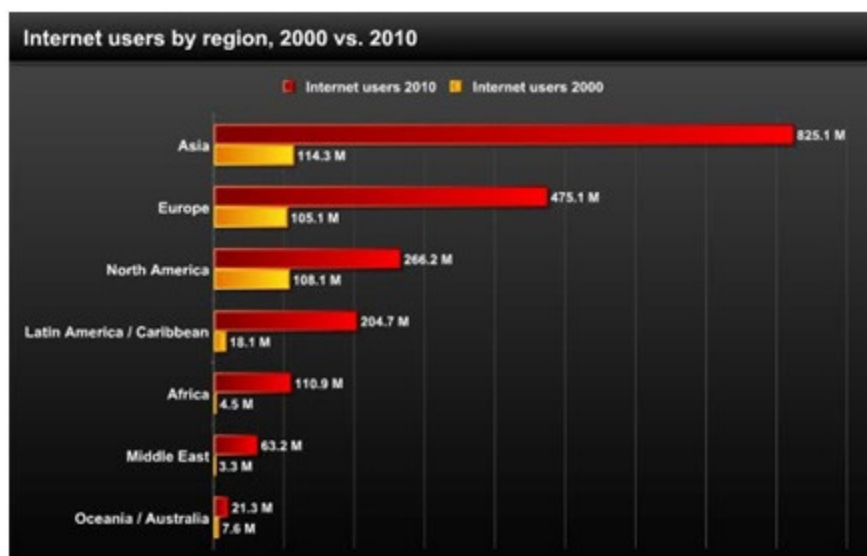

Figure 2-1: Internet Users per Region

2.2   Growth and Significance of Mobile Development

A recent study by Whitfield (2013) shows that there are over 1 200 000 000 mobile application users worldwide. Information technology is constantly advancing and so the need for software developers will increase. The latest industry to achieve significant growth is the mobile industry. Smartphones have now become part of many daily routines and cannot be compared to the smartphones of a number of years ago. Smartphones of the past were only able to send and receive emails and had mobile browsers that displayed text and an image depending on the mobile device and mobile site (Charland & Leroux, 2011).

The growth in mobile application development is being noticed by universities globally and has caused a global reaction whereby universities are now offering courses and even degrees in mobile development. Gardner has predicted that by the end of the year 2015, mobile development projects will outnumber personal computer applications by four to one (Hall, 2012).

Besides the global change at universities regarding going mobile, mobility is now an integral part of the day to day activities of many business people and, in turn, this is creating contributory factors to mobile development growth. People in the office enjoy roaming, carryinga mobile device instead of sitting at a desktop computer where they are confined to a desk. This luxury has led to an increase in engagement with customers and an increase in

business relations between businesses and their customers. Over the past years there has been an increase in business related mobile applications that allow users to display critical information related to business. This increase in efficiency has resulted in a large increase in revenue for many businesses (Angel, 2012).

The recent rise in mobile use globally has caused mobile development to become one of the fastest growing markets in the world (Figure 2-2). The rise in mobile development has also been boosted by vigorous competition between the major mobile operating systems and the advantage of having the best mobile "app stores" is highly sought after. The major operating systems include Apple's iOS and Google'sAndroid, followed closely by Windows.
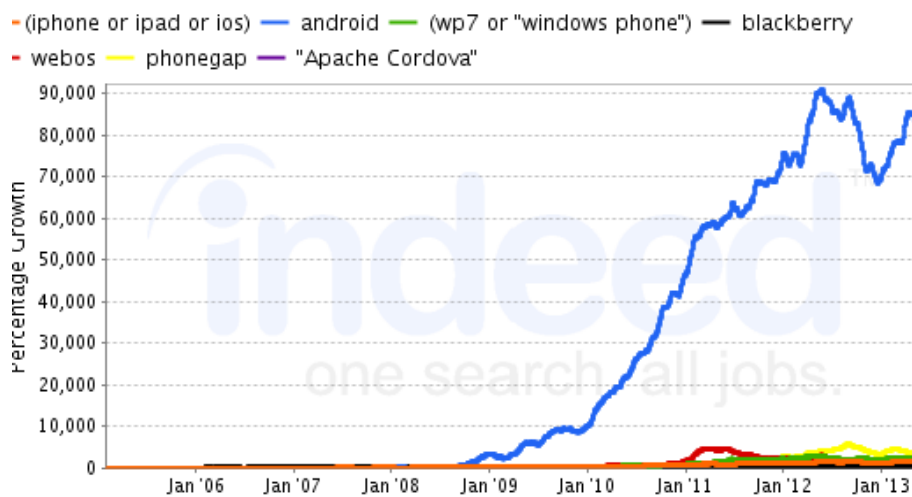

Figure 2-2: Latest Mobile Development Job Trends (Diana, 2013)

The rapid interest in mobile development and growth of mobile development and availability of qualifications that require some form of mobile development has reignited the field of ICT. Studies conducted by ITCareerFinder(2010) have placed Mobile application development as the best computer job for the future as it was placed above Database Administration, Software Engineer, Business Analyst and Video Game Designer.

2.3   Mobile Application Specification

Mobile applications (apps) are software written for mobile devices such as smart phones and the applications are developed with a specific task in mind. Mobile applications are often placed in three categories (Melchor, 2010). The three categories include:

•   Utility;

•   Productivity; and

•   Immersive.

Utility applications are the applications which take a simple task and help the user to perform the task efficiently. Utility applications usually help in determining or calculating something such as converting numbers into the format the user desires. It is an application that can be used by everyone every day in order to accomplish simple tasks performed by the user on a daily basis. Productivity applications have been designed simply to create productivity within a user's normal life and his/her daily routines. They are applications that can be used by everyone every day in order to accomplish simple tasks performed by the user on a daily basis. Mobile applications that make it difficult to differentiate between the real world and the digital world are known as immersive applications. After the mobile application has been installed, it   runs permanently. The users become immersed in the application as it holds a user's full attention.

When developing a mobile application, the developer will have to choose between two specifications of mobile applications. The two types of applications are Native applications and Web applications. There is an ongoing debate as to which is the better choice, but this depends on what the user requires from the application. Each application has its own set of advantages and disadvantages.

Native applications are applications that are designed for specific devices. The applications are downloaded from various online sources, such as the App Store (iOS) or Google Play (Android) and installed directly onto the mobile device. Native applications are designed differently for each platform as the platforms have different firmware and operating systems. Web applications are applications that are Internet enabled and these applications are accessed through a browser on the mobile device. Web applications are often referred to as browser applications as all or parts or the applications require Internet functionality every time the application is running. Web applications can be accessed from all web enabled mobile devices and there is often no difference in the appearance of the user interface(Mudge, 2012).

2.4   Extant Mobile Career Applications

In order to determine what features were necessary on a mobile application, an investigation into similar mobile applications was conducted. Every mobile application is unique, but each of the selected mobile applications has common features that may be useful when designing the prototype. The mobile applications that were included in the investigation were all downloaded at no cost (Table 2-1).

The first mobile application that was investigated was My Career, which allows users to search for a desired job no matter the job location. When a successful job search is completed, the job details and summary of what the job entails are displayed. One unique feature of the My Career application is that it allows users to add personal notes and comments to jobs that have been successfully searched for, thus allowing the users to make notes for future use. Based on user reviews it seems that the majority of users were satisfied with the shortlist option provided by the mobile application, as it allows users to sort and shortlist jobs that may be of interest.

Table 2-1: Review of Mobile Applications

	MyCareer	**Career Builder**	**Monster Job App**	**Proposed ICT career app**
Sign in functionality	√	√	√	
Search available jobs	√	√	√	√
Recommended jobs	√	√	√	√
Calculating APS score				√
Detailsaboutjob description.	√			√
Details about qualifications needed for the desired job				√

The second mobile application that was investigated was Career Builder. This mobile application was developed for the online search of one of the largest job sites in America. Career builder is aimed at graduates in America who want to search available job opportunities. Career builder allows users to search for jobs based on their current location by using Global Positioning System (GPS). If the user opens a CareerBuilder account, the user

can create a cover letter and curriculum vitae (CV) which can be used when applying for a job which was successfully searched on the Career Builder app.

The third mobile application investigated was a global job search application known as Monster Job App. The application allows for searching, saving and emailing qualifications when searching and applying for jobs. Features that make the Monster job search application attractive include email notifications about job opportunities arising from desired job adverts, as well as the inclusion of interview techniques that will help to give any user confidence when walking into a job interview room.

All the extant existing systems discussed above will form part of the development of the proposed mobile ICT career application. The difference is that these mobile applications placed no importance on the ICT qualification needed; the mobile applications discussed above only focused on jobs available. The proposed mobile application will include ICT qualification searches and once a qualification is chosen, the users will be able to see the job opportunities that link to the specified qualification. This function has not been provided in the above systems and that is the differentiating factor between the proposed mobile application and the existing mobile career applications.

3.   Research and Design Methodologies

3.1   Requirements

In order to determine how the mobile application would function, a detailed requirements analysis was conducted. Mobile application requirements cannot be assumed. The developers had to consider a diverse user population of different abilities who used various mobile devices and abilities. The selected research methodology selected for the purpose of this study in order to address the research problem was the Design Science Research methodology. This study included both research and development; therefore the Design Science Methodology best suited the study as it addresses two main issues in Information System (IS) research, namely, the information technology (IT) artefact and the relevance of the artefact in the domain (Hevner & Chatterjee, 2010; Peffers, 2008).

The investigation into requirements focused on the previously determined features of existing mobile applications. The investigation further included the current NMMU ICT Career portal and determined what functions and features could be used on the mobile platform.

The investigation into the current online NMMU ICT Career portal also identified the current usage and growth of the portal. The growth in access to the NMMU ICT Career portal is important for the development of the mobile application as it determined how many scholars

and students accessed the portal. Utilising the Google web traffic tool (www.google.com/analytics) and another web traffic tool used by developers (www.statcounter.com),it was determined that there was a steady growth of first time visitors (75%) and an increase in first time visitors (25%) over a period of three months(Evert, 2012). The current My ICT Portal (myictportal.csdev.nmmu.ac.za) has seen increases of up to 3639 page loads, 557 unique page visits, 460 first time visits and 97 returning visitors. The statistics gathered can be used to increase the need for a mobile application similar to that of the online web portal. The statistics show that the portal is being used by students and scholars to access and view ICT qualification information and career opportunities.

After the investigation, it was decided that due to the nature of mobile development an incremental prototyping design methodology should be applied. A prototype is a manifestation of a design that allows users to interact with the prototype and explore the suitability of the prototype(Rogers et al., 2012).

Prototyping can consist of low fidelity prototyping and high fidelity prototyping. Low fidelity prototypes are put together quickly and look nothing like the end product as they look crude and unpolished (Saffer, 2010). Low fidelity prototyping is quick and inexpensive but does not show the users any form of functionality. High fidelity prototypes are based on software and provide users with a functional version of the system that can be interacted with (Debbie, Caroline, Mark, & Shailey, 2005).

Incremental design is best described as the designing of a number of parts for the intended system in succession (Prakken, 2000). Incremental prototyping is best suited for mobile applications as the specifications cannot be immediately decided upon and the specifications change over time. During incremental prototyping, the requirements and specifications are reviewed after each deliverable and then the requirements are further refined. Incremental prototyping allows requirements to be established iteratively and repeatedly upgraded as this provides a clearer understanding of what is required during the next phase (Patel, 2013).

Incremental prototyping encourages the design of an application in parts after the overall architecture of the system has been established. When all the increments have been completed, an integration process takes place which makes sure that all increments function with one another. Validation of incremental prototyping is a complex task that is not only done by placing specification against functionality, but also consists of users' participation in the evaluation process (Albert & George, 2007).

Incremental prototyping has many advantages, but the main advantage is that prototyping encourages and increases the amount of communication between users and the developers as after every increment the developer is able to eliminate confusion in function and help the user to understand each increment of the intended system (Bainbridge, 2004).

3.2   Prototypes

Within the Design Science Methodology, IT artefacts are created and evaluated to solve identified organisational problems. The artefacts are often found to be in various forms, such as software, formal logic and language descriptions (Henver, 2010). Two prototype applications were developed in this research study.

The first prototype includes the design of the Admission Point Score (APS) activity where the users calculate their APS (Figure 3-1), which determines whether or not the scholar is eligible to proceed in studies towards the selected ICT qualifications. The first prototype also included the View Profile activity, which allowed users to create, modify and maintain a profile within the mobile application (Figure 3-2).
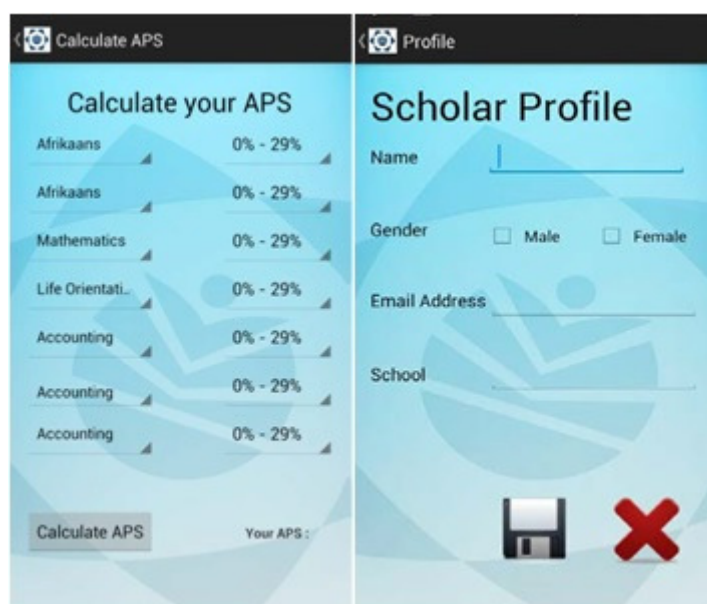
Figure 3.2-1: Calculate APS   **Figure 3.2-2:** Scholar Profile

The second prototype included the qualifications and careers activity. The qualifications activity (Figure 3-3) allows the user to scroll through a list of available ICT qualifications offered by the NMMU. This enables a user to select the qualification and obtain information about the qualification. The careers activity involves the same process as the qualifications except the user is able to select a job, obtain career information and employment opportunities at the various companies listed (Figure 3-4).

Figure 3.2-3: Qualification Tab   **Figure 3.2-4:** Career Tab

The prototype further provided a list of careers (Figure 3-5) and an explanation of each listed career, for example a Business Analyst (Figure 3-6).
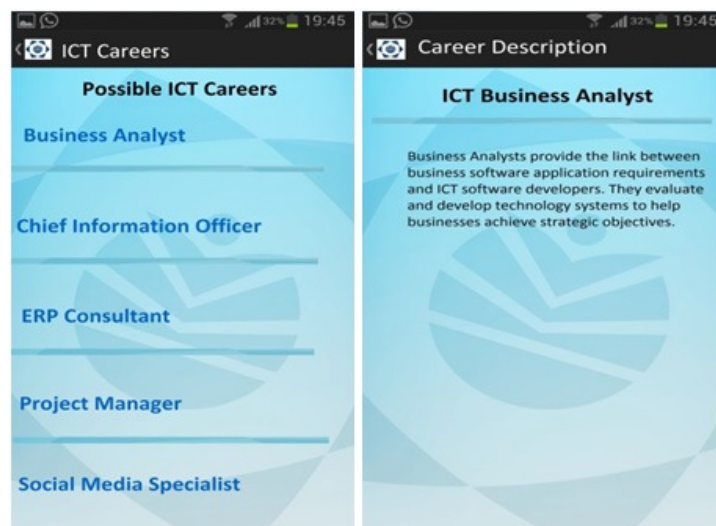

Figure 3.2-5: List of ICT Careers   **Figure 3.2-6:** Career Description

4.   Evaluation

4.1   Usability Questionnaires

The evaluation of the mobile application made use of questionnaires based on the usability of the application. Evaluations involved participants from the vulnerable group (scholars and students) in research. For these evaluations, scholars from various schools in the Nelson Mandela Bay area were chosen as participants. Questionnaires had to be designed and approved for ethical clearance by the NMMU Research Human Ethics Committee (REC-H). The questionnaires were divided into three main sections:

Section A: Biographical information

The information gathered included demographics of the participant groups and the correlation between each group's variables such as age, gender and year of study.

Section B: Mobile experience

The information collected from this section was used to determine the participant's mobile experience in terms of the use of a smart phone, the length of use as well as the availability of Wi-Fi and the purpose of having Internet connectivity on a mobile phone.

Section C: Post task usability questionnaire (PSSUQ)

PSSUQ is a questionnaire that is designed to assess the perceived satisfaction of users with a system or application they have worked on. The PSSUQ consists of questions that determine the overall level of satisfaction and user experience. The PSSUQ was chosen as a questionnaire as other questionnaires tend to focus more on the usability of the system and not on the experience after using the system or application. The success of the NMMU ICT mobile career application's usability evaluation was based on the ability of the application to provide full functionality to users and to provide an efficient and effective experience whilst searching for ICT career information.

The fact that the mobile application was aimed at scholars and students without a permanent Internet connection means that the application had to be easy to learn and provide enough ICT information that was regarded as relevant without losing the interest of the participants. The NMMU ICT mobile career application was intended to provide users with information about the ICT industry and career opportunities. Privacy is another issue that is faced by many mobile application users as they are hesitant to hand out personal details and information that is considered private.

The NMMU ICT mobile career application does not require sensitive login information as each application has a single user per mobile device. In conclusion, the metrics of the successful evaluation of a mobile application included:

- Efficiency;
- Effectiveness;
- Learnability; and
- Privacy.

4.2   Participants

The focus of the mobile application is on ICT career information so the two samples consisted of scholars and students. The two user groups were requested to perform different

tasks. The user selection was important as the mobile application is aimed at users that wish to find out more information regarding ICT careers and qualifications offered by NMMU. The next two sections describe the two user groups selected.

4.2.1   Scholars

Secondary school scholars were selected to be part of the evaluation of the NMMU ICT mobile career application. The scholar evaluation assisted with usability concerns as well as measuring overall satisfaction and experience whilst using the mobile application. The scholars consisted of Information Technology (IT) scholars at various schools in the Nelson Mandela Bay area. IT scholars were chosen as these are the type of scholars that would require insight into ICT qualifications at NMMU and will have to make use of the mobile application. The IT scholars were also familiar with the ICT field and the work done in this field. Grade 11 scholars were chosen as at the particular time of the evaluation Grade 12 scholars were under pressure as they needed to focus on their final examinations.

The scholars were from Alexander Road High School (n=10), Grey High School (n=8) and Victoria Park High School (n=7). These schools were selected as they were willing to take part in the study and the fact that these schools had willing teachers in the IT departments. The ethical clearance documentation made it possible to approach the schools and give a short presentation on NMMU ICT qualifications and careers, which was followed by an introduction into the background of the research, followed by a user evaluation of the application, using the task list and completing the PSSUQ questionnaire.

4.2.2   Students

Tertiary education students were chosen for the second sample to evaluate the mobile ICT career application. The students were from the Department of Computer Sciences at NMMU. The student evaluations (n=5) were conducted in the Honours laboratory. The students were requested to complete the task list on the mobile application and complete the PSSUQ questionnaire which assisted to determine the student's user experience of working on the mobile application.

4.3   Tasks

The participants in the user evaluation were asked to perform specific tasks to introduce them to the basic functionality of the NMMU ICT mobile career application. Both scholars and students were provided with a task list but the users were encouraged to try other tasks and features in order to test the functionality of the mobile application. The following is a summary of the task list provided to scholars and students:

Task 1 – User maintenance

- User selection;

- Creating a profile.

Task 2 – Qualifications

- Selecting a qualification;

- Choosing whether or not to enter an APS;

- Reading information about the ICT qualification;

- Checking if the user qualifies for a specific qualification.

Task 3 – Careers

- Searching for careers;

- Selecting a specific career;

- Reading information regarding a career;

- Exploring an ICT company offering a career opportunity.

The tasks exposed the users to the basic functionality of the mobile application and exposed them to what type of tasks could be performed when using the mobile application. The tasks were done in the presence of the developer in case users needed to ask for assistance.

5.   Results and Discussion

In the following sub-sections the results will be presented and discussed.

5.1   Data collection

Data were collected by using the PSSUQ questionnaire that was given to participants when they received the mobile device used to complete the evaluation tasks. The researcher explained to the users that they needed to complete the user task list and fill in the PSSUQ questionnaire for the application evaluation. The PSSUQ contained both qualitative and quantitative data that was further statistically analysed. The information captured was analysed by using statistical techniques and presented using graphs and charts. The sample size of the evaluation was 30 which consisted of 25 scholars and 5 students (Figure 5-1).
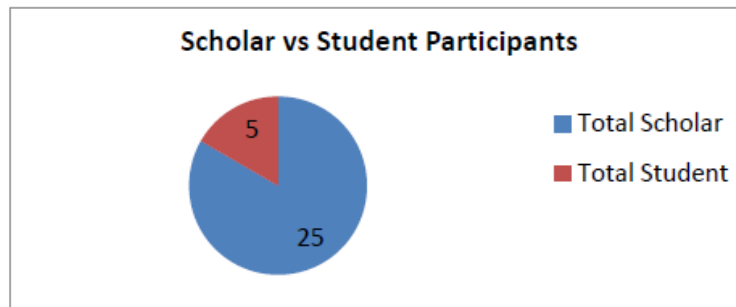
Figure 5-1: Scholar vs. Student participants

5.2   Evaluation restraints

The evaluations took place at three schools in the Nelson Mandela Bay area, the selected schools assisted with gathering useful insight into the user experience whilst working with the NMMU ICT mobile career application, but visiting these schools posed a number of problems.

The first problem was that the developer was given one period (roughly 45 minutes) at each school, to introduce himself, give an ICT presentation, followed by an introduction and evaluation of the mobile application. The allotted time was not enough to create an environment in which the scholars' completion time could be monitored as well as the error rate. If these tasks had been performed, the developer would not have been able to get enough user evaluations done per period.

The second problem was that the developer only had four mobile devices per evaluation period. The developer had to bring in devices as at most secondary schools in South Africa the scholars are forbidden to bring mobile devices onto the school grounds. The shortage of mobile devices caused a time delay as a scholar had to wait until one user had finished the task before starting to use the mobile device.

The third problem was caused by the nature of evaluations done at the secondary schools, as the task completion rate was always 100%. The tasks were straight forward and if the scholars needed assistance the users asked the developer how to proceed to the next task.

Finally, it would have also been preferable to get the grade 12s to evaluate the application as they were currently applying for qualifications at various universities, but the schools did not allow the matrics (Grade 12) to participate in the study as they were busy with final year exams and the developer did not want to interrupt the scholars' studies.

5.3   Analysis of the data

The information gathered from the PSSUQ questionnaire was divided into sections which helped measure the user's evaluation of the efficiency and effectiveness when using the mobile application. The information was used to measure the correlation between efficiency and effectiveness. User satisfaction and learnability metrics were also determined from the qualitative data collected from the PSSUQ questionnaire. Some necessary changes were made to the application as a result of the data collected in the qualitative section of the questionnaire.

5.4   Results

Questions in the PSSUQ questionnaireasked users to rate the overall satisfaction of the system. These results were added together and divided by total number of students to get an average rating per level of satisfaction. The Likert scale that was used during evaluation consisted of a scale from 1 to 5, the range consisted of strongly disagree to strongly agree. The three levels include low (Likert score of 1 or 2), average (Likert score of 3) and high (Likert score of 4 or 5). The results are positive as most users ranked the system as having a high level of satisfaction (Figure 5-2).
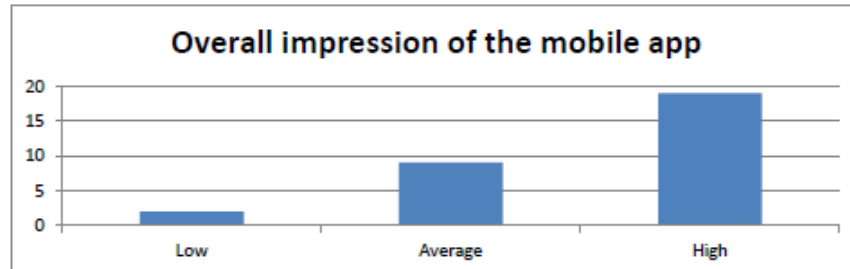

Figure 5-2: Overall Satisfaction

The overall satisfaction with the mobile application is important, but besides the overall satisfaction, the learnability of the mobile application was measured. The users found the mobile application easy to learn (Figure 5-3).
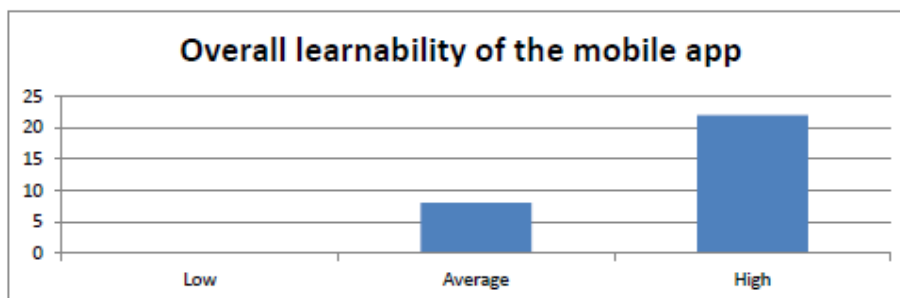

Figure 5-3: Overall Learnability

5.5   Mobile data

The evaluation of the application also assisted with the gathering of important mobile experience data, as well as the use and availability of mobile Wi-Fi data. At the moment, the smart phone market is flooded with large numbers of mobile devices, each available within a specific price range. Households and the majority of education environments have wireless Internet connectivity. Wi-Fi is part of the day to day activities of many people and they rely on Wi-Fi to complete work and specific Internet and smart phone related tasks.

Households are increasingly investing in wireless Internet in order to connect to the Internet. However there are still many households, specifically in the rural areas without Wi-Fi and native applications such as the NMMU ICT mobile career application are still popular amongst these users. Not all of the users had used a smartphone before and it was important to record this data as it could influence the learnability and satisfaction levels of the mobile application.
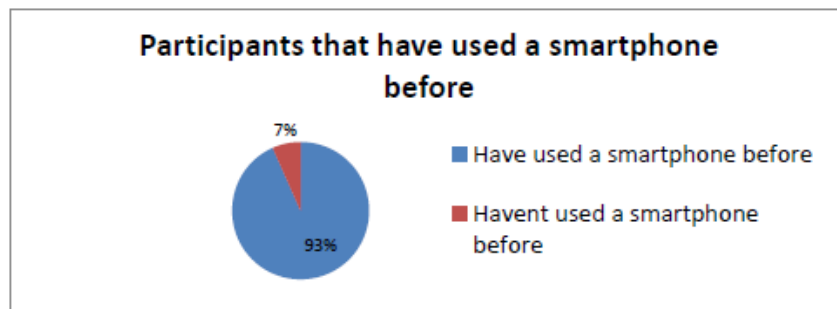

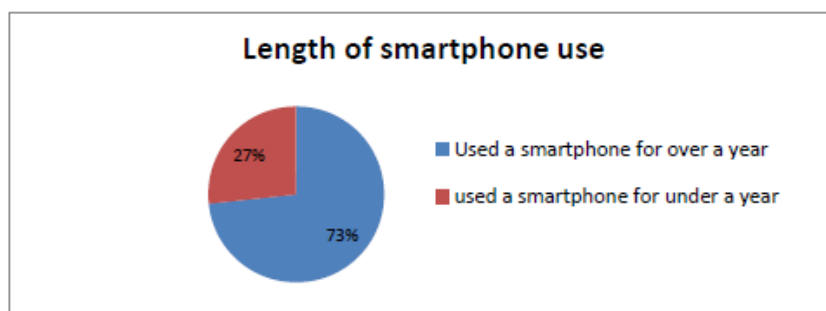**Figure 5-4:** Participants that have used a smartphone

Figure 5-5: Length of smartphone use

The majority of the users (93%) have used a smart phone (Figure 5-4) and 73% have used a smart phone for more than a year (Figure 5-5). Sixty percent of the users had Wi-Fi at home (Figure 5-6). The students have Wi-Fi at university, however only 36% of the scholars had Wi-Fi at school (Figure 5-7).
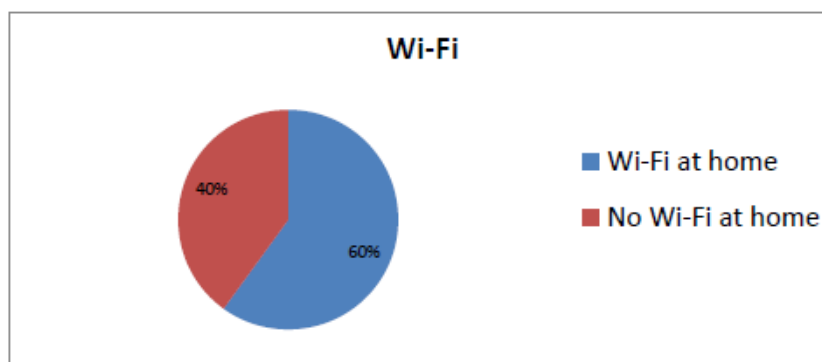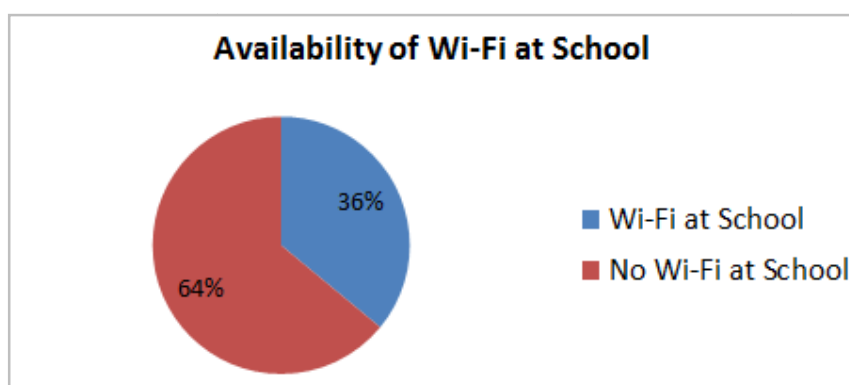
Figure 5-6: The availability of Wi-Fi at home

Figure 5-7: The availability of Wi-Fi at schools

5.6   Participants comments

Table 5-1: Effectivness and efficiency comments

Effectiveness and efficiency
"I enjoyed using the application on the smartphone and would use it again".
"Helpful application that helps find specific ICT career information".
"Unsure of what I was doing sometimes, but the information was clear and easy to read and easy to navigate".
"Very simple and user friendly with clear text and perfect button sizes for touch screen".
"I would use this application in the future to learn about different ICT qualifications".
"User friendly application, would use it".
"Very simple, clear and you know what to do and it was very helpful".

Through the use of the PSSUQ questionnaire, participants were able to provide qualitative data in the form of comments after each question or at the end of the questionnaire. These open-ended questions helped gain further insight into the users' satisfaction levels after using the mobile application. The comments regarding the effectiveness and efficiency (Table 5-1) generally indicated that the users found the application easy to use and that they would continue using it in the future.

Learnability
"Useful application easy to use".
"Cool app easy to use. Helps students to decide on courses to take after school".
"Very good application, simple easy to use and understand".
"Much simpler than a website, great idea or concept for the future".

Table 5-2: Learnability comments

The comments on the learnability of the application (Table 5-2) indicated that the application provided ICT career information that the users found very useful and the application was easy to use. Some scholars indicated that they do not have a large amount of air-time, thus using the application is more beneficial than accessing a website. The users provided useful suggestions (Table 5-3) and identified improvements which were implemented.

Suggestions
"Bug found in view profile".
"Well programmed, would like APS stored".
"Needed more information about jobs".
"Would like to start off the application by entering APS".

Table 5-3: Suggestions made by users

The comments were taken from both students and scholars. The resulting changes were made to improve the user experience of the NMMU ICT mobile career application as indicated in Table 5-4.

Comment	Resulting change
"Unsure of what I was doing sometimes, but the information was clear and easy to read and navigate".	Included a "back function" on the action bar when a user selects the NMMU logo he/she is taken to the home screen.
"Well programmed, would like	Changed the scholar profile to store the entered

APS stored".	APS of the user.
"Needed more information about jobs".	Provided as much information as possible on screen and added additional links to specific job sites.

Table 5-4: Developmental changes based on user comments

6.   Conclusion

The current lack of ICT skills required by industry is a concerning factor and an investigation into the skills shortage has created a need for a greater focus on the field of ICT at a secondary and tertiary education level (Calitz, 2010; Hall, 2012). The evaluation of the NMMU ICT mobile career application provided much needed insight into the views of students and scholars towards ICT and ICT qualifications. The scholars enjoyed using the mobile devices and many of the scholars said they would definitely use the ICT Career mobile application again as it taught them about the different qualifications and the career opportunities as seen in the open-ended questions used in the evaluation process.

The shortage of skilled ICT employees in South African businesses has become a great concern and something needs to be done in order to reignite the interest in the field of ICT (Isele & Bizer, 2012). Over the past years the number of students enrolling for ICT related qualifications has decreased dramatically and according to studies conducted by Calitz(2010) the reason behind this decrease is mainly due to the negative perception of the ICT field, the lack of sufficient ICT career information and limited knowledge of the job opportunities in ICT.

Greyling (Greyling, 2014) conducted a survey on first year enrolment figures in Computer Science, Information Systems and other ICT departments at Higher Education Institutions in South Africa. It was found that the majority of the departments had experienced a growth in first year enrolments over the past three years. The reasons for the growth are currently being investigated.

It can be concluded that the main objective of the study has been met through the successful implementation and evaluation of a mobile application that provides scholars and students with a means to access information regarding ICT careers and qualifications without having an Internet connection. The NMMU ICT mobile career application provides scholars and students, with an opportunity to learn about ICT qualifications and careers, without incurring expensive data charges. Providing scholars and students with an opportunity to learn about ICT qualifications and careers can hopefully alter the thought processes of scholars when

applying for tertiary education and change their perception of the field of ICT and thus encourage them to enter the field of ICT.

References

[1] Albert, Y.& George, B. H. (2007). *Spatial database systems,* p. 545. Springer.

[2] Angel, J. (2012). Is Mobile App Development Slated for Further Growth? Retrieved from http://socialmediatoday.com/jessy-angel/921151/mobile-app-development-slated-further-growth.

[3] Bainbridge, W. (2004). Encyclopedia of Human-computer Interaction. Berkshire.

[4] Calitz, A. (2010). *Model for the Alignment of ICT Education with Business ICT Skills Requirements*. DBA, Business School. Nelson Mandela Metropolitan University, Port Elizabeth, South Africa.

[5] Celik, D., Karakas, A., Bal, G., Gultunca, C., Elci, A., Buluz, B. & Alevli, M. C. (2013). Towards an Information Extraction System Based on Ontology to Match Resumes and Jobs. *2013 IEEE 37th Annual Computer Software and Applications Conference Workshops*, pp. 333–338.

[6] Charland, S. & Leroux, B. (2011). Mobile Application Development: Web vs. Native, *54*, pp. 49–53. Retrieved from http://cacm.acm.org/magazines/2011/5/107700-mobile-application-development/fulltext.

[7] Debbie, S., Caroline, J., Mark, W. & Shailey, M. (2005). User Interface Design and Evaluation. San Fransico: Elsevier.

[8] Diana, R. (2013). Indeed.com. Retrieved from http://www.indeed.com/jobtrends/Mobile-app.html.

[9] Evert, C. (2012). *My ICT Career Portal*. Honours project. Department of Computing Sciences. NMMU.

[10] Greyling, J. (2014). Growth in first year enrolment figures. *Personal Interview*.

[11] Goldstuck, A. (2012). Mobile pushes internet to the masses. *World Wide Worx* 2012.

[12] Hall, S. (2012). Key Skills Pay Off in Fast-Evolving World of Mobile App Development. Retrieved from http://www.itbusinessedge.com/blogs/charting-your-it-career/key-skills-pay-off-in-fast-evolving-world-of-mobile-app-development.html.

[13] Henver, A. (2010). Information Systems and Decision Sciences. *College of Business Administration*, 18. Retrieved from http://em.wtu.edu.cn/mis/jxkz/sjkx.pdf.

[14] Hevner, A. & Chatterjee, S. (2010). Design Research in Information Systems, *22*, pp. 9–23.

[15] Isele, R. & Bizer, C. (2012). Learning Expressive Linkage Rules using Genetic Programming, *5*(11), pp. 1638–1649.

[16] ITCareerFinder. (2010). IT Careers, Certifications, Training, Jobs & Salaries - ITCareerFinder. Retrieved from http://www.itcareerfinder.com.

[17] Kubalik, J., & Matousek, K. (2011). Analysis of Portal for Social Network of IT Professionals. *Journal of Information Systems*, *1*, pp. 21–28. Retrieved from http://www.si-journal.org/index.php/JSI/article/view/80.

[18] Melchor, E. (2010). Different types of mobile apps. Retrieved from http://www.slideshare.net/eprometheus/different-types-of-mobile-apps.

[19] Mudge, J. (2012). Native App vs. Mobile Web App: A Quick Comparison. (S. Revisions, Ed.). Retrieved from http://sixrevisions.com/mobile/native-app-vs-mobile-web-app-comparison/.

[20] Patel, P. (2013). Tech Companies Treat Their Interns Well, And Some Are Already Hiring. IEEE. Retrieved from http://spectrum.ieee.org/tech-talk/at-work/tech-careers/tech-companies-treat-their-interns-well-and-some-are-already-hiring.

[21] Peffers, K. (2008). A Design Science Research Methodology for Information Systems Research. *Management Information Systems*, *24*(23), pp. 45–78.

[22] Pingdom. (2014). No Title. Retrieved from https://www.pingdom.com/.

[23] Prakken, B. (2000). Information, Organization, and Information Systems Design: An Integrated to Information Problems. Netherlands: Kluwer Academics.

[24] Rogers, Y., Sharp, H. & Preece, J. (2012). *Interaction Design* (3rd ed.). West Sussex: Wiley & Sons Ltd.

[25] Saffer, D. (2010). Designing for Interaction: Creating Smart Applications and Clever Devices. New Riders.

[26] Smith, A. (2010). *Mobile access 2010: Summary of findings*. *PEW Internet* (pp. 1–35). WAshington DC. Retrieved from http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:Mobile+Access+2010+Summary+of+Findings#3.

[27] Telang, R. (2004). Drivers of Web portal use. Retrieved from http://www.heinz.cmu.edu/~rtelang/sdarticle_ecra.pdf.

[28] Waverman, L., Meschi, M. & Fuss, M. (2005). The impact of telecoms on economic growth in developing countries. *TPRC*. Retrieved from

http://web.si.umich.edu/tprc/articles/2005/450/L Waverman- Telecoms Growth in Dev. Countries.pdf.

[29] Whitfield, K. (2013). Fast growth of apps user base in booming Asia Pacific market. Retrieved from http://www.portioresearch.com/en/blog/2013/fast-growth-of-apps-user-base-in-booming-asia-pacific-market.aspx.