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Promoting ICT Careers Using a South African ICT Career Portal

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Promoting ICT Careers Using a South African ICT Career Portal

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ABSTRACT

South Africa is experiencing an Information and Communications Technology (ICT) skills shortage and a limited number of scholars and students are pursuing ICT careers. The provision of a web-based ICT career information platform as an effective solution to the growing demand for skilled ICT employees is the focus of this study. The study is grounded in the network theory of social capital. The aim of the development of an ICT career portal was to provide ICT career information to scholars, students and the ICT industry. Scholars can obtain information about ICT career opportunities and determine if they qualify for specific degree/diploma programs. Quantitative and qualitative data was collected from students as well as Grade 9 – Grade 11 scholars from schools in the Port Elizabeth area. The results indicate that scholars became more aware of ICT careers and tertiary qualifications and students reported an increase in awareness of the number of careers and job opportunities in the ICT industry.

Keywords (Required)

ICT skills shortage, career portal, ICT career guidance.40

INTRODUCTION

The Information and Communications Technology (ICT) industry is experiencing a shortage of skilled ICT employees (Cohen, 2012; McLachlan, Craig and Coldwell, 2012; Telegraph, 2014). The shortage of skilled employees has become a great concern internationally; in South Africa it has been noted as a contributing factor to the weakening economy (Isett Seta, 2010). The supply of skilled ICT employees has decreased at a time when the demand from industry is increasing (McLachlan, et al., 2012; Deloitte, 2014). The Science Council in Britain indicated that 745,000 additional employees with digital skills would be required from 2014 to 2017 (Telegraph, 2014). In April 2008, the National Department of Labor in South Africa indicated in their National Master Scarce Skills list that a minimum of 37,565 ICT professionals were needed in the ICT sector. In the 2011 IT Web survey, the estimate for ICT skills needed in South Africa had nearly doubled to 70,000 practitioners (Cohen, 2012).

The number of students enrolling for ICT courses and degree programs in South African higher education has generally decreased in the past decade. Studies conducted in 2010 indicate that the increase in demand for skilled ICT graduates and employees is related to the smaller number of scholars enrolling for ICT-related qualifications (Calitz, 2010). The decrease in enrollments is mainly due to the negative perception of the ICT industry, the lack of relevant ICT career information, and limited knowledge of ICT job opportunities. Universities are continuously investigating reasons for the declining number of high school children (scholars) not pursuing careers in ICT (Babin, Grant and Sawal, 2010).

In Britain, a study conducted by City and Guilds in 2013 showed that 47% of the employers surveyed indicated that the education system was not meeting the needs of businesses (Telegraph, 2014). The ICT skills shortage can be attributed to low student enrollments, which in turn lead to a smaller number of graduates and a scarcity of skilled ICT professionals in almost every computer-related field (Alexander, Holmner, Lotriet, Matthee, Pieterse, Naidoo, Twinomurizi and Jordaan, 2010).

This study is grounded in the network theory of social capital (Lin, 1999). The benefits of social capital can aid individuals and the community. The benefits can be social, psychological, emotional, and economical (Lin, 1999). Social capital can exist between individuals and by extension can facilitate the accrual of economic and non-economic benefits to the individuals.

Individuals participate in interactions and networking to gain benefits. Scholars, students, and ICT employers would provide the backdrop for membership of the ICT network as specified in network theory (Lin, 2005). The flow of information is an embedded resource in social networks and will enhance the outcomes of actions (Lin, 1999). In this study, the provision of ICT career information through the use of an ICT portal, informing scholars and students of ICT qualifications and related job opportunities, could assist the actors (scholars and students) to be better prepared and better-informed of the South African ICT labor market.

The decrease in ICT enrollments and the problem of the negative perceptions of the ICT industry could possibly be resolved by the provision of a comprehensive and informative web-based career guidance platform, which could serve as a network where information and resources are shared (Lin, 2005). The provision of a career guidance platform could assist in educating the youth on ICT career opportunities and the relevant qualifications required in the ICT industry. Research has shown career portals to be helpful in providing guidance in selecting a career and qualifications, which is the basis for this research (Moses, 2006). Research conducted in South Africa further indicates that scholars are influenced by parents and teachers when making career choices (Alexander, et al., 2010).

This study investigates the ICT skills shortage in South Africa and the effect that the provision of an informative ICT career portal has on the perceptions of scholars and students regarding ICT careers in the Nelson Mandela Bay Municipality, Port Elizabeth, South Africa. Scholars in this study are high

school children (also referred to as learners in South Africa) generally aged between 15-17 years of age and in grades 10-12 (Standard 8-10). Students in this study are receiving university education, are aged between 18-23 years, and are completing their undergraduate ICT degree studies.

A South African based ICT career portal has the potential to allow ICT companies to provide information regarding the ICT sector and the effects of qualifications on career paths. A portal acts as an informative platform for scholars and students and includes a communication medium between ICT companies and students who wish to apply for ICT positions. The problem statement investigated in this study was: *Information regarding ICT qualifications, career opportunities, and respective ICT skills, including job titles and potential employers was not available to scholars and students in South Africa.*

The research objectives for this study were as follows:

- Provide a South African web-based ICT career portal which will act as an informative and comprehensive platform regarding the ICT job market, industry, qualifications, and relevant ICT skill-sets;
- Provide relevant ICT career information to scholars, ICT students, and employers of ICT graduates through the ICT career portal;
- Conduct a user evaluation of the ICT career portal by scholars and students; and
- Evaluate portal usage by obtaining portal access statistics.

LITERATURE REVIEW

This section discusses a literature review conducted concerning topics such as ICT skills shortages, perceptions of industry, industry engagement in ICT education, and the effectiveness of career portals as networks, specifically ICT based career portals. The purpose of this literature review is to describe the problems being faced by the ICT industry, the reason for the identified issue, and the way in which an ICT career portal acts as a possible solution for the discussed issue.

ICT skills shortage

Globally, tertiary institutions are experiencing a decline in student enrollment in ICT courses. The number of students enrolling for ICT courses in South African higher education has generally decreased over the past decade. Internationally and nationally, universities are investigating reasons for the declining number of high school children not pursuing careers in ICT (Babin, Grant & Sawal, 2010). The number of students enrolling for ICT courses at tertiary institutions in South Africa has decreased since the late 1990s. The shortage results primarily from low student enrollments, which lead to a smaller number of graduates entering the ICT profession (Alexander et al., 2010). A similar trend was found internationally, however, enrollments have started to stabilize in the United States and Canada since 2007 (CBC, 2009).

In April 2008, the National Department of Labor indicated in their National Master Scarce Skills list that a minimum of 37,565 IT professionals were needed in the ICT sector to ensure that there were enough skills within this sector. In 2010, the Information Systems, Electronics and Telecommunications (ISETT) Education and Training Authority (SETA) in South Africa documented that the number of vacancies for skilled ICT employees has increased, while the skill-set required has become more specialized (Isett Seta, 2010). In the 2011 IT Web survey, the estimate for ICT skills needed in South Africa had nearly doubled to 70,000 practitioners (Cohen, 2012). Internationally, similar trends are being experienced. For example, in a recent study by the trade body ScotlandIS, 45,000 new ICT professionals will be required in Scotland in the next five years (BBC, 2013). The British ICT workforce

will grow by 39% by 2030 and an additional 745,000 employees with ICT skills will be needed by 2017 (Telegraph, 2014).

The ICT skills shortage in South Africa is of national concern and industry is increasingly relying on tertiary institutions to address the ICT skills crisis (Calitz, 2010). Universities are not taking in their maximum capacity of students as a limited number of scholars pass mathematics and science in matric with the necessary requirements (Cohen, 2012). South Africa experienced a drastic decline in the number of scholars registering for math (21%) and science (20%) from 2009 to 2013 (Deloitte, 2014). The basic education system in South Africa needs to be more involved in promoting an interest in technology in scholars from an early age to cultivate a large and relevant ICT skills base (Cohen, 2012). Similar findings are recorded in Britain, indicating that the education system was not meeting the ICT skills requirements of business (Telegraph, 2014).

Perception of the ICT industry

Koppi (2008) attributed the shortage in skilled employees to factors such as the perception of the ICT industry and professions, the relationship between industry and tertiary institutions, and the relationship between industry and secondary education institutions. Scholars at a secondary education level are not informed of ICT qualifications or job titles available as a result of the poor relation between industry and secondary and tertiary educational institutions. Scholars require a better understanding of the ICT sector to equip themselves with the modern skill sets required by business (Mahomed, 2014). Scholars are not enrolling in universities for ICT-based qualifications and are thus not gaining the necessary skill-sets required by industry to fill respective job positions. Isett Seta (2010) stated that fewer than 8% of secondary education students are opting to study ICT related qualifications and it is predicted that this percentage will drop by 2016.

Lynch (2007) reported that people who work in the ICT industry are typically portrayed as male, with a “geeky” or “nerdy” appearance and are socially inept. Harris and Wilkinson (2004) identified a lack of understanding of the ICT industry and computer profession. The ICT profession is perceived as one which requires long hours indoors and working in front of a computer screen all day. Studies conducted in the Nelson Mandela Metropolitan Municipality showed that secondary education scholars thought of the ICT profession as “boring” or reserved only for those students who were top in their class (Calitz, 2010). The negative perception of the ICT industry and careers is a contributing factor to the decrease in students and scholars enrolling for ICT-based qualifications.

Industry engagement in ICT education

A solution to the problem being faced by industry, concerning the decline in skilled ICT graduates, is achieved through industry’s involvement in ICT education and awareness. As proposed by Koppi (2008), industry can become more involved in high school teaching, which may improve the poor perception of an ICT career and increase student interest. A number of university CS&IS departments have encouraged industry’s engagement in ICT education by establishing an Industry Advisory Board where members of industry, academics, and student bodies meet to discuss current issues in industry as well as the desired skills required from graduates. Members of the Advisory Board offer internships to students who wish to gain experience in the ICT industry and opportunities to network with employees from respective companies. Companies provide an educational platform for students to work with developers, learn more about software development methodologies and the technologies used through career days and industry workshops. Not only does the ICT industry need to improve the relationship with scholars and students, but there is also a need for a better relationship between universities and the

ICT industry, through which the two constantly strive to provide employment and learning opportunities to students.

Career portals

A report released by Stats (2011) shows that more people are using the Internet, not only to communicate and socialize, but also to gather crucial information. Google search trends (Google, 2012) show that during the 2008 economic recession, the phrase “career portals” was searched most frequently and that searching concerning careers is a growing trend. Figure 1 illustrates the graphical trend of the search phrase “career portals.”



Figure 1. Graphical trend of the search phrase "career portals"

A portal is a single web location or address where an individual can access web-based services and information most important to that individual (Moses, 2006). Career portals (or also known as job portals) are defined as an online resource built to facilitate the internal career development process for managers and employees (Farren, 2010). Typical services offered by portals include the ability to search for information, news, weather information, and emails as can be seen on most South African career portals such as CareerJunction or Career24. Career portals such as CareersPortal.ie provide prospective employees with documents describing job roles, resources, and “Career Skills Self-Assessment” to allow university graduates to assess their own skills against what is demanded by industry. Comparable to a career portal, an ICT career portal is an online source of ICT-specific information, ideally containing job titles and descriptions, careers, qualifications, and skills requirements (Figure 2).

A proposed solution to the ICT skills shortage problem came in the form of an informative graduate and industry platform, focusing on topics such as ICT qualifications, job titles and necessary skills. The MyICTPortal (Figure 3) was designed to be specific to ICT companies in South Africa which require qualified and skilled graduates, thereby building a relationship between scholars and students and the ICT industry.

The concept of a portal could be likened to a social network with members as actors who bring their resources to bear, so that social capital for the collective is reflected in the embedded resources as provided by members (Lin, 2005:15). The flow of information is an embedded resource in social networks and will enhance the outcomes of actions (Lin, 1999). Lin (2005) identifies layers in the network-based theory of social capital which vary in intensity and reciprocity of relations among the ties. The ICT career portal would be classified as an intermediary layer where ties share information and resources, but not all members have direct interaction with one another or maintain strong and reciprocal

relations with each and every one. With the provision of such an ICT career portal, scholars and students from both secondary and tertiary institutions are given access to information regarding qualifications offered by the university, careers and job titles, skills required, and ICT company information in South Africa.

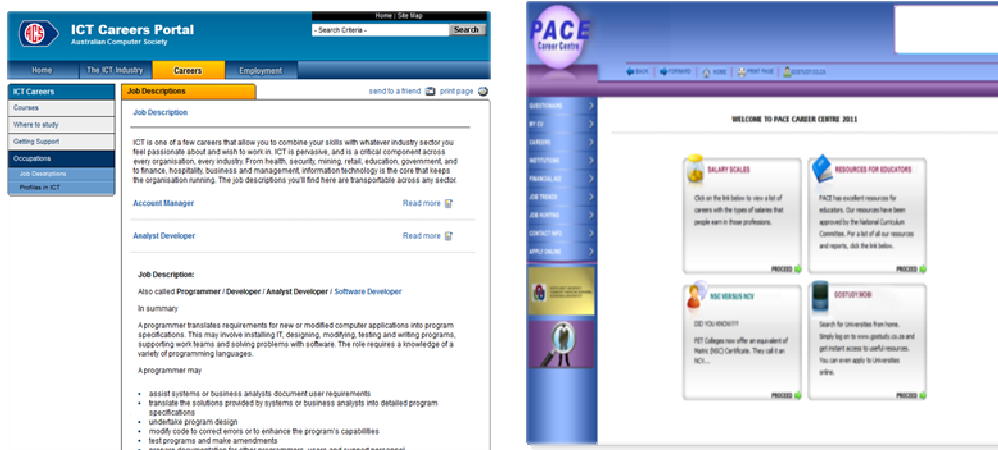


Figure 2. Examples of existing career portals

DEVELOPMENT OF THE ICT CAREER PORTAL

The portal was incrementally developed over a period of ten months, consisting of multiple prototypes until the final prototype was able to provide a range of ICT-based qualifications, skills, and career information. The portal was developed using three-tier architecture. The architecture consisted of the following three layers as follows:

- Data Access Layer - This layer contains a .NET Entity Framework database and all its respective tables exposed as entities;
- Business Logic Layer - This layer consists of C# methods gaining access to each of the database entities through LINQ statements. Each LINQ statement accesses the exposed data entities the same way in which SQL statements access data from a SQL database; and
- Presentation Layer - This layer manages the display of correct and desired information through the implementation of business logic layer C# methods. The presentation layer consists of a number of .aspx pages containing HTML code and tags.

The decision to develop the portal using three-tier architecture was done in order for the separation of logic in the event of either data or visual aspects needing to change. Another advantage of implementing three-tier architecture is that of scalability, which allows for each tier to be scaled horizontally, allowing for better performance in case of the presentation layer being accessed from a different server to that of the business logic and data access layers (Ektron, 2011). The database was designed in order to cater for the extension of the portal and available careers paths, not only specific to ICT. Figure 3 illustrates the completed portal.

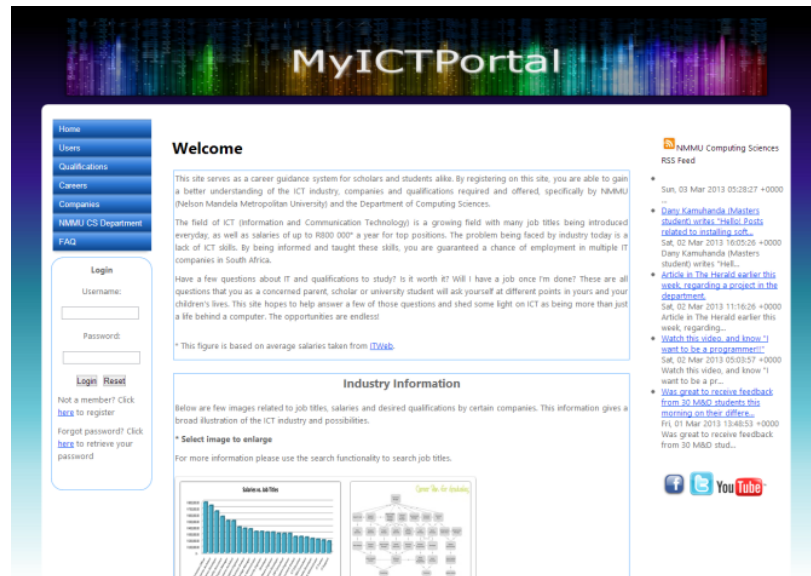


Figure 3: MyICTPortal Home Page

METHODOLOGY

The research methodology followed a positivist approach, the objective is to generalize the results to a broader population. A quantitative and qualitative, exploratory and descriptive research design was used. The research method included a literature review of the ICT skills shortage problem and provision of career portals. The requirements for an ICT career portal were established from scholar, ICT student, and industry perspectives. Interviews were conducted with IT scholars and IT teachers at three schools and ICT industry representatives serving on the Department of Computing Sciences Advisory Board at NMMU in order to establish detailed requirements. The implemented ICT career portal was evaluated using standardized usability questionnaires (QUIS) by the two selected user groups.

The user groups consisted of undergraduate students ($n=7$) from the Department of Computing Sciences at NMMU and high school scholars ($n=80$) from schools in the Port Elizabeth area. The seven students were selected for the usability and eye-tracking component of the career portal evaluation in the usability laboratory in the Department of Computing Sciences. The eighty scholars evaluated the career portal in their own school's computer laboratories, which are connected to the Internet.

User selection

The choice to evaluate the portal using both scholars and students was made in order to determine whether the portal is effective in providing useful career information to the two groups of users in different stages of their lives. The evaluations were conducted in two separate environments, one for each user group. Scholars evaluated the career portal in their own school's computer laboratories, which are connected to the Internet. Metrics used for scholars differed from those of students. As a result, the use of eye-tracking software was not possible for scholars. According to Tullis and Albert (2008: 116), environments are one of the biases which could negatively affect the outcomes of an evaluation. The data analyzed for scholars focused on the overall perception, learnability of the portal, and whether or not scholars were able to gain valuable information regarding ICT qualifications, job titles, salaries, and respective skills.

Grade 9 to Grade 11 Information Technology (IT) scholars from Victoria Park High School and Alexander Road High School in the Nelson Mandela Bay Municipality were selected for scholar

evaluations. Scholars were selected to determine the effectiveness of the portal in providing comprehensive career and qualification information and the relation between the two. The effectiveness and usefulness of the portal to scholars was determined by statistically analyzing quantitative and qualitative data from the post-task questionnaires and measuring metrics such as usefulness and overall perception of the portal. The tendency to use the portal in the future was also measured. Grade 9 IT scholars were selected as their knowledge of the IT syllabus and ICT industry was new, while Grade 10 and Grade 11 IT scholars were completing their syllabus and in the initial stages of selecting careers and qualifications to enroll for. The comparisons of these two groups were used to determine the effect the portal had on students preparing to enroll for tertiary education qualifications and scholars beginning with the IT syllabus at school level.

The choice to include 7 students was due to the fact that the error discovery rate increases exponentially with more than 5 users when conducting user evaluations and eye-tracking specifically (Nielsen, 2000). By including more users in the evaluation, there is a possibility that all the users may discover the same issue, or may discover various errors with each evaluation. Undergraduate students from the Department of Computing Sciences at NMMU were selected in order to determine the effectiveness of ICT career portal in providing valuable career information, specifically those seeking career advice. Students evaluated the ICT career portal using NMMU's CoE Usability Laboratory and the Tobii Eye-tracking technology to measure behavioral metrics. The choice to make use of the eye-tracking equipment allowed for the recording of what is known as "Areas of Interest" (Tullis and Albert, 2008: 116) and to identify where a participant is looking in real time. The data analyzed for students included task time, successful task completion, learnability, and whether students were able to gain valuable information regarding ICT job titles, skills, and ICT companies.

Questionnaires utilized

Information was obtained from scholars using questionnaires to determine the user demographics, experience with online career portals, and user experience (UX) gained after using the MyICTPortal career portal. Two questionnaires were utilized in this study, namely the *Questionnaire for User Interface Satisfaction (QUIS)* and the *Post-task questionnaire* (Appendix A). The Post-task questionnaire was divided into three separate sections, namely:

- **Biographical information:** This information was used to determine the demographics of the user group as well as any relationships between variables, such as age, gender, and the desire to study ICT-based qualifications;
- **Experience:** Information captured from this section determined the user's level of experience with various technologies such as the Internet and career portals as well as knowledge of ICT-based qualifications; and
- **Post-task evaluation:** This information was analyzed to determine use, experience, and the level of user satisfaction in the form of captured quantitative and qualitative data. The *Overall Perception* and the *Career Portal System* evaluation were evaluated by ten questions, each using a semantic differential 5 point Likert scale.

Post-task evaluation questions were formulated using the standardized *Questionnaire for User Interface Satisfaction (QUIS)*. The QUIS scale was selected as it measures the level of user interface satisfaction covering five topics, namely: Overall Reaction, Screen, Terminology, Learning, and System Capabilities. The results showed the degree to which the ICT career portal was useful, easy to learn, appealing, and whether the systems capabilities matched the users' expectations. The semantic scale uses a pair of bipolar and opposite adjectives to determine a user's opinion of the system. These scales

provide data which can be analyzed to determine the level of success of the system in meeting stated requirements.

A pilot study was included for the *Post-task questionnaire* utilized in this research study. Pilot studies have several functions and advantages, principally to increase the reliability, validity, and practicability of the questionnaires utilized (Saunders, et al., 2009). A pilot study was conducted with five scholars and minor changes were made to the questionnaire and the task list before the main study was conducted at the two schools.

Task analysis

The task analysis required scholars and students to complete a set of tasks on the ICT career portal. The tasks required scholars to enter their examination results and search for ICT qualifications, ICT salaries, and career related information. Students completed tasks regarding ICT qualifications and industry related career opportunities.

Usability Metrics

A definition by Tullis and Albert (2008: 116) of a usability metric is that it “adds structure to the design and evaluation process, giving insight into the findings and provides information to the decision makers.” A usability metric, in terms of systems development, is a measurement tool which helps to identify issues and measure the success or failure of projects using both qualitative and quantitative data. The usability metrics derived from Tullis and Albert (2008: 7-8) being used for the purpose of this study included performance metrics and behavioral metrics. Scholars and students completed performance metrics and only the students completed eye-tracking evaluations in the Center of Excellence (CoE) usability laboratory in the Department of Computing Sciences at NMMU, due to logistical constraints.

Performance Metrics

- **Task completion:** This is measured by whether a participant is able to successfully complete a task from start to finish. Task completion is measured by the end-state of reaching a confirmation or by correctly answering a task question. This is measured on a scale of 0%, 50%, or 100%, where 0 is a task not completed and 100% is a task completed with no errors.
- **Learnability:** This is the level to which a user is able to learn how to use the portal. This is measured in two ways, namely: Post-task questionnaire comments and the amount of time taken per task. If time taken to complete each task decreases incrementally, it can be said that the portal is easy to learn (Tullis and Albert, 2008: 51). Learnability for the student user group will be measured by the time taken to complete each task.
- **Efficiency:** Time on task is used to measure the efficiency of the portal and the participant’s ability to perform tasks efficiently. As with learnability, if time taken to complete each task is less than the previous task (taking into account that no errors arose), the participant is efficient in obtaining information. Efficiency will only be measured for the student group.
- **Satisfaction:** Satisfaction is measured in order to determine the level of user satisfaction and user experience (UX) with the portal and its functionality. *Usefulness* is a component of UX and this metric is recorded to identify if usability goals have been met and if functionality meets the expectations of the users. This will be measured for both scholars and students by means of Post-task questionnaire data.

Behavioral metrics

Eye-tracking technology measures and records the exact position where a participant is looking on the screen. In the case of an error, eye-tracking data is able to illustrate the exact position where the participant was looking on the screen as opposed to where they should have been looking.

Research ethics

The research conducted in this study included vulnerable groups, namely scholars and undergraduate students. The questionnaires utilized in this study, the consent forms for scholars, students, and parents, and letters to relevant parties and bodies were approved by the NMMU Research Ethics Committee: Ethics number: H12-SCI-CS-011.

RESULTS

The following sub-section discusses the results of the study, including the metrics which were recorded and method of recording, results from the two separate user groups being scholars and students, and analysis of web traffic. Table 1 tabulates the metrics recorded for each user group and the method by which the metrics are calculated. Metrics were recorded in order to quantifiably measure the success of the portal in meeting the objective of being an informative career platform to both scholars and students.

Metric	User group recorded	Method of recording
Learnability	Scholars and students	Scholars: Post-task questionnaire. Students: Time taken to complete each task (eye tracking).
Efficiency	Students	Students: Completion Rate = Percentage/ Task time (in minutes) using eye tracking.
Satisfaction (including Usefulness)	Scholars and students	Post-task questionnaire.
Self-reported	Scholars and students	Post-task questionnaire.

Table 1. Metrics recorded and suitable methods of recording

Scholar evaluations

The focus of the scholar group is largely on the provision and dissemination of ICT qualification and career information with specific reference to ICT skills required and job opportunities available. By means of the evaluation of the MyICTPortal data regarding ease-of-use, satisfaction with the portal's functionality and usefulness were recorded as well as the overall perception. Analysis of the questionnaire data provided a positive overall perception of the portal concerning topics such as learning to use the system and layout of information.

Perception rating and usefulness rating for scholars were grouped as *low* for a rating of 0 – 15, *neutral* for a rating of 16 – 30, and *high* for a rating of 31 – 45. The overall perception of the portal is measured as follows:

$$\frac{\text{Sum of perception rating}}{\text{Number of participants}}$$

While average usefulness rating is measured as follows:

$$\frac{\text{Sum of usefulness rating}}{\text{Number of participants}}$$

Table 2 tabulates the comparison of the two school’s overall perception rating of the portal, indicating that Alexander Road High School scholars were more impressed with the portal than were scholars from Victoria Park High School. However, Figure 4 indicates that scholars from Victoria Park High School found the portal to be more useful in obtaining career and qualification information when compared with the opinion of Alexander Road High School scholars.

School	No Scholars	Low (0-15)	Neutral (16-30)	High (31-45)	Average overall perception (Out of 45)
Victoria Park High School	28	0%	71%	29%	29
Alexander Road High School	52	0%	37%	63%	33

Table 2. Comparison of school’s overall perception ratings

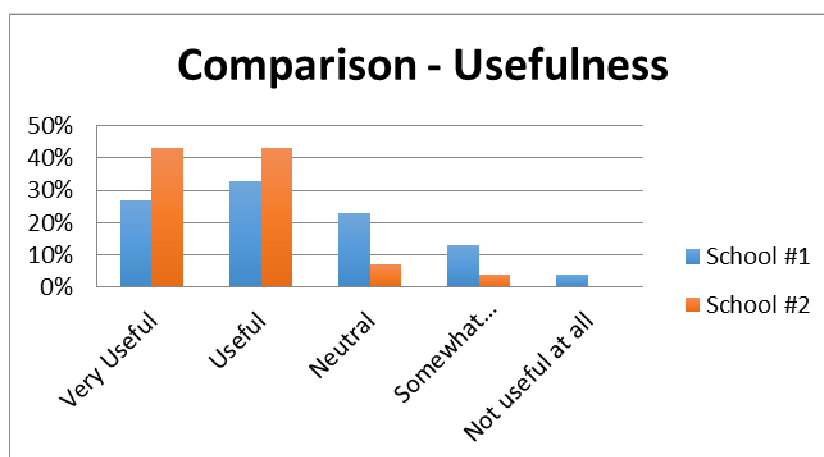


Figure 4. School’s usefulness rating (School #1: Alexander Road; School #2: Victoria Park)

Alexander Road High School’s scholars indicated that they would be inclined to use the system in the future, showing that although they do not find the system to be “very useful” now, there is a possibility

that they would use the system in the future (Table 3). The 13% difference between Victoria Park High School scholars and Alexander Road High School scholars is not significant enough to state that one is more inclined to use the system than the other; however, the 33% of Grade 9 Alexander Road High School scholars that will definitely use the portal is a significant finding. This finding shows that scholars in Grade 9 are now aware of the portal and intend to make use of ICT career guidance portals in the decision making process about their future careers. Thematic analysis of participant comments indicates that Alexander Road High scholars did find the portal useful in providing a large amount of information and would use the system in the future.

Usage Intention	% Alexander Road High School	% Victoria Park High School
Definitely use again	33%	46%
Use again	23%	29%
Neutral	27%	11%
Probably use again	12%	14%
Never use again	5%	0%
Number of scholars	52	28

Table 3. Comparative results on two schools repeatedly using the portal

The results from biographical information collected indicated that more males are sure about their plans to study ICT-based qualifications in the future, while females are not sure or do not wish to pursue a career in ICT. Further results based on participant's comments show that scholars are more aware of the impact which subject choices such as Mathematics, Mathematics Literacy, Science, and English have on qualification choices after using the ICT career portal.

Scholars' perception of the ICT industry

The thematic analysis of participants' comments on open-ended questions regarding the ICT industry indicates that the perception of ICT-based qualifications by scholars was not radically altered through the use of the portal, however the scholars were more aware of career opportunities in the ICT industry. By utilizing the ICT career portal, scholars requested more information regarding other qualifications and careers apart from Computer Science, Information Systems, or Information Technology.

Comments showed that scholars were not aware of the multitude of ICT career opportunities which were available and the salaries paid per job title, which in turn created an awareness of the ICT industry, career opportunities, and the ICT skill shortage. The comments included were: "There are many more job opportunities than I originally thought," "I have learnt what companies are out there and what qualifications I need," and "Earn more money than expected." The thematic analysis of the open-ended questions of scholars resulted in three main themes; learning about Job opportunities (n=11), Qualifications (n=12), and Salaries (n=9). These qualitative findings support the findings of Harris and

Wilson (2004) and Calitz (2010) indicating that scholars do not have a good perception of career opportunities in the ICT industry.

Student usability evaluations

Metrics recorded for the student user group included learnability, efficiency, satisfaction (focusing on usefulness), general issues, and eye-tracking results. These metrics were chosen to determine if the portal provided information which is useful and the degree to which the portal was effective in doing so. In order to evaluate efficiency, seven randomly selected undergraduate students were chosen to conduct evaluations using the Tobii eye-tracking equipment. This allowed for the recording of time per task in order to calculate learnability and efficiency. Table 4 tabulates the efficiency of student participants completing the tasks on the ICT career portal.

Participant No.	Task 1	Task 2
1	100%	71%
2	12%	100%
3	50%	100%
4	100%	100%
5	67%	83%
6	91%	30%
7	100%	100%

Table 4. Efficiency of students completing tasks

The students (n=6) rated the portal as being “very useful” for obtaining career and qualification information, with one student indicating a “useful” rating. Student evaluations were conducted in the Center of Excellence (CoE) usability laboratory in the Department of Computing Sciences at NMMU. Figure 5 illustrates the eye-tracking screen shots taken with the Tobii Eye-tracking equipment, showing that students focused on the skills and companies which were registered on the portal. This indicated that the portal was effective in providing the information specifically included for student users. The yellow, green, and red in an increasing order indicates the areas where students’ eyes focused the most.

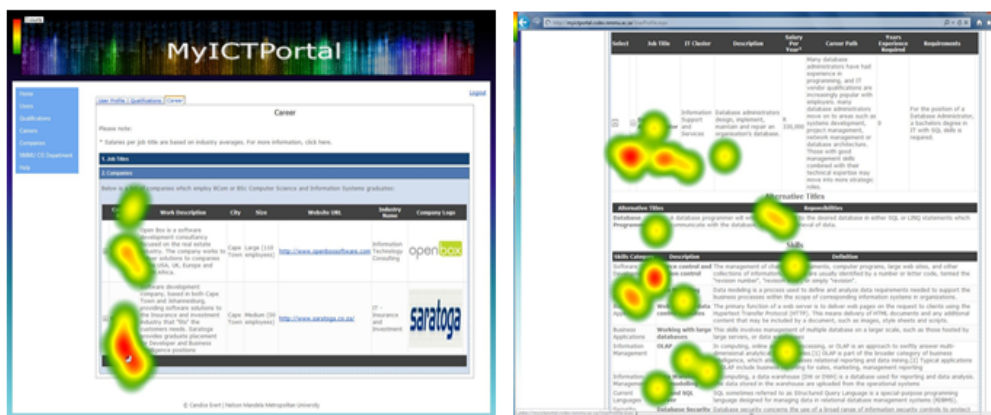


Figure 5. Eye-tracking evaluation by students

Impact of ICT career portal provision

Thematic analysis of participant questionnaires indicates that the provision of an ICT career portal for both students and scholars has a great impact on the perception and awareness of ICT-based qualifications and careers. The findings support Farren (2010), indicating that career portals support the career development process. Participant comments showed a trend towards student's becoming more aware of employment opportunities available through studying various Computer Science and Information Systems qualifications. Scholar comments from Post-task questionnaires indicate that the scholars were able to identify the relationship between qualifications and careers, as well as the impact of a subject choice such as Mathematics and Mathematics Literacy has on the qualification options available.

The analysis of the research data indicates that the impact of the provision of the ICT career portal was positive in that users were able to gain valuable information regarding careers, qualifications, skills required, and the relation between the three. The portal is effective in providing comprehensive career and qualification information to both students and scholars. The measurements of social network theory require that the initial and attained status of both the actor (scholars and students) and the information provided are determined to reflect the process by which value has been added through the network (Lin, 2005). The flow of information is an embedded resource in social networks (Lin, 1999). The findings presented with regard to the scholars indicate that value was added in the form of information benefitting the individuals (scholars).

CURRENT PORTAL STATISTICS

A number of applications are available to monitor web traffic. The authors are using Google's web traffic tool, Google Analytics (www.google.com/analytics) and an additional tool (www.statcounter.com). The developers of the portal were able to keep track of the web traffic on the web-based portal. The data captured from these tools indicated a steady growth of first time visitors (75%) and a 25% increase of returning visitors over a period of three months (Figure 6) with 573 visitors in total.

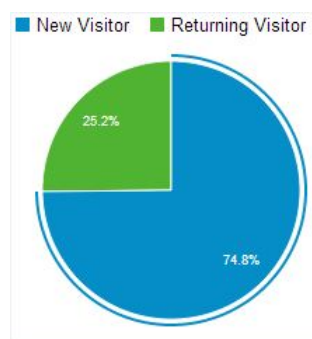


Figure 6. Illustration of New vs. Returning visitors during the period January – March 2013

Analysis of data shows that views of the portal are from as far as Pakistan and the United States of America (Figure 7). The portal has been updated to allow ICT companies to register on the portal and provide company related information and advertise job vacancies.

Country / Territory	Visits
1. South Africa	580
2. (not set)	161
3. United Kingdom	8
4. United States	4
5. Australia	3
6. Germany	2
7. Pakistan	2
8. Algeria	1
9. Ireland	1
10. Iraq	1

Figure 7. Site views from as far as Australia and the United States of America

Statistics analyzed from StatCounter indicate that over the period beginning December 2012 and ending January 2013, the number of first time visitors increased by 20%, with most visits seen a few days before South African matriculation results were released and before Computer Science and Information Systems registration at the Nelson Mandela Metropolitan University in Port Elizabeth took place in January. This indicates the portal is being made use of during the crucial stages of scholars’ and students’ lives with trends and patterns possibly growing. From the dates ranging 1 March to 31 March 2013, the MyICTPortal has seen an increase of 3639 page loads, 557 unique page visits, 460 first time visits, and 97 returning visitors (Figure 8). This indicates that students and scholars are utilizing the portal to access ICT career and qualification information. These statistics indicate that the portal is now being used by scholars, students, and members of industry as an information and communication tool.

Monthly Stats Report: 1 Mar - 31 Mar 2013
 Project: MyICTPortal
 URL: <http://myictportal.csdev.nmmu.ac.za>

Summary

	Page Loads	Unique Visits	First Time Visits	Returning Visits
Total	3,639	557	460	97
Average	117	18	15	3

Date	Page Loads	Unique Visits	First Time Visits	Returning Visits
Fri, 1 Mar	74	10	4	6
Sat, 2 Mar	2	2	0	2
Sun, 3 Mar	0	0	0	0
Mon, 4 Mar	243	15	11	4
Tue, 5 Mar	137	15	11	4
Wed, 6 Mar	14	14	14	0
Thu, 7 Mar	450	30	20	10
Fri, 8 Mar	153	18	12	6
Sat, 9 Mar	21	4	4	0
Sun, 10 Mar	79	10	4	6
Mon, 11 Mar	469	141	135	6
Tue, 12 Mar	63	20	14	6
Wed, 13 Mar	1,042	118	109	9
Thu, 14 Mar	520	52	42	10
Fri, 15 Mar	39	20	18	2
Sat, 16 Mar	6	6	6	0

Figure 8. Statistical counter results

The Google Analytics statistics confirm the ICT portal usage and effectiveness (Figure 9), with 74% new visitors accessing the site during February-March 2013. This included 2708 page views.

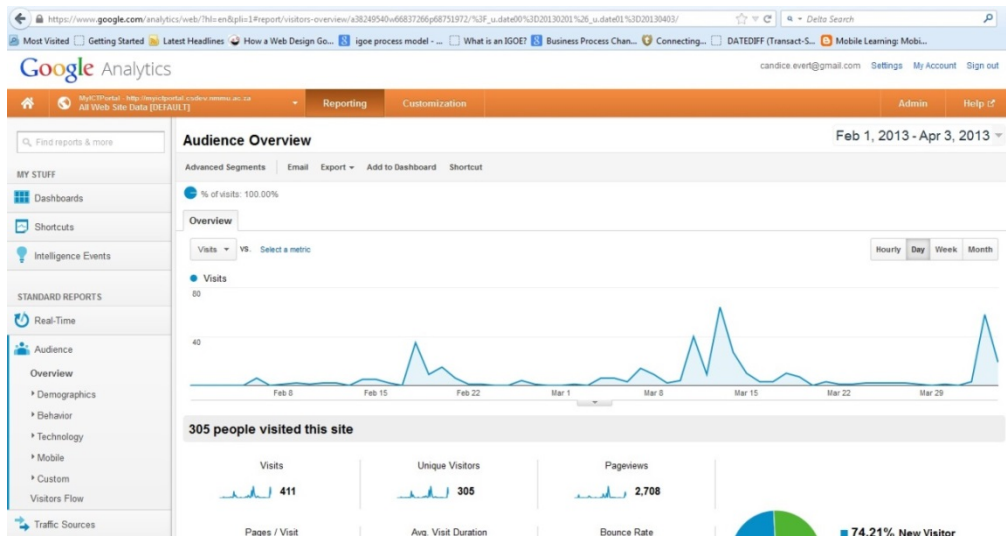


Figure 9. Google statistics February – March 2013

Since starting the project in September 2012, the web site has had 4708 first time visits, 6135 visits in total, and 1427 returning visits. Figure 10 indicates that there are more visits to the site around August/September when scholars have to apply and choose career programs and December/January when they have received their matriculation results and can register for degree programs at the university.

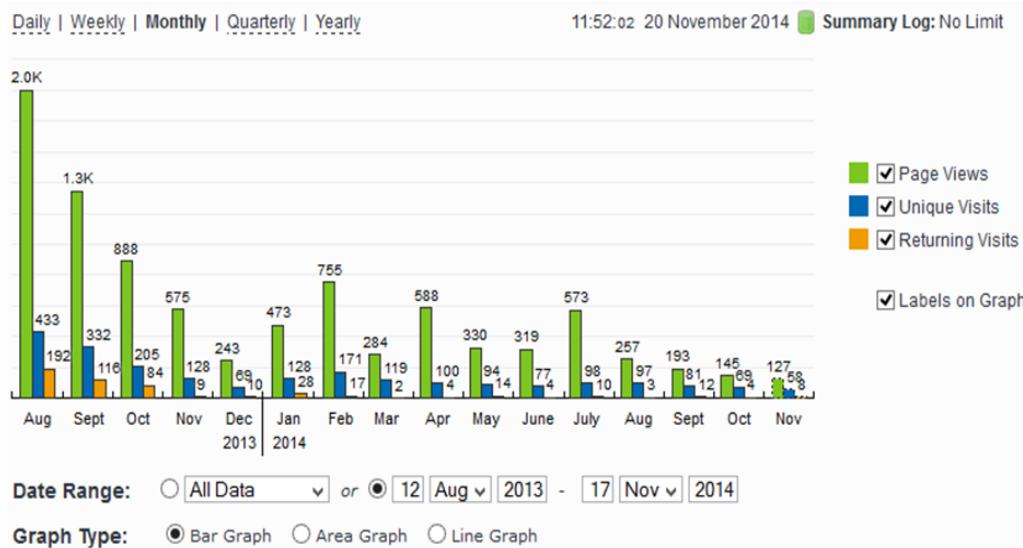


Figure 10. Portal statistics August 2013 – November 2014

CONCLUSIONS

This research paper explored the ICT skill shortage and the effect of the provision of an ICT-based career guidance portal on scholars’ and students’ perceptions of the ICT industry. Research found that due to the lack of comprehensive career information, scholars and students had formed their own opinions and attitudes of the ICT industry and due to these opinions had not enrolled for ICT qualifications, causing a shortage of ICT skilled employees (Cohen, 2012; Telegraph, 2014). Career

portals have increasingly been used as sources of information (Farren, 2010). This paper investigated the effectiveness of an ICT career portal in informing and educating students and scholars of the career opportunities available and the extent to which such a portal is able to provide career related information.

The study is grounded in the network theory of social capital (Lin, 1999). The measurements of network theory require that the initial and attained status of the actor (in this case the scholars and students) are determined to reflect the process by which value has been added through the network (Lin, 2005). The flow of information is an embedded resource in social networks and will enhance the outcomes of actions (Lin, 1999). In this study, the provision of ICT career information through the use of an ICT portal, informing scholars and students of ICT qualifications, salaries, and related job opportunities, assisted the actors (scholars and students) to be better informed (enhance their actions) in the South African ICT labor market.

A literature review was conducted concerning the ICT skills shortage (Alexander, et al., 2010; Calitz, 2010), ICT career portals, and the effect which existing portals have had on its target audience. For the purpose of this study, students from the Department of Computing Sciences, NMMU were selected. Grade 9 to Grade 11 IT scholars from two schools were approached to participate in the study. Scholars were selected to determine the effectiveness of the ICT career portal on scholars obtaining ICT career information and assisting them with ICT study program choices. Scholars evaluated the ICT career portal in their school computer laboratories using the Post-task questionnaire while undergraduate students evaluated the usability of the ICT career portal using eye-tracking and the Post-task questionnaire.

The results of the evaluation indicated that the implemented ICT careers portal was successful in providing comprehensive career and qualification information to both scholars and students. The findings support Farren's (2010) findings. Students were able to identify the link between careers and currently registered qualifications, while scholars were able to gain more information regarding careers and the importance of subject choices in their future studies. Both scholar and student users found the portal to be useful in gaining career information and preliminary portal statistics show a strong indication that users will use the portal again. The research study shows how departments in Higher Education Institutions can assist with scholar career choices and the industry they are operating in. Future research will monitor the ICT student enrollments and scholar awareness of ICT career opportunities and ICT industry involvement.

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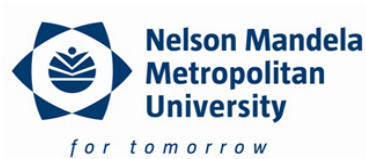
APPENDIX

Appendix A: Post-task Questionnaire

Department of Computing Sciences

Candice.Evert@nmmu.ac.za

ETHICAL CLEARANCE NO: H12-SCI-CS-011



E-mail:

Thank you for agreeing to participate in the MyICTPortal Usability Study. Your identity will remain anonymous and information provided in questionnaires will be used to report findings.

Please tick in the appropriate box and fill in where necessary.

SECTION A: BIOGRAPHICAL INFORMATION

1. **Age:**

15 – 18

19 – 21

22-25

26+

2. **Gender:**

Male

Female

3. **Are you currently?**

Scholar

Name of school: _____

Grade: _____

Student

Degree or qualification: _____

4. **If Scholar, are you considering studying a Computer Science, Information Systems or Information Technology degree?**

Yes

No

Not sure

5. **If University student:**

a. **What year/level are you in?**

First Year

Second Year

Third Year

Postgraduate

(Honors/Masters/PhD)

b. **What made you choose to study Computer Science, Information Systems or Information Technology (select as many that may apply)?**

Parental influence

Information

Interest in Computers

obtained from school

Information from

Newspapers

Friend's influence

websites/ portals

Other: _____

SECTION B: EXPERIENCE

6. Have you ever used a computer before?

Yes No

7. How long have you been using a computer for?

0-1 year 2-4 years 5+ years

8. Do you have access to the Internet?

Yes No

If yes to question 8, please answer the following questions

a) Please state where you access the Internet from (state > 1, if applicable):

Home School University
 Internet café Cell phone Wi-Fi Hotspot
 Other: _____

b) How long have you been using the Internet for?

0-1 year 2-4 years 5+ years

c) For what purposes do you use the Internet (state more than one, if applicable):

Shopping Banking Weather
 Social Networking News Information gathering
 (Facebook, Twitter, LinkedIn, etc.) (Google, Wikipedia, etc.)
 Other: _____

9. Do you know the difference between Computer Science, Information Systems and Information Technology?

Yes No

10. Have you ever used the Internet to gain information about qualifications or career opportunities?

Yes No

If yes, please state which website you frequent most often for this information: _____

11. Have you ever used Pace Career Centre (<http://www.pacecareers.com>) to gain information regarding career paths?

Yes No

SECTION C: POST-TEST EVALUATION

12. Overall Impression

12.1	Overall reaction to the system.	VERY FRUSTRATING			VERY SATISFYING	
		1	2	3	4	5
12.2	Screen Design.	VERY POOR			VERY GOOD	
		1	2	3	4	5
12.3	Layout of information on the screen.	VERY CONFUSING			VERY CLEAR	
		1	2	3	4	5
12.4	Help provided by the system.	NOT ENOUGH			ENOUGH	
		1	2	3	4	5
12.5	Using the system and its functions were...	VERY FRUSTRATING			VERY SATISFYING	
		1	2	3	4	5
12.6	Learning how to use the system was...	VERY DIFFICULT			VERY EASY	
		1	2	3	4	5
12.7	Navigating the systems was...	VERY DIFFICULT			VERY EASY	
		1	2	3	4	5
12.8	Completing the tasks were...	VERY DIFFICULT			VERY EASY	
		1	2	3	4	5
12.9	Error messages were...	NOT HELPFUL			VERY HELPFUL	
		1	2	3	4	5

13. Career Portal

		STRONGLY AGREE	NEUTRAL	STRONGLY DISAGREE		
13.1	I could easily find all the information I needed.	1	2	3	4	5
13.3	Information provided to me was easy to understand.	1	2	3	4	5
13.4	Layout of information was pleasant.	1	2	3	4	5
13.5	Layout of information was easy to follow.	1	2	3	4	5
13.6	I learnt something new about ICT (Information and Communications Technology) qualifications.	1	2	3	4	5
13.7	I learnt something new about ICT (Information and Communications Technology) careers.	1	2	3	4	5
13.8	The system was useful.	1	2	3	4	5
13.9	I would use this system in the future.	1	2	3	4	5
13.10	I would recommend this system to others.	1	2	3	4	5

14. What do you **like** about the CareerWeb ICT Career Portal?

--

15. What do you **dislike** about the CareerWeb ICT Career Portal?

--

16. Have you learnt anything new about **ICT careers**? If Yes, please elaborate:

--

17. Have you learnt anything new about **ICT-based qualifications**? If Yes, please elaborate:

--

18. General Comments:

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Thank you for participating in the research study.