

Educational Research for Social Change (ERSC)

Volume: 2 no. 1, April 2013

pp. 64-81

ersc.nmmu.ac.za

ISSN: 2221-4070

The Influencers of Scholars' ICT Career Choices

André Calitz

Department of Computing Sciences, Nelson Mandela Metropolitan University

andre.calitz@nmmu.ac.za

Jean Greyling

Department of Computing Sciences, Nelson Mandela Metropolitan University

Margaret Cullen

Business School, Nelson Mandela Metropolitan University

Abstract

The international Information and Communications Technology (ICT) skills shortage affects the business and the education sectors. Tertiary degree registrations for ICT courses globally have declined since the dot-com boom. The shortage of ICT professional skills has been exacerbated, both nationally and internationally, by the scarcity of scholars entering the ICT career market. The number of scholars choosing ICT careers in South Africa has declined. Many scholars do not meet university entrance criteria in their final examinations. In addition, scholars do not have a good understanding of what ICT is about nor the numerous career opportunities available. In South Africa, fewer than 25% of schools have access to computer facilities, and teachers and parents have never been exposed to the possibilities of careers in ICT.

In this study, the influencers (parents, teachers, friends, and career counsellors) of a scholar's ICT career choice are investigated. This article is based on, and develops further, some aspects of the research work reported in the author's unpublished 2010 doctoral thesis. The data-collection tools used in the study were a comprehensive literature study as well as four questionnaires distributed (in 2011 and 2012) to parents and first-year students. Parents, teachers, and friends with knowledge of ICT careers influence a scholar's ICT career choice. Exposure to technology and social media were found to further influence a scholar's choice of career. Education and creating an awareness of ICT career opportunities must become a national priority that will positively affect educational change.

Keywords: ICT Skills Shortage; Scholar ICT Career Choices; ICT Career Influencers.

Copyright: © 2013 André Calitz

This is an open access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original author and source are credited.

Educational Research for Social Change, April 2013, 2 (1)

Faculty of Education: Nelson Mandela Metropolitan University, Port Elizabeth, South Africa

Introduction

The availability of suitably qualified Information and Communication Technology (ICT) educators can have a positive effect on educational change. ICT plays an increasingly important role in education and the use of modern technologies such as e-learning, blended learning, and mobile technologies can be a critical catalyst for educational change. The ICT education and training of educators in South Africa has not achieved the required standards of continual teacher professional development.

The professional development of teachers and specifically that of Information Technology (IT) teachers should be compulsory and on a continual basis. Teachers require re-skilling of their ICT skills, and schools that offer Computers Applications and Technology (CAT) and Information Technology (IT) often require teachers offering these subjects to provide the required training and skills development to colleagues (Koorse, Calitz, & Cilliers, 2010). Schools offering CAT and IT as subjects are faced with additional problems of finding suitably qualified teachers and ICT infrastructure.

The ICT skills shortage in South Africa is of national concern and industry and educational institutions are increasingly looking towards tertiary institutions to address the ICT skills crisis (Calitz, 2010). Globally, tertiary institutions are experiencing a decline in student enrolment in ICT courses. The number of students enrolling for ICT courses in South African higher education has decreased over the past decade. Internationally and nationally, universities are investigating reasons for the declining numbers of high school children pursuing careers in ICT (Babin, Grant, & Sawal, 2010).

The number of students enrolling for ICT courses at tertiary institutions in South Africa has decreased considerably since the late 1990s. A similar trend was found internationally, however, enrolments have started to stabilise in the United States and Canada since 2007 (Conference Board of Canada [CBC], 2009). Internationally, various government bodies and academics at universities have voiced their concern about the ICT skills shortage. The shortage results primarily from low student enrolments which lead to a smaller number of graduates and a scarcity of skilled ICT professionals in almost every computer-related field (Alexander et al., 2010).

In April 2008, the National Department of Labour 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 the 2011 ITWeb survey, the estimate for ICT skills needed in South Africa had nearly doubled to 70,000 practitioners (Cohen, 2012).

A limited number of ICT students and professionals enter the industry every year. Universities are not taking in their maximum capacity of students because a limited number of scholars pass Mathematics and Science in matric with the necessary requirements (Cohen, 2012). The basic education system in South Africa needs to be more involved with promoting an interest in technology in scholars from an early age to cultivate a large and relevant ICT skills base (Cohen, 2012).

Research has indicated that scholars choosing a career and specifically ICT careers are influenced by parents, teachers, career counsellors, and role models (Babin et al., 2010). Parents and teachers were ranked as important sources of information when deciding on a future ICT careers (Ross, 2007). Research conducted in South Africa indicated that scholars are influenced by parents and teachers when making career choices (Alexander et al., 2010). In a Canadian study, the majority (83%) of scholars indicated that they consult with their parents or guardians for education and career advice (CBC, 2009). Careers in ICT were found less appealing by parents than by scholars in Canada (CBC, 2009). Parents had misperceptions about ICT careers and parents and guidance counsellors perceived that there are no jobs in computing (Benamati, Ozdemir, & Smith, 2010).

Research problem

In South Africa, scholars with an aptitude for ICT are reluctant to pursue Computer Science and Information Systems (CS&IS) degree programmes at universities. Students, scholars, and parents have misperceptions about the ICT job market and salaries (Benamati et al., 2010). The image of computing held by the general public, teachers, and career counsellors is deteriorating even though teenagers use mobile technologies and social networking sites daily. Scholars generally have misperceptions of ICT careers and job descriptions and scholars' disinterest can be attributed to a lack of familiarity with the degree programmes Carter (2006). Koorsse et al. (2010) and Havenga and Mentz (2009) indicate that the lack of interest in IT as a secondary school level subject has been observed by IT educators, the Department of Education, subject co-ordinators, and academics at universities.

South African scholars and their career advisors (parents, teachers, and guidance counsellors) believe that many national and international ICT job opportunities have been lost due to the downturn when the dot-com bubble burst in 2000, and to the extent of offshoring (Alexander et al., 2010; Benamati, et al., 2010). South African schools do not appoint full-time career or guidance counsellors, and teachers and parents have limited knowledge of the ICT career opportunities available. Scholars do not receive appropriate career advice and are not encouraged to pursue careers in ICT, although more than 290 different careers are available in the ICT industry (Calitz, 2010). Scholars' career choices are influenced by role models; however, the majority of scholars in South Africa generally do not have any role models in the ICT industry.

The following research objectives have been identified in this study:

- Determine the role parents, teachers, and career counsellors play in scholars' ICT career choices
- Report on the four surveys conducted amongst parents and first-year students during ICT career awareness events in 2011 and 2012
- Indicate the strategy that the Department of Computing Sciences implemented to increase the awareness of ICT careers in the Eastern Cape.

The important career advice that parents and teachers provide, influences scholars to pursue careers in ICT and is the primary focus of this research study. The literature review investigates which corrective steps can be taken by tertiary institutions to alleviate the ICT skills shortage in South Africa.

Research conducted amongst parents and first-year students indicated the crucial role of parents and teachers in a scholar's career choices. In this study, a survey was conducted amongst high school parents and first-year students to establish the following research questions:

- Who influenced their child's career choice?
- What were the parents' and teachers' roles in influencing their children's career choices?
- Did parents and teachers know of the ICT skills shortage in South Africa and related career opportunities?
- Did parents and teachers encourage their children to pursue careers in ICT and in the ICT teaching and education profession?
- What strategies can CS&IS departments implement to increase the awareness of ICT careers?

Research methodology

Research strategies are based on the selected research philosophy as well as the type of research questions that this study aims to answer. The interpretivist research philosophy primarily makes use of literature reviews, surveys in the form of questionnaires, focus groups, and case studies. A combination of related literature and data collected from questionnaires was used for this study.

The parent questionnaire and first-year student questionnaire were designed in a research study by Calitz (2010). The consistency and reliability of the questionnaires were validated in the research study. Parents of prospective ICT students attended parent and scholar evenings hosted by the Department of Computing Sciences at Nelson Mandela Metropolitan University (NMMU) during the period 2010 to 2012. The parents were given a presentation on the different career opportunities in Computer Science and Information Systems and various guest speakers in the field of Computer Science addressed the parents.

The parent questionnaire was distributed at these events to gather information about what career advice the parents had provided to their children as well as any other sources of career advice their children had used. The parents were questioned about their own studies and ICT career knowledge. The parent questionnaire aimed at assessing the parents' knowledge of CS and IS to establish whether they were able to provide their children with career advice in the ICT field.

The parent questionnaire consisted of biographical and career questions. It also investigated which specific people had given their children career advice, namely themselves as parents, teachers, career counsellor, or guidance counsellors and, specifically, what career advice these people gave the children. The questionnaire asked parents if they would recommend that their children pursue a career in ICT and whether they knew the difference between the CS and IS degree programmes. Lastly, the current employment status of the parents was established. The parent questionnaire comprised of open-ended and closed questions, including contingency questions.

The first-year CS&IS student questionnaire developed by Calitz (2010) was used in 2011 and 2012. First-year BSc and BCom CS&IS students completed the questionnaire at the beginning of their studies in the Department of Computing Sciences at NMMU. The first-year questionnaire comprised open-ended and closed questions. The first-year questionnaire established the following:

- Where did you hear about the NMMU Department of Computing Sciences?
- Who influenced your ICT career choice?
- What career advice was provided and by whom?
- What is your knowledge of the different ICT careers?

The parent and first-year questionnaires were statistically analysed, obtaining descriptive statistics and using thematic analysis for open-ended questions.

Research ethics

The research conducted in this study included vulnerable groups namely, undergraduate students. The questionnaires utilised in this study, the consent forms for students and parents, and letters to relevant parties and bodies were approved by the NMMU Research Ethics Committee, Ethics number: H 2010 BUS BS 15.

Literature study

Scholar perceptions of ICT

The National Association of Colleges and Employers in the USA indicated that Computer Science graduates were amongst the highest paid of any major with an average starting salary of \$53,000 per annum in 2007 (Ross, 2007). However, students entering tertiary education are not selecting CS&IS majors because of the perceived dot-com bust and the effects of outsourcing (Carter, 2006; Benamati et al., 2010).

In the USA, Ross (2007) found that people with the aptitude for computing lack the interest to pursue an ICT career. Jill Ross, Director of the Image of Computing National Task Force at the University of Colorado, identified the following four root causes for the lack of interest in computing:

- The general public's image of computing
 - They think that computing is only programming
 - Only nerds pursue computing careers
 - Computing is only related to iPods and cell phones
 - There are no jobs due to offshoring and outsourcing
- The teen's image of computing
 - Teens aged between 12 and 17 years increasingly use social networking sites
 - Teens use mobile technologies daily
 - Computing is part of teens' daily life and they think they already know everything about computing
- The undergraduate's image of computing
 - High school teachers influence the choice of computing programs
 - IT students like to solve problems
 - Computing projects are not exciting
 - IT is only coding (writing programs)
- The computing professional's image of computing
 - They have a positive impact on society
 - Computing needs a more human and less abstract orientation
 - Computing intends to preserve the rigour of computer science as a discipline
 - Computing requires interdisciplinary collaboration
 - There is an underrepresentation of women and minorities in IT.

The *Running on Empty* Association for Computing Machinery (ACM) report by Wilson, Sudol, Stephenson, and Stehlik (2010) indicated that approximately two-thirds of the states in the USA have limited Computer Science education standards for secondary schools and that most high schools include Computer Science as an elective and not as part of the core education. The downward spiral of Computer Science is continuing and little is done to redirect the trend (Roman, 2010).

The Conference Board of Canada (CBC, 2009) conducted an extensive study on secondary school students' views about ICT and why limited numbers chose careers in ICT. Researchers interviewed 1, 034 Grade 9 and 10 scholars, 60 parents, and 54 guidance and career counsellors. The results indicated that 36% of the scholars considered ICT career opportunities and their decisions were only marginally influenced by job availability and job security. Scholars (37%) found ICT jobs to be creative and 77% indicated that they believed ICT jobs provided better salaries.

The concerns scholars identified were that ICT jobs were difficult and complex (34%), the jobs were “not fun” (31%), and “not cool” (25%). The study found that girls’ enthusiasm for ICT was lower than boys’. The majority (83%) of scholars reported that they consulted with their parents or guardians for education and career advice. The study found that parents and guardians found ICT less appealing than scholars. Career and guidance counsellors (75%) viewed ICT careers in a positive light.

Scholars may develop a negative attitude towards computing as a result of high school education (ACM Bulletin, 2009). In South Africa, research indicates that the high school subject, IT, has a negative impact on future career choices by scholars (learners) and has direct impact on the number of ICT professionals entering and graduating from tertiary institutions (Havenga & Mentz, 2009; Koorsse et al., 2010). The numbers of scholars selecting IT as a subject in Grades 10–12 are further declining (Koorsse et al., 2010).

Research conducted by Babin et al. (2010) and Biggers, Brauer, and Yilmaz (2008) has focused on identifying reasons for the lack of interest by scholars in choosing computing as a career choice at tertiary level. The results indicate that scholars are uninformed or misinformed about ICT career opportunities, salaries, and job availability. The scholars’ perceptions are that a career in computing is asocial, only focused on programming, and ICT professionals have limited interaction with other individuals (Biggers et al., 2008).

Scholars at school level over the last decade are less inclined to consider ICT career programmes at tertiary level (Becerra-Fernandez, Elam, & Clemmons, 2010; Benamati et al., 2010). Ross (2007) found that talented young people are turned off by computing’s image. High school scholars, specifically, have a negative perception about a lack of high-paying ICT careers, career opportunities, and ICT academic programs offered by tertiary institutions.

Interventions by tertiary institutions

A number of interventions by tertiary institutions at secondary school level to address the problems of scholars not choosing ICT careers have taken place worldwide. Choudhury, Lopes, and Arthur (2010) implemented an IT Careers Camp, a specific promotional initiative designed to improve enrolment in IT-related courses, and aimed at high school scholars and teachers. The IT Career Camp was specifically designed to convince participants that:

- Career prospects in the ICT industry are excellent
- There are numerous ICT career possibilities and career tracks
- ICT work is creative and interesting.

The camp was designed in collaboration with industry partners and allowed for industry visits, thus allowing scholars to gain hands-on experience in solving business problems by utilising ICT in a practical environment. The camp was very successful in changing scholars’ perceptions about the nature of ICT work and the ICT job market. Choudhury et al. (2010) indicated that they believed the camp could be a useful tool to create a pipeline of well-informed scholars interested in ICT careers.

Ericson, Guzdia, and Biggers (2005) supported the proposal that tertiary CS&IS departments should assist computing teachers at school level, for example, presenting workshops on programming for computing teachers. The workshops made computing teachers more confident and provided the opportunity for

teachers to keep up-to-date with current technologies. Post-graduate students seconded to a specific teacher at a school to provide programming technical assistance, proved to be very valuable for computing teachers and scholars.

The Computer Science Education Week (CSEdWeek) in the USA was the second government-supported event promoting ICT specifically at school and tertiary institution level (ACM MemberNet, 2010). Computer Science Unplugged (CS Unplugged) is a series of activities to expose scholars to central concepts in Computer Science and Information Systems in an entertaining way and has been implemented in New Zealand and Israel (Taub, Ben-Ari, & Armoni, 2009). The activities do not require access to a computer and the research results indicate that CS Unplugged did start a process of changing scholars' views about ICT.

The CSEdWeek 2010 included CS Unplugged, CSEdWeek Pledge, and various computing activities and visits to schools to promote the importance of Computer Science and Information Systems education. CSEdWeek 2010 in the USA sought to improve involvement of students, educators, parents, and industry leaders in signing a pledge to participate in, and support, a national effort to promote ICT careers and to promote the importance of computing education (ACM MemberNet, 2010).

In the Eastern Cape, South Africa, the Department of Computing Sciences (NMMU) has implemented similar initiatives for IT school teachers. The department has been working closely with IT teachers in the region providing IT teacher seminars, programming training courses, scholar ICT career presentations, and educational support. Various initiatives such as gaming days, school IT project competitions, promotional brochures, and IT trophies for IT scholars achieving at individual schools have been initiated by the department.

The department regularly produces a departmental newsletter that is distributed to schools in the region. The Department of Computing Sciences has appointed a professional journalist on a contract assignment to interview graduates working in industry and produce articles that are included in the departmental marketing materials, newsletters, and web site. The Department of Computing Sciences *NEWS*, Issue 2 (2011) included an article on department alumni and the perks of having a formal qualification, specifically a post-graduate qualification and working in the ICT industry.

The Department of Computing Sciences and TELKOM SA further presented a Computer Literacy Programme to 350 teachers in Port Elizabeth during 2009 and 2011. The programme aimed at providing continual education to teachers, included introductory and advanced courses of the Microsoft Office Suite 2003/2007 and Expression Web. The File Management and Word Processing Beginners and Intermediate courses were rated the most useful by teachers. The effectiveness and success of the programme was confirmed and teachers applied the skills learnt, both in their personal lives and in their profession.

ICT career interest at school level and influences on ICT career choice

Research internationally, has indicated that scholars choosing a career, and specifically ICT careers, are influenced by parents, teachers, career counsellors, and role models (Babin et al., 2010). The ICT skills shortage globally has sparked renewed interest in research into what influences scholars' career choices. Authors and panels have cited the need to attract more high school scholars to enrol in CS&IS tertiary degree programmes. Current research is focusing on how and why scholars make decisions to pursue ICT careers and degree studies (Babin et al., 2010; Biggers et al., 2008; Calitz, 2010).

Parents are one of the most important sources of advice to scholars (Trusty, Watts, & Erdman, 1997) and have expectations and aspirations for their children. Parents are often seen as role models and further

motivate and support their children. Parents play a significant role in assisting their children make career decisions. Career counsellors are also a valuable source of advice for scholars; however, the advice given is often rated lower in importance than that of parents (Alexander et al., 2010). In a recent study, students ranked their sources of advice in decreasing order of influence. Parents were ranked first, then friends, then teachers and lastly counsellors (Babin et al., 2010).

Parents help to shape the perceptions of their children regarding the appropriateness of their career decisions and are valuable sources of encouragement. Parental encouragement significantly influences the learning experiences, efficacy, and outcome expectancies of scholars. Parents and guidance teachers at schools assist scholars to develop confidence concerning career competence, career planning, and occupational exploration (Turner & Lapan, 2002).

Babin et al. (2010) interviewed and surveyed Canadian career counsellors (n=111), ICT university students (n=141), and first-year Business and IT Management students (n=1,335). The survey findings suggest that parents have the strongest influence on career choice and guidance counsellors the weakest influence. Recommendations from the research study are that ICT industry representatives must speak directly to scholars, students, and parents to improve the number of scholars and students choosing ICT careers. The study found that scholars were attracted by the relatively high income of ICT professionals.

Gender, socioeconomic background and access to computers and technology all have an influence on ICT career choices. The research study conducted by Miliszewska and Sztendur (2010) that investigated the perceptions of ICT studies and careers among female secondary school students in an educationally disadvantaged metropolitan region of Melbourne, found that female students had positive perceptions of ICT; however, this interest did not translate into the consideration of ICT as a career choice.

Cosser (2010), in a longitudinal study, further found that a wide disparity exists between scholar career preferences and actual enrolments in higher education institutions. The study found that fewer than 20% of the total number of scholars specifying areas of study for which they planned to register, enrolled at higher education institutions. The study found that although scholar preferences were predominantly for studies in the fields of Science, Engineering, and Technology (SET), student graduations were predominantly in the Humanities.

Research conducted on the reasons why scholars do not choose ICT careers in South Africa, are based on two main studies: one conducted by Seymour, Hart, Haralambous, Natha, and Weng (2005) in the Western Cape and the other by Jacobs and Sewry (2010) in Grahamstown (Eastern Cape) respectively. The studies were conducted to determine Grade 12 scholars' inclinations to study Computer Science and Information Systems at a tertiary level in South Africa. It was found that students' previous experience with computers affected their attitudes toward any future use. Both studies found that learners with no access to computers at school were more inclined to study Computer Science than those with access to computers. The studies also found that scholars who have negative perceptions of ICT jobs available are less inclined to study Information Systems or Computer Science. Both studies found that scholars do not know what Information Systems as a field of study comprises although the perceptions of Computer Science were slightly more accurate.

Jacobs and Sewry (2010) conclude that educational institutions need to promote accurate representations of ICT-related subjects and career fields to scholars. Their research results indicate that, of the scholars who take IT as a school subject, very few continue with CS&IS courses at a tertiary level. Thus, after being exposed to the IT curriculum at school, scholars then did not decide to continue with a career in computing.

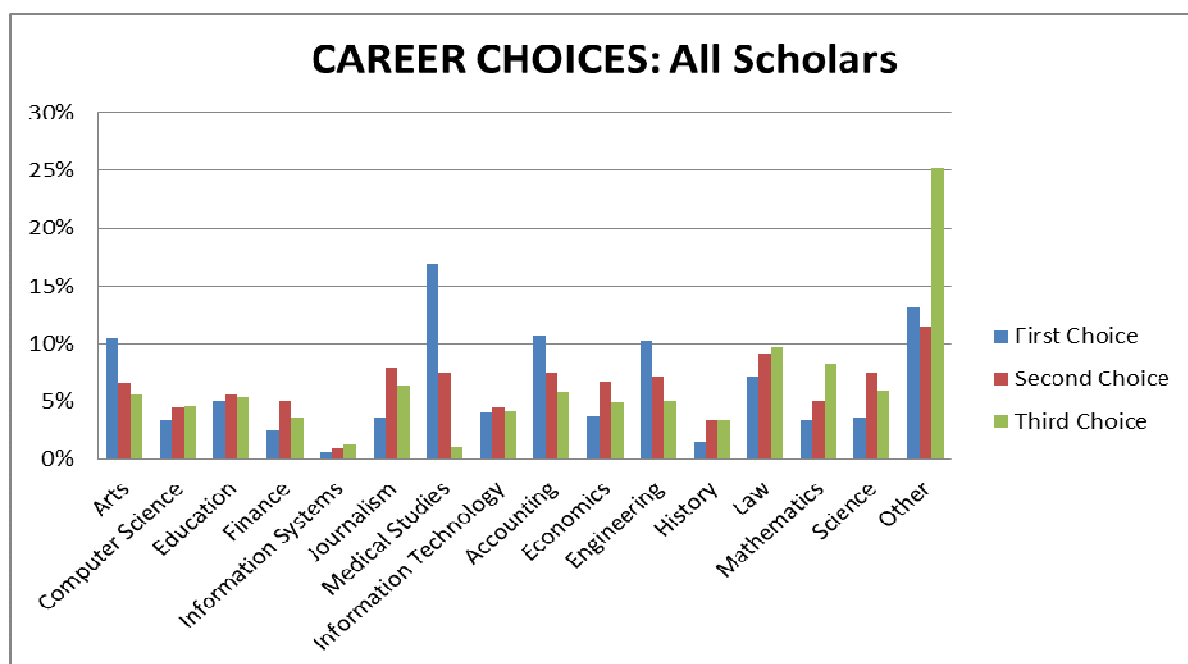
Scholars career choices

Research has indicated that scholars' interests and career choices, including ICT careers, are influenced by parents, teachers, career counsellors, and role models (Babin et al., 2010). The ICT skills shortage worldwide has sparked renewed interest in research into what influences scholars' career choices.

In a study by Calitz (2010) in 11 secondary schools in the Eastern Cape, a total of 1,536 scholars returned a completed a career interest questionnaire. The career choices of all scholars (Grades 9, 11 and 12) that participated in the study (Figure 1) indicate that scholars' first career choice is Medicine (17%), "Other" (13%), Arts and Engineering (10%), Computer Science (3%), Information Systems (1%) and Information Technology (4%).

Figure 1

Career choice by all participants in the study (n=1,536)



The "Other" category, out of the 16 categories, received the most responses: first choice (13%), second choice (11%), and third choice (25%). This indicates that scholars are increasingly considering other fields of study not identified in the questionnaire.

National decline in ICT registrations

The International decline in ICT enrolments has been echoed in South Africa. Seymour et al. (2005) examined why scholars were not enrolling for CS&IS. It was found that the schooling system in South Africa was partly to blame and that many scholars did not meet university criteria when they left school. Scholars also did not have a good understanding of what ICT was about. With only 24% of schools having access to computer facilities in South Africa, many scholars have never been exposed to the possibilities of careers in ICT (Seymour et al., 2005).

The shortage of qualified science and technology teachers in South Africa has influenced the ICT career shortage dramatically because scholars are not being exposed to ICT, and a lack of training has led to poor

ICT standards. Rhodes University in Grahamstown, South Africa experienced a significant increase in ICT enrolments after the dot-com boom from 2000 to 2003, but that was followed by a significant decrease in enrolments up to 2008 (Jacobs & Sewry, 2010).

A decline in first time ICT registrations has also been experienced at NMMU in the Department of Computing Sciences. In 2002, a large number of first-year CS and IS students (307) registered for the first time in a degree program in Computer Science. This number steadily decreased over the next decade and only 91 first-year students were registered for a degree in Computer Science in 2012. Table 1 illustrates the registration figures for first-year CS and IS students taking Programming as a subject at NMMU.

Table 1

NMMU first-year Programming registration figures (Greyling, personal communication, 2013)

Year	Registration figures	% Decline/rise annually	% Decline compared to 2002
2002	307	-	-
2003	270	-12.05%	-12.05%
2004	103	-61.85%	-66.45%
2005	105	+1.94%	-65.80%
2006	106	+0.95%	-65.47%
2007	74	-30.19%	-75.90%
2008	89	+20.27%	-71.01%
2009	99	+11.24%	-67.75%
2010	84	-15.15%	-72.64%
2011	69	-17.86%	-77.52%
2012	91	+31.88%	-70.36%
2013	106	+16.48%	-65.47%

Table 1 summarises information on first-year registration figures. The average decline of first-year registrations between 2002 and 2012 is 65%. This rapid decline in CS and IS enrolments has contributed to the ICT skills shortage. The growth from 69 enrolments in 2011 to 91 in 2012 can be attributed to increased marketing in the Department of Computing Sciences during 2010 and 2011.

Research results and discussion

Parent questionnaire results

The important role of parents in influencing scholars' career choices has been reported in various research studies (Babin et al., 2010; CBC, 2009). The results from a first-year career choice pilot study conducted in 2009 indicated the important role of parents in first-year students' career choices.

Parents of prospective Computing Sciences students completed surveys at the Department of Computing Sciences parent information evenings held in 2011 and 2012. The children of the parents who attended the evening were predominantly in "advantaged" schools. The biographical data of the parents of scholars interested in ICT are presented in Table 2.

Table 2**Parents' gender and race**

Year	Male	Female	Asian	Black	Coloured	White
2011 (n=47)	27 (57%)	20 (43%)	2 (4%)	12 (26%)	13 (28%)	20 (42%)
2012 (n=50)	42 (84%)	8 (16%)	3 (6%)	3 (6%)	9 (18%)	35 (70%)

Fifty three percent of the parents who attended the evening presentation in 2011 studied at university and 56% in the 2012 presentation (Table 3). Parents who completed the survey indicated their children's current school grade. A large number (68%) of Grade 12 scholars who attended the information evenings with their parents had decided on a career.

Table 3**Parents attended university and scholar decided on career**

Year	Parents at university		Decided on career	
	Yes	No	Yes	No
2011 (n=47)	25 (53%)	22 (47%)	30 (63%)	17 (37%)
2012 (n=50)	28 (56%)	22 (44%)	30 (60%)	20 (40%)

The career choices made by scholars, as indicated by the parents in 2011, showed that the majority of respondents (n=30, 63% who answered "Yes") were ICT related careers (programming, web design, Computer Science, software development). Other careers chosen included Psychology, Education, Accounting, and Mechatronics. The career decisions indicated by the 2012 group included ICT, Accounting, Teaching, Law, and Engineering. The majority of the scholars who had not decided on a career were considering more than one career option.

Table 4**Career advice provided**

Year	Parents		Teachers		Career counsellors	
	Yes	No	Yes	No	Yes	No
2011 (n=47)	34 (72%)	13 (28%)	27 (57%)	20 (43%)	11 (23%)	36 (77%)
2012 (n=50)	38 (76%)	12 (24%)	28 (56%)	22 (44%)	22 (44%)	28 (56%)

Respondents were asked to indicate who had provided their children with career advice (Table 4). Parents (74%) were the biggest source of advice, followed by teachers (57%) and career counsellors (33%). Thematic analysis of the career advice given to scholars by parents, teachers and career counsellors included:

- Study for a professional qualification
- Pursue a career you are passionate about
- Pursue a career where job opportunities exist
- Follow a career that you are interested in and will enjoy.

A large percentage of parents (98%) indicated that they would recommend ICT as a career for their children. Various reasons were given for recommending ICT as a possible career. Thematic analysis of the results indicated the following main themes:

- ICT is relevant and the sky is the limit
- ICT has a large number of career opportunities
- All business sectors need ICT
- International job opportunities are available
- Modern career, and has a high future demand.

A large number of the parents (67%) indicated that their children had decided to pursue a career in ICT. Parents indicated the career advice they had given their children. Thematic analysis of the results provided the following main themes:

- Study hard so that they can have a bright future
- Do something that one will enjoy
- Explore options and match talent with passion
- Excel at school, especially in mathematics
- Do ICT because it is the future.

Advice given to scholars by teachers and by career counsellors was also requested in the survey. The career advice given to scholars by teachers and career counsellors as indicated by the parents included:

- Areas a scholar likes, suits their abilities and values
- Careers that are in high demand
- Make sure you follow your interests
- Subject choice advice
- Choose a career that they can grow in, and which interests them.

Results of the first-year students' survey

First-year Computing Sciences students completed the first-year survey, in 2011 (n=877) and 2012 (n=388). The group consisted of students registered for first-year Computer Science and Information Systems (programming and end-user computing) as well as students registered for the end-user computing service course. The biographical details for gender and race are presented in Table 5.

Table 5

First-year students' biographical details

Year	Male	Female	Asian	Black	Coloured	White
2011 (n=877)	440 (50%)	437 (50%)	23 (2%)	610 (70%)	75(9%)	169 (19%)
2012 (n=388)	232 (60%)	156 (40%)	20 (5%)	202 (52%)	31 (8%)	135 (35%)

The first-year students were asked where they obtained career information and who influenced their career choice (Figure 2). The 2011 group (n=877) indicated that their parents (n=266, 30%), teachers (n=198, 23%), and friends (n=141, 16%) provided career information and assisted them in deciding on a career choice. The sources of information that assisted in their career choice were the NMMU website (n=170, 19%), Openday (n=127, 15%), and school visits by NMMU staff (n=114, 13%).

Figure 2

First-year students 2011 (programming and end-user courses, n=877)

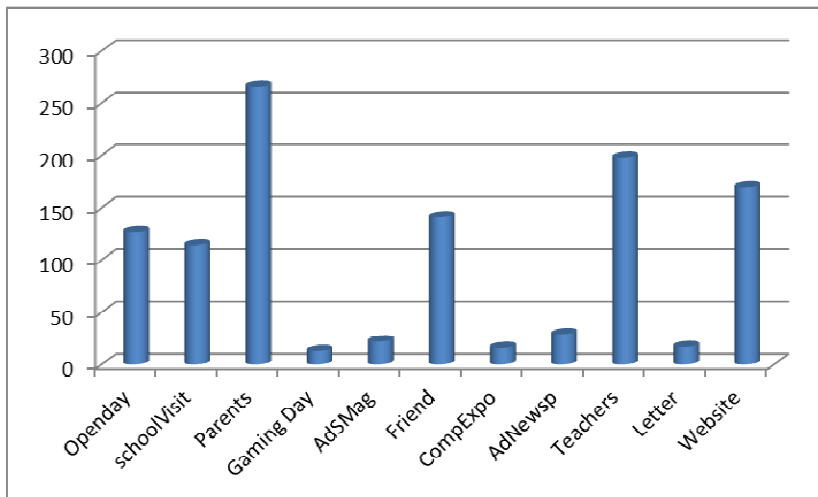
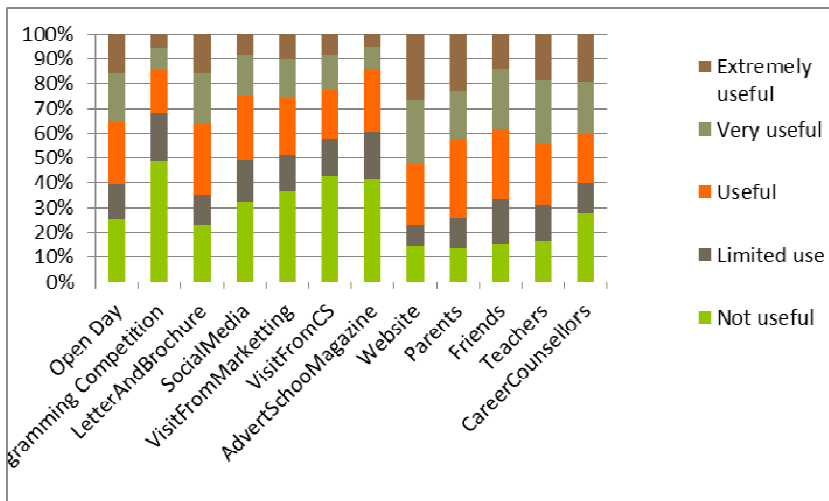


Figure 3

First-year students 2012 (programming and end-user courses, n=388)



The questions in the first-year questionnaire relating to sources of career advice were changed to a 5-point Likert scale in 2012 (1=not useful, and 5=extremely useful). The results (Figure 3) indicate a similar pattern to the 2011 results. The 2012 group (n=388) indicated that their parents (n=268, 69%), teachers (n=249, 64%), friends (n=141, 36%), and career counsellors (n=208, 54%) provided useful to extremely useful career information and assisted them in deciding on a career choice. The results support international research findings (Babin et al., 2010; Biggers et al., 2008; Turner & Lapan, 2002).

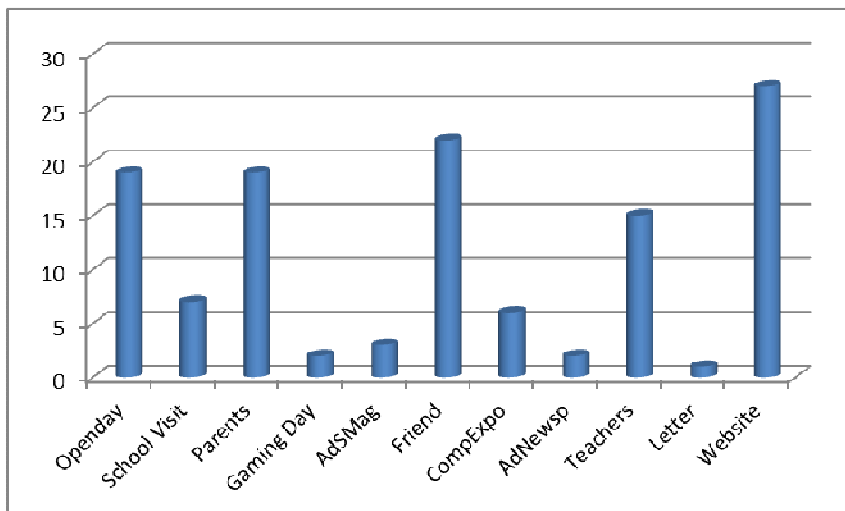
The sources of information that assisted in their career choice were the NMMU and Department of Computing Sciences websites (n=179, 46%), Openday (n=213, 55%), and school visits by NMMU marketing staff (n=164, 42%). Additional sources of information included in the 2012 survey were the use of social media (Facebook, Twitter). The Department of Computing Sciences uses social media (Facebook and Twitter) for marketing purposes and 47% (n=182) of the first-year students indicated that this was useful, very useful or extremely useful (Figure 3). Visits and presentations at schools by members of the Department of Computing Sciences were also found to be useful to extremely useful (n=143, 37%).

The literature and background discussed in this paper focuses on scholars and students considering careers in ICT. The following extracts from the previous surveys discussed will focus on students who have registered in degree programs in Computer Science and Information Systems. First-year Computing Sciences programming students completed the first-year student survey, in 2011 (n=97) and 2012 (n=98). The students who completed the questionnaire included new first year registrations and students who failed and repeated the course.

The first-year Computer Science and Information Systems students, enrolled for an ICT career, were asked where they obtained career information and who influenced their career choice (Figure 4). The 2011 group (n=97) indicated that their parents (n=19, 20%), teachers (n=15, 15%) and friends (n=22, 23%) provided career information and assisted them in deciding on a career choice. The sources of information that assisted in their career choice were the NMMU website (n=27, 28%), Openday (n=19, 20%) and school visits by NMMU staff (n=7, 7%).

Figure 4

2011: First-year CS&IS students taking Programming only, n=97



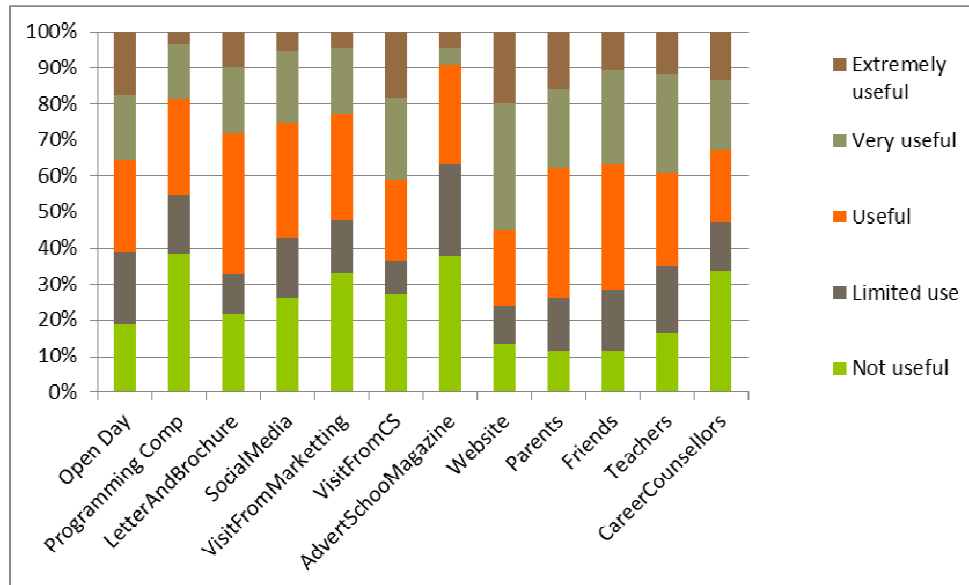
The 2012 ICT programming group (n=98, Figure 5) indicated that their parents (n=70, 71%), teachers (n=60, 61%), friends (n=68, 69%) and career counsellors (n=47, 48%) provided useful to extremely useful career information and assisted them in deciding on a career choice. These results support the research findings by Babin et al. (2010) that ranked parents first, followed by friends, teachers, and career counsellors.

The sources of information that assisted in their career choice were the NMMU and Department of Computing Sciences websites (n=73, 74%), Openday (n=55, 56%) and school visits by NMMU marketing staff (n=46, 47%). Additional sources of information included in the 2012 survey were the use of social media (Facebook, Twitter). The Department of Computing Sciences uses social media (Facebook and Twitter) for marketing purposes and 53% (n=52) of the first-year CS&IS students indicated that this was

useful, very useful, or extremely useful (Figure 5). Visits and presentations at schools by members of the Department of Computing Sciences to schools were also found to be useful to extremely useful (n=56, 57%).

Figure 5

2012: First-year CS&IS students taking Programming only, n=98



The first-year CS&IS students further indicated that they would like to pursue the following popular ICT careers (most popular ranked first):

- Programmer
- Business Analyst
- Software Engineer
- Systems Analyst
- Information Auditing Specialist
- Network Administrator
- Project Manager
- Software Tester
- Mobile Applications Developer.

Strategies that the Department of Computing Sciences have implemented

The Department of Computing Sciences at NMMU has implemented the following strategies to increase the awareness of ICT careers amongst stakeholders over the past 3-year period:

- Schools—doing presentations at schools, making scholars aware of careers in ICT
- Teachers—providing ICT training courses in Microsoft word, Excel, and so forth

Educational Research for Social Change, April 2013, 2 (1)

Faculty of Education: Nelson Mandela Metropolitan University, Port Elizabeth, South Africa

- IT teachers—providing programming training
- Parents—bi-annual parent evenings, including presentations by the ICT industry
- Students—industry presentations, career advice, and implementation of an ICT career portal
- Marketing ICT careers and CS&IS degree programs using social media (Facebook and Twitter)
- ICT career portal for scholars, students, and industry (<http://cs.nmmu.ac.za/Home>).

The final results of the above efforts indicate an increased awareness by parents, teachers, scholars, and students in ICT careers and an increase in CS&IS degree programme registration at NMMU.

Conclusions and future research

Parents, teachers, career counsellors, and friends play an important role in a scholar's career choice and place of study. Parents were generally unaware of the ICT skills shortage in South Africa, and of ICT career prospects, salaries, and numerous career opportunities. The important role of teachers in influencing a child's career choice was emphasised by a number of parents in this study. Scholars need to be made aware of the ICT career opportunities and education-related ICT careers.

The CSEdWeek 2010 (ACM MemberNet, 2010) and the national iCompute campaign (Ross, 2007) in the USA promoting ICT career awareness and targeting people such as parents, teachers, and career counsellors who influence scholars' career choices are important initiatives which universities, governments, and industry should consider. These initiatives could have a positive impact on the ICT skills shortage, encourage scholars to enter the ICT education sector, and effect educational change.

Organisations in industry are also launching initiatives to raise awareness of the ICT skills shortage and make contact with potential future employees whilst they are still in school. Dimension Data has a Saturday school that focuses on computer-based training (Harris, 2011). The Oracle Academy Initiative provides universities with access to Oracle software and training for a nominal fee. IBM also has an Academic Initiative that provides hardware, software, courseware, tools, training, and books at a discount to tertiary institutions (Harris, 2011). Universities are further launching educational programmes and ICT career awareness events at schools and at parent career awareness evenings, which could have a positive effect on educational change.

The results of this survey indicate the urgent need for more interventions and emphasise the important fact that scholars do not pursue CS&IS degree programs due to limited knowledge of the fields of study. The majority of comments provided by students indicated that they required and desired more information about the ICT career prospects and study directions.

The NMMU Department of Computing Sciences has launched an ICT career awareness project in the Port Elizabeth area where Department of Computing Sciences students visit schools and show a departmental video on ICT careers and degree programmes at NMMU. An ICT marketing presentation is also presented, showing the exciting work environments at Google and Facebook. It includes South African companies, ICT salaries, and career opportunities. The Department of Computing Sciences will continue marketing ICT careers and degree programs at schools in the Eastern Cape. The use of social media, specifically integrated social media marketing campaigns, will increase in the future because scholars are familiar with, and increasingly use, social media. The ICT Career Portal linked to the NMMU Department of Computing Sciences' website is further attracting national and international attention.

Parents generally indicated that they advised their children to study a qualification that leads to a professional career. They indicated that they did provide career advice and influenced the choice of university. Teachers and friends were cited as people who further influenced a child's career choice. ICT was considered a career option because South African parents perceived ICT as a career that can provide international employment opportunities. The parents indicated that they considered universities that provided on-campus accommodation in well-managed residences, a vibrant student life, and had a good academic standing.

CS&IS departments at universities in South Africa should engage in parent and teacher ICT career education. The availability of suitably qualified ICT educators can have a positive effect on educational change. Future research will focus on the factors that influence scholars' ICT career choices and on providing educational career information to scholars by using social media and the NMMU Department of Computing Sciences ICT career portal (<http://cs.nmmu.ac.za/Home>). Reaching scholars, parents, and teachers in townships and rural areas remains a major challenge.

References

- ACM Bulletin. (2009). *Congress Passes Resolution to Establish Computer Science Education as a National Priority*. ACM Bulletin Service. Retrieved from <http://www.acm.org/press-room/news-releases/2009/cs-education-week>
- ACM MemberNet. (2010). *CSEdWeek Seeks to Boost Involvement of Students, Educators, Parents, Industry Leaders*. Retrieved from <http://membernet.acm.org/archives.cfm?fo=2010-11-nov/nov-18-2010.html#CS-edweek>
- Alexander, P.M., Holmner, M., Lotriet, H.H., Matthee, M.C., Pieterse, H.V., Naidoo, S., Twinomurizi, H., & Jordaan, D. (2010). Factors affecting career choice: Comparison between students from computer and other disciplines. *Journal of Science Education and Technology*, 20(3), 300–315.
- Babin, R., Grant, K.A., & Sawal, L. (2010). Identifying influencers in high school student ICT career choice. *Information Systems*, 8(26).
- Becerra-Fernandez, I., Elam, J., & Clemmons, S. (2010). Reversing the landslide in computer-related degree programs. *Communications of the ACM*, 53(2), 127–133.
- Benamati, J.H., Ozdemir, Z.D., & Smith, H.J. (2010). Aligning undergraduate IS curricula with industry needs. *Communications of the ACM*, 53(3), 152–156.
- Biggers, M., Brauer, A., & Yilmaz, T. (2008). Student perceptions of computer science: A retention study comparing graduating seniors with CS leavers. *ACM SIGCSE Bulletin*, 40 (1), 402-406.
- Calitz, A.P. (2010). *A model for the alignment of ICT education with business ICT skills requirements*. (Unpublished doctoral dissertation, Nelson Mandela Metropolitan University Business School, Port Elizabeth).
- Carter, L. (2006). Why students with an apparent aptitude for computer science don't choose to major in Computer Science. *SIGCSE Bulletin*, 38(1), 27–31.
- Conference Board of Canada (CBC). (2009). *Connecting students to tomorrow's ICT jobs and careers*. Retrieved from http://70.33.247.10/~ccictt/wp-content/uploads/2010/11/Connecting_Students_to_ICT_Careers_Report.pdf
- Choudhury, V., Lopes, A. B., & Arthur, D. (2010). Issues and opinions—IT Careers Camp: An early intervention strategy to increase IS enrolments. *Information Systems Research*, 21(1), 1–14.

- Cohen, D. (2012). *The IT skills gap is everyone's business (Part 1)*. IDG Connect. Retrieved from <http://www.idgconnect.com/blog-abstract/429/douglas-cohen-south-africa-the-it-skills-gap-everyone-business-part?region=africa>
- Cosser, M. (2010). The skills cline: Higher education and the supply-demand complex in South Africa. *Higher Education*, 59, 43–53.
- Ericson, B., Guzdial, M., & Biggers, M. (2005). A model for improving secondary CS education. *ACM SIGCSE Bulletin*, 37(1), 332–336.
- Harris, L. (2011). *No end to ICT skills crunch*. ITWeb. Retrieved from http://www.itweb.co.za/index.php?option=com_content&view=article&id=46862
- Havenga, M., & Mentz, E. (2009). The school subject Information Technology: A South African perspective. *SACLA '09*, 76–81.
- Jacobs, C., & Sewry, D.A. (2010). Learner inclinations to study Computer Science or Information Systems at tertiary level. *South African Computer Journal*, 45, 3–10.
- Koorsse, M., Calitz, A. P., & Cilliers, C. B. (2010). The impact of IT at schools on e-skills development. In P. Cunningham & M. Cunningham (Eds.), *eSkills Summit 2010 Proceedings*.
- Miliszewska, I., & Sztendur, E. M. (2010). Interest in ICT studies and careers: Perspectives of secondary school female students from low socioeconomic backgrounds. *Interdisciplinary Journal of Information, Knowledge, and Management*, 5, 237–260.
- Roman, D. (2010). School grades need improvement. *Communications of the ACM*, 53(12).
- Ross, J. (2007). *Perhaps the greatest grand challenge: Improving the image of computing*. Retrieved from <http://archive.cra.org/CRN/articles/nov07/ggc.html>
- Seymour, L., Hart, M., Haralambous, P., Natha, T., & Weng, C. (2005). Inclination of scholars to major in Information Systems or Computer Science. *South African Computer Journal*, 35, 97–106.
- Taub, R., Ben-Ari, M., & Armoni, M. (2009). The effect of CS unplugged on middle-school students' views of CS. *ITiCSE '09*, 99–103.
- Trusty, J., Watts, R.E., & Erdman, P. (1997). Predictors of parents' involvement in their teens' career development. *Sciences-New York*, 23(3), 189–201.
- Turner, S., & Lapan, R.T. (2002). Career self-efficacy and perceptions of parent support in adolescent career development. *Career Development Quarterly*, 51(1), 44–55.
- Wilson, C., Sudol, L., Stephenson, C., & Stehlik, M. (2010). *Running on empty: The failure to teach K–12 Computer Science in the digital age*. Retrieved from <http://www.acm.org/runningonempty>