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Factors Affecting Career Choice: Comparison Between Students from Computer and Other Disciplines

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Abstract The number of student enrolments in computer-related courses remains a serious concern worldwide with far reaching consequences. This paper reports on an extensive survey about career choice and associated motivational factors amongst new students, only some of whom intend to major in computer-related courses, at two South African universities. The data were analyzed using some components of Social Cognitive Career Theory, namely external influences, self-efficacy beliefs and outcome expectations. The research suggests the need for new strategies for marketing computer-related courses and the avenues through which they are marketed. This can to some extent be achieved by studying strategies used by other (non-computer) university courses, and their professional bodies. However, there are also distinct differences, related to self-efficacy and career outcomes, between the computer majors and the 'other' group and these need to be explored further in order to find strategies that work well for this group. It is not entirely clear what the underlying reasons are for these differences but it is noteworthy that the perceived importance of "Interest in the career field" when choosing a career remains very high for both groups of students.

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Introduction

The number of students enrolling for computer-related[1] courses at universities has decreased substantially worldwide since the late 1990s (Akbulut and Looney 2007, 2009; Benokraitis et al. 2009; Granger et al. 2007; Huang et al. 2008; Looney and Akbulut 2007; McGettrick 2009; Sheard et al. 2008; Slonim et al. 2008; Walstrom et al. 2008; Zhang 2007) and a similar trend has been noted in South Africa (SA DoC 2008). Student enrollments do, however, appear to have started stabilizing in the United States and Canada since about 2007 (Benokraitis et al. 2009; Slonim et al. 2008; Zweben 2009). The resulting reduction in the number of new graduates, along with the current and projected shortages of skilled professionals in almost all computer-related fields, has been noted with alarm, not only by academics at universities, but by officials in various state bodies in many countries of the world (DCITA, 2006; E-skills UK 2008a, b; Granger et al. 2007; ISETT-SETA 2007; SA DTI 2005; Seymour et al. 2005; The European e-Skills Forum 2004; Zweben 2009). The impact of lower student numbers has resulted in some universities reducing the number of academic teaching and research positions in Computer Science and Information Systems departments, and even in a few cases, the closure of such departments (Frolick et al. 2005; Huang et al. 2008). This is in sharp contrast with the earlier situation where such

[1] This covers the full spectrum of Information and Communication Technology courses including Computer Science, Information Science and Information Systems.

departments were flourishing and were often considered to be the "cash cow" of the schools or faculties in which they were located. This is dramatically illustrated in the quotation below.

> In the Institutes of Technology, which were so crucial to the start of Ireland's high-technology boom, competition to enter computing courses has been falling steadily. Demand for computer science degrees in Ireland's leading universities has also been falling, so that by 2005 it was easier to enter a degree programme in computer science at University College Dublin than it was to enter a diploma course in computing at Cork Institute of Technology in 1999. Indeed, by 2005, in some Institutes of Technology, the fall was so great that some courses were accepting all candidates with the minimal entry requirements. (Wickham and Bruff 2008, p. 35)

Although there is general agreement that large shortages exist (Kim et al. 2006; Rettenmayer et al. 2007; Scime 2008; Seymour et al. 2005; Walstrom et al. 2008; Wickham and Bruff 2008; Zhang 2007), the impact of the Information and Communication Technology (ICT) skills shortage on the economies of countries is less easy to quantify (Trauth et al. 2008). This requires serious attention at national level since the ICT industry is believed to be a very significant contributor, both directly and indirectly, to national economies (D'Costa and Kelly 2008; Slonim et al. 2008; Trauth et al. 2008; Warhurst et al. 2006; Zhang 2007). The direct component is made up of revenues generated by the development of hardware and software as well as services related to advising and assisting clients in the implementation and use of computer systems. The indirect component involves the informed, efficient and effective use of computers in business, government and civil society. Several agencies, such as the European E-Skills Forum, e-Skills UK, the Australian Government Department of Communications, Information Technology and the Arts, and the South African Information Systems, Electronics and Telecommunications Technologies Sector Education Training Authority (ISETT SETA) have been tasked with a detailed assessment of the ICT skills shortage and asked to propose initiatives to address it.

The published drop in enrollments refers primarily to the United States. Apparently there is a belief by students and their career advisors that job opportunities have been scarce since the severe downturn in the ICT industry after the 2000 dot com bubble burst (Huang et al. 2008; Zhang 2007) and that further job opportunities have been lost as a result of out-sourcing (Huang et al. 2008) and off-shoring (Akbulut and Looney 2007). However, these "gloomy headlines" seem to be inaccurate (Huang et al. 2008; Walstrom et al. 2008). A further reason given for the apparent reluctance of students to enroll for ICT courses is that they have insufficient information about the subject and related jobs, and cannot differentiate between the different computing sub-disciplines (Courte and Bishop-Clark 2009; Gupta and Houtz 2000). There is a pronounced gender bias, with a low percentage of women enrolling for all computer-related courses, worldwide. Studies reveal that social and cultural influences are pertinent for all research into this gender issue (Beyer 2008; Joshi and Kuhn 2001; Trauth et al. 2008). However, the commonly accepted reasons for the disparity do not fully explain why the severity of the enrollment crisis varies in extent between countries with similar challenges and economies and yet is evident in both highly developed and developing countries.

The sudden and severe downturn in the global economy since the second half of 2008 is likely to have a major impact on university computer-related course enrollments and the demand for ICT skills. However, both aspects are difficult to predict and have not been taken into account in this research.

Purpose of Study

Identifying factors which influence career choice, and the differences in the factors influencing different groups of students, will assist us in identifying underlying causes for low student enrollment. This will also allow us to make recommendations regarding how recruitment and advisory resources can be used more effectively and how campaigns can be focused appropriately in order to attract students. This paper will be limited to examining the students' perceptions as to which factors are most important and will compare the perceptions of students registered for computer-related courses and those registered for other courses. Hence we will be looking at symptoms. The underlying reasons for these differences, and hence a full diagnosis of the problem, is beyond the scope of the paper. The research is, therefore, exploratory and raises a number of further questions for investigation in future.

This paper reports on an extensive survey amongst students who recently began studying at two South African universities and who were taking a number of different introductory, computer-related courses. The paper compares the responses of students who intended to major in computer-related courses (we will refer to these as computer majors or CM) versus those of students who had chosen non-computer-related majors (referred to as NCM). This paper does not investigate the students' attitudes towards *ICT careers*, but rather tries to determine differences between the two groups of students regarding how important various factors and sources were in making their

actual career choices in terms of selecting a degree programme at a tertiary institution.

Literature

Social Cognitive Career Theory (SCCT)

Our theoretical consideration of factors affecting career choice is grounded in Social Cognitive Career Theory (Lent et al. 1994), which was developed from Bandura's general social cognitive theory and has been applied to career choices made by Information Systems (IS) students (Akbulut and Looney 2007, 2009; Looney and Akbulut 2007) and IT students (Smith 2002).

Bandura's General Social Cognitive Theory

Social cognitive theory (SCT) emphasizes the bi-directional interactions between three elements, namely person, environment and behaviour. The intrinsic, personal factors include cognitive ability, affective and physical attributes. Environment involves extrinsic factors such as economic and social circumstances. Overt behaviour is influenced by these intrinsic and extrinsic factors but people are not "just mechanical responders to deterministic forces" (Lent et al. 1994, p. 84). Individuals reflect on and regulate their own behaviour, and are aware of their environment. Hence a person's actions, and assessment of the outcomes of those actions, will influence his or her attitudes and opinions and may also impact on the environment. Individuals develop constantly and contexts are always changing. In addition, people can be proactive and hence anticipation, planning and conscious attempts to predict consequences and to understand the impact of behaviour on the environment are all important aspects recognized by SCT.

Three particularly relevant socio-cognitive mechanisms have been identified by Lent and Brown in the development of the model (Fig. 1) which underlies their social cognitive career theory (SCCT) (Lent et al. 1994). These are self-efficacy beliefs, outcome expectations and goal representations.

Self-Efficacy Beliefs

Self-efficacy was defined by Bandura as, "people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances" (Bandura 1986 cited by Lent et al. 1994, p. 83). Since self-efficacy is specific to a particular skill or topic, computer self-efficacy indicates the individual's assessment of his or her own ability to succeed in computing-related activities. Bandura considered self-efficacy to be the mechanism that has the strongest influence on personal agency (Lent et al. 1994). It has also been identified in numerous studies as being the predominant factor in career choice and in performance, both during the education phase and subsequently in a career (Akbulut and Looney 2007, 2009; Johnson et al. 2008; Lent et al. 2002; Looney and Akbulut 2007; Smith 2002). It is important to note that, although self-efficacy is built on past performance to some extent, students often either over-estimate their own capabilities (Galpin et al. 2003; Hilberg and Meiselwitz 2008; Lent et al. 1994; Looney and Akbulut 2007; Smith 2002) or, particularly in the case of women, under-estimate them (Beyer 2008; Zhang 2007). Hence, past results are not

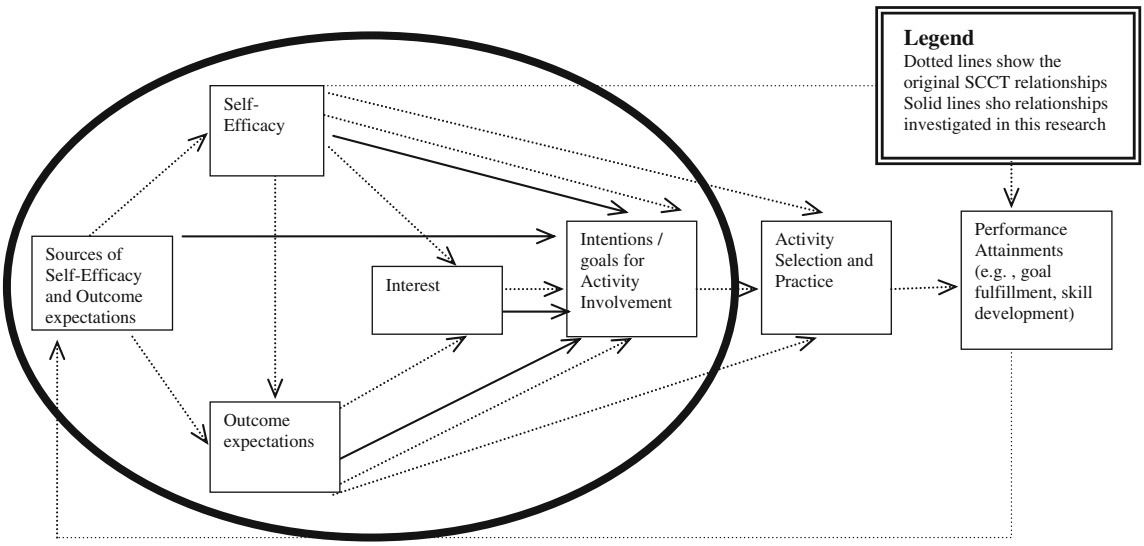

Fig. 1 Model of how basic career interests develop over time with the current research focus identified (adapted from SCCT copy right Lent and Brown, permission obtained from the authors to reproduce the diagram)

the only, or even necessarily the most important, predictor of self-efficacy.

The influence of self-efficacy on performance is indirect as will be explained later. The central role of self-efficacy on the development of career interests, selection of options in relation to academic courses and career opportunities, and on performance and persistence in following these career paths, means that this is an important topic for research. As SCT stresses, self-efficacy is neither passive nor static. Students constantly re-assess their ability, and this assessment is influenced by active learning experiences, feedback from others, observation of the success of role models, and even psycho-biological states such as tiredness (Looney and Akbulut 2007). The ongoing, reciprocal relationship between person, environment and behaviour that is central to SCT can, therefore, be seen in relation to self-efficacy.

Outcome Expectations

The second mechanism that features predominantly in the SCCT model is that of outcome expectations. This is defined as "imagined consequences of performing particular behaviours" (Lent et al. 1994, p. 83) and Bandura (1986 cited by Lent et al. 1994) distinguishes between three types of outcomes, namely, physical (for example, job opportunities), social (image, status, et cetera) and most importantly self-evaluative (self-satisfaction). Personal expectations can change quite dramatically and, over time, individuals will give different values or preferences to outcomes. Furthermore, different individuals value the same outcome differently. Hence, outcome expectations incorporate the concept of values (Lent et al. 1994).

Goal Representations

The third mechanism, goals, is defined as "the determination to engage in a particular activity or to effect a particular future outcome" (Lent et al. 1994, p. 85). Since goals refer to the future, they embody the forethought mentioned earlier, act as means of self motivation and include aspects of personal standards. Hence, they are an essential component for the self-regulatory and reflexive aspects (personal agency) of SCT. The more specific goals are, and the shorter the time span between setting the goal and its expected realization, the greater the commitment to the goal is expected to be (Lent et al. 1994).

Interest

SCCT investigates three aspects of career development, namely, career-relevant interests, selection of career choice options, and performance and persistence in pursuing the proposed career. Interest has been identified as an essential precursor to career choice and is defined as "an emotion that arouses attention to, curiosity about, and concern with…" (Akbulut and Looney 2007, p. 68).

As can be seen in Fig. 1, interest, self-efficacy, outcome expectations and goals are inter-related via various paths in the SCCT model, with interest playing an important intermediate role. Interest has proven to be the major, direct influence in goal setting, although both self-efficacy and outcomes contribute directly to goals to some extent (Zhang 2007). The impact of self-efficacy on the ultimate choice of career is because it not only contributes directly to goal formation, but to a greater extent contributes to the development of interest. Self-efficacy affects outcome expectation, as belief in one's ability to achieve in a particular field makes one more hopeful of benefiting in a meaningful way from the positive outcomes one associates with the career. Outcome expectations also contribute to development of interest and, to a limited extent, directly to goal formation.

Factors Affecting Choice of Computer-Related Careers

SCCT and Computer Careers

The SCCT model has been verified by various empirical studies related to careers in various types of computing (that is, Computer Science, Information Systems and more generally, IT) (Akbulut and Looney 2007, 2009; Johnson et al. 2008; Looney and Akbulut 2007; Smith 2002).

Computer Self-Efficacy

As noted in "Self-Efficacy Beliefs" above, in SCCT self-efficacy is considered to be the most important mechanism in career choice and, even in cases where neither SCT nor SCCT have been used as the under-lying model, research reports on factors affecting choice of computer-related careers have frequently discussed computer self-efficacy. For example, the relationship between computer self-efficacy and gender is commonly studied as there is a noticeable difference in scores between men and women, both at school and university (Beyer 2008; Galpin et al. 2003; Joshi and Kuhn 2001; Papastergiou 2008; Rettenmayer et al. 2007; Zhang 2007).

Insufficient exposure to relevant and representative Information Systems or Computer Science activities at High School can contribute to unrealistic individual computer self-efficacy. Students who have little or no personal experience of ICT may have unrealistically high expectations of it as a possible career and of their own ability to cope with the courses (Galpin et al. 2003; Johnson et al. 2008; Seymour et al. 2005). Although students who have

had a lot of exposure to ICT at school tend to have high confidence in their ICT skills (Beyer 2008) the contrary has also been shown—self-efficacy may decline once the students have actual experience and hence a realistic understanding of what the course entails, or alternatively, the way the courses are taught at schools scares them away (E-skills UK 2008a, b). An appropriate assessment standard, combined with sufficient feedback, assists students in setting their own, realistic goals (Seymour et al. 2005; Walstrom et al. 2008). Using an example from another discipline, students identified performance in accounting at school as the most important factor in selecting accounting as their future career (Myburgh 2005).

Computer Career Outcome Expectations

SCCT identifies outcome expectations as the second mechanism in the development of career choice. Studies have tried to identify the most important outcome expectations in the choice of computer-related careers (this includes occupational stereotypes and the image of ICT careers). Three practical factors appear frequently in these studies, namely, salary, job security and job availability.

High salaries are considered important (Lee and Lee, 2006 cited by Granger et al. 2007; Walstrom et al. 2008). In a 2000 report, "good money/benefits" was noted as being important almost 7 times more often than any other factor (Gupta and Houtz 2000, p. 5), while Rettenmayer et al. (2007) found that high salary and job security were rated most highly, and that job availability was close in importance to these top two. These are similar to findings for accounting students. Myburgh (2005) carried out a study amongst students in a South African university and found that availability of jobs, followed by job security, were top in importance. Another South African study amongst secondary school pupils, by Seymour et al. (2005), found that job availability was significantly associated with interest in ICT.

Granger et al. (2007) reported on a number of US studies, some of which were still in process. Two of these looked at the reasons why students were not taking up computer-related jobs and found that lack of employment opportunities was *not* the reason (Lomerson and Pollacia 2006 and Lee and Lee 2006 both cited by Granger et al. 2007). Walstrom et al. (2008) concur that there is no perception of poor career opportunities in ICT. Hence, these various authors conclude that job-related concerns are not as significant as commonly perceived. Instead studies identify self-efficacy issues and interest as being primary reasons for not selecting computer-related courses and careers (for example, the subject is too difficult or too technical) (Lomerson and Pollacia 2006 and Lee and Lee 2006 both cited by Granger et al. 2007; Papastergiou 2008; Zhang 2007).

Sources of Advice

Various factors influence both self-efficacy and outcome expectations—shown as Sources of Self-Efficacy and Outcome Expectations in Fig. 1. In this section we will look specifically at sources of advice that help shape outcome expectations.

Parents feature prominently both as sources of advice and as motivators (Granger et al. 2007; Huang et al. 2008; Myburgh 2005; Rettenmayer et al. 2007; Sheard et al. 2008; Zhang 2007).

> Parental aspirations and expectations affect the self-efficacy of their children and are important role models. Parental support is a key factor in women's decisions regarding science, women are most greatly affected by verbal persuasions active mentoring. (Beyer 2008, p. 306)

People who are employed to give career advice seem to be rated rather low in terms of how important their advice is. Rettenmayer et al. (2007) found that guidance high school teachers and counselors were ranked lowest of all sources of advice. Myburgh (2005) found visits to schools by lecturers were least useful.

Females appear to value advice more than male students (Zhang 2007) with general reports saying that there is a contradiction between what students say (that advisors are important influences in their decisions regarding courses and careers) and the actual situation, as in fact career choice is not directly influenced by this advice (Sheard et al. 2008). There may be a deeply-rooted social bias in some societies that implies that the IS major is not appropriate for women (Joshi and Kuhn 2001; Trauth et al. 2008; Zhang 2007).

Research Hypotheses and the SCCT Model

As noted in "Purpose of the Study", this is an exploratory study focusing on factors influencing students' career and course selection. It is limited to those factors which influence interest and, therefore, provide inputs directly and indirectly to interest (see Fig. 1). The students' perceptions regarding the importance of the factors will be compared for CM and NCM student groups. These factors are: Sources of self-efficacy and outcome expectations. Interest levels for the groups will also be compared.

The following hypotheses have been investigated.

Sources and Extent of Career Information

H1: CM and NCM students will rank and value sources of career advice similarly in terms of importance.

H2: CM and NCM students will have equal knowledge about the listed careers.

Self-Efficacy

H3: CM and NCM students will perceive self-efficacy regarding their chosen careers as important to the same degree.

Outcome Expectations

H4: CM and NCM students will assign the same importance to opportunities in their chosen careers.

Interest

H5: CM and NCM students will assign the same importance to interest in their chosen careers.

Methodology

Research Approach

The primary research approach was a survey which was analysed quantitatively. Subsequently, interesting results were discussed in unstructured interviews with a professor in the Financial Sciences who has published on career choice factors in Accounting and the head of Student Advice, both at University A. "Findings" describes the findings from the quantitative part of the research whereas the information obtained via the interviews in presented in "Discussion".

Sampling

Questionnaires were handed to several groups (a total of 1,868 students) at the beginning of the first semester in 2009, before they were overly influenced by their experience of the course. The responses were anonymous. The majority (1741) of the students in the sample were taking first year courses from the School of IT at a major university (University A) in South Africa. A smaller number (127) came from a second university (University B). 316 students were registered for computer-related degrees,[2] 876 for one of the degrees associated with the financial sciences (for example, Accounting and Auditing), 325 for other B Com (business and commerce) degrees, and 349 for degrees that do not fall into any of these groups. The large number of students in the sample who were taking financial sciences is clearly relevant to the discussion that follows. This apparent bias is unavoidable as these students are required to take the classes concerned.

Table 1 Demographic information

	Males	Females
CM	262	149
NCM	629	828

All of the respondents have passed Mathematics at secondary school level with the grades needed to take an ICT degree. Hence the issue as to whether the students in the sample would be accepted into computer-related degrees need not be considered as there is no maximum class size or other exclusionary mechanism for the computer courses. The actual ability of the NCM students, as reflected in school results, can be considered to be at least as good as that of the CM students.

More than 86% of the students left school in 2007 or 2008 and a further 10% in the preceding 2 years and hence age and work experience are not factors in the research. Based on these demographics and the admission requirements of the degrees, the CM and NCM students are considered to be comparable in terms of ability and some aspects of background (Table 1).

Data Collection

The ways used for eliciting response from the various groups of students was left to the discretion of the lecturers involved (circumstances and preferences differed) and this resulted in very different return percentages varying from 13% to 95% but with an overall response of 49%. This is acknowledged as a limitation, but it was considered more important to get feedback from a relatively wide selection of students than to exclude those where the percentage response was lower.

In order to build on work already done in the field, the questions were based on published sets from research on factors affecting career choice (Beyer 2008; Walstrom et al. 2008; Seymour et al. 2005). The questions focused on factors that influence the choice of career and qualification

[2] Four hundred and eleven (411) students indicated that they intended taking a computer-related subject up to final year (a computer major) but some of these were taking a degree that would be considered to be non-computer related. Further analyses are in terms of the larger group, that is, computer majors, rather than by degree.

no matter what that choice was, and hence were not specific to computer-related decisions. They include perceived importance of sources of advice, self-efficacy, career opportunities, quality of life, and extent of knowledge all related to the selected career. The actual questions can be seen in Tables 2, 3, 4, 5, 6, 7, and 8.

Table 2 Importance of source of career advice: CM versus NCM (% of students selecting each category)

	NCM				CM			
	Importance in Career Choice			Rank	Importance in Career Choice			Rank
	Low	Med	High		Low	Med	High	
Friend or family member who works in a similar career	19.5	22.8	57.7	2	26.3	22.6	51.1	1
Parents (**)	19.5	29.6	50.8	3	24.4	31.3	44.4	2
Advice at Open Day at university	27.5	25	47.4	5	30.3	26.6	43	3
Advertisements or articles in newspapers, magazines or the internet (**)	27.6	27.2	45.2	6	23.9	33.5	42.6	4
Professor(s) at university	31	24.1	44.9	7	36.1	24	39.9	5
University Student Advisors (***)	18.1	21	60.9	1	33.6	28.9	37.5	6
A counselling centre/career tests/assessment not attached to school or university (***)	23.7	27.6	48.7	4	35.4	28.6	36	7
Career guidance teacher at school (***)	34.7	23.5	41.9	8	36	30.1	33.9	8
Other teachers at school	39.8	28.1	32.1	9	42.4	27.9	29.7	9
Older brother or sister	45.2	24.1	30.7	10	44.7	27.8	27.5	10

*** $p < 0.01$; ** $p < 0.05$

Table 3 Self-reported High knowledge of different careers sorted by simple average

Thinking back to High School, how informed were you about possible careers in each of the following areas	NCM	CM	CM/NCM	NCM/CM	Simple Average i.e., (CM% + NCM %)/2)
Accounting	75	41.5		1.81	58.25
Financial Management	52.2	29.7		1.76	40.95
Computer Science	28.5	52.6	1.85		40.55
Economics	43	29.3		1.47	36.15
Computer Engineering	20.2	50.1	2.48		35.15
Auditing	45.5	23.1		1.97	34.3
Web and Multimedia design and development	17.6	48.2	2.74		32.9
Computer Networks	17	40.9	2.41		28.95
Human Resource Management	34.3	23.1		1.48	28.7
Business Science	33.7	19.5		1.73	26.6
Information Systems/Informatics	12.4	34.3	2.77		23.35
Business Analyst	24.3	20.9		1.16	22.6
Public Administration	16.2	12.3		1.32	14.25

Table 4 Self-efficacy (Student % selecting each category)

	NCM			CM		
	Importance in Career Choice			Importance in Career Choice		
	Low	Med	High	Low	Med	High
Performance in High School subject matter courses***	13.4	35.8	50.7	12.5	24.2	63.3
Performance in university subject matter courses***	19.4	31.9	48.7	12.6	38.7	48.7
Difficulty of subject matter—difficult for most people***	29.1	32.2	38.7	21.2	45	33.8
Ease of subject matter—easy for me***	42.2	32.6	25.2	30.7	41.4	27.9

*** $p < 0.01$

Table 5 Challenging career (Student % selecting each category)

	NCM			CM		
	Importance in Career Choice			Importance in Career Choice		
	Low	Med	High	Low	Med	High
My chosen career will be quite easy**	42.2	36.5	21.3	30.1	36.9	33
My chosen career will not be very stressful**	37.5	39.1	23.5	31.1	40.5	28.4

** $p < 0.05$

Table 6 Outcome expectations with highest High values highlighted (Student % selecting each category)

Once you are working in the career you are preparing for, there will be	NCM			CM			Difference[a]
	Importance in Career Choice			Importance in Career Choice			
	Low	Med	High	Low	Med	High	
Flexibility							
A flexible work schedule**	18.7	35	46.4	10.9	38	51.1	−4.7
Different tasks at different times (variety)	7.9	33.8	58.3	6.3	32.3	61.4	−3.1
Opportunities to work in different kinds of businesses**	2.9	14	83.1	4.5	19.8	75.7	+7.4
Opportunities to work overseas**	5	17.1	77.9	9.8	21.5	68.8	+9.1
Security							
Job security**	3.6	13.8	82.6	4.5	24.6	70.9	+11.7
A stable career with fairly guaranteed employment no matter what the general economic climate**	7.6	24	68.4	11.4	40.2	48.4	+20
Other outcomes							
Good prospects in obtaining a first job without any prior experience	10.7	31.4	57.9	11.6	34.4	53.9	+4
Good prospects for a better than average starting salary	3.6	19.4	77	4.7	24.9	70.3	+6.7
A good image/status in the chosen profession**	7.6	23.8	68.6	10.4	29.9	59.7	+8.9
Job satisfaction: there will be a sense of accomplishment**	2	11.7	86.3	2.5	21.2	76.3	+10
Good long-term salary prospects**	2.5	12.1	85.5	3	22	75	+10.5
Good prospects for promotion and professional development**	2	13	85	5.7	25.3	69	+16

*** $p < 0.05$

[a] NCM(High) − CM(High)

Table 7 Outcome Expectations Ranking (similar values were grouped as a single rank)

Once you are working in the career you are preparing for, there will be	Ranking	
	NCM	CM
Opportunities to work in different kinds of businesses	2	1
Good long-term salary prospects	1	1
Job satisfaction: there will be a sense of accomplishment	1	1
Opportunities to work overseas	3	2
Job security	2	2
Good prospects for a better than average starting salary	3	2
Good prospects for promotion and professional development	1	2
Different tasks at different times (variety)	5	3
A good image/status in the chosen profession	4	3
A flexible work schedule	6	4
Good prospects in obtaining a first job without any prior experience	5	4
A stable career with fairly guaranteed employment no matter what the general economic climate	4	5

Table 8 Interest (Student % selecting each category)

	NCM			CM		
	Importance in Career Choice			Importance in Career Choice		
	Low	Med	High	Low	Med	High
Interest in the subject—you know that this is the kind of work you want to do	2.5	14.1	83.4	2.7	14.3	83
Interesting challenges to be mastered	5.3	22.5	72.1	4	24	72

Data Analysis

The questions required the students to indicate the importance of a factor in influencing their choice of career or, in a few cases, agreement with a statement. A scale of 0–6 was provided, with 6 being most important or most in agreement and zero for "Do not know or have not really thought about it". In the analysis of the data option zero was ignored and the rest were reduced to three categories (low, medium and high). All analyses were done using SPSS. Pearson Chi-Square was used to determine significant differences unless otherwise stated.

A "positivity score" or acquiescence bias score was calculated[3] to determine whether the groups being used in the analyses were more or less likely to select high or low scores in answering the complete set of questions. (For example, are CM students more likely than other students to select 5 or 6 in answering the questions?) The positivity scores for the two main categories, CM and NCM are 230 and 225. These are considered to be sufficiently close and hence the scores are considered comparable. (In all the analyses that follow, the two groups, CM and NCM, are analyzed separately and results are given as the percentage of the group who selected a particular option, so the unequal number of students in the two groups is not material.)

Findings

Sources of Advice

The first set, comprising ten questions, asked the students to indicate how important various sources of advice regarding careers were. For each of the two groups the different sources of advice were then ranked using the percentage of students selecting High as a score.

As can be seen in Table 2, two sources are very clearly regarded differently by the students. Firstly, University Student Advisors are the most important source of advice for NCM students. Therefore, this is ranked 1st for this group as the largest % of NCM students, that is, 60.9%, gave this a High score. We will write this as NCM(High) = 60.9. However, University Student Advisors are ranked only 6th for CM. (CM(High) = 37.5%). Secondly, NCM students ranked the combined external advice category (made up of counseling centres, career tests and assessment not attached to a school or university) as the 4th most important source of advice (NCM(High) = 48.7%) while CM students ranked this only 7th (CM(High) = 36%).

However, there was agreement between CM and NCM in terms of the importance of advice from friends or family members who work in a similar career. This was ranked 2nd by NCM students and first by CM students and there was no significant difference between these when Pierson Chi squared was applied. Parents were ranked similarly by the students by both the groups (3rd for NCM and 2nd for CM) in agreement with the literature.

A minor finding that validated the results was that for cases where NCM(High) > CM(High)[4] in almost every case NCM(Low) < CM(Low). For example, in the case of Parents, NCM(High) = 50.8 and CM(High) = 44.4, so NCM(High) > CM(High) and NCM(Low) = 19.5 and CM(Low) = 24.4, therefore NCM(Low) < CM(Low). The exceptions were, "Advertisements or articles in newspapers, magazines or the internet" and for advice from older siblings, although the differences in High and in Low percentages was small in both cases. In both these cases, NCM(High) > CM(High) and NCM(Low) > CM(Low). However, these particular differences were significant using Pierson Chi squared tests only in the case of advertisements and other media content. This showed that, although the NCM students were slightly more definite regarding the importance (or otherwise) of advertisements and other media content than the CM students were, the size of the group selecting "Medium" affected the result significantly. It is apparent that while NCM students value *all* forms of career advice more highly than CM students do, that CM students value published information at least as much as NCM students do.

[3] The positivity score = $\sum i n_i$ where i represents the score (values from 1 to 6) and n_i is the count of responses selecting option i across all questions in the survey. Choice of option zero was not taken into account as these are ignored in the analyses.

[4] NCM (High) > CM(High) means that the % of High scores for NCM is greater than the % of High scores for CM. Similarly NCM (Low) > CM(Low) means that the % of Low scores for NCM is greater than the % of Low scores for CM.

Extent of Knowledge About Named Careers

Table 3 shows the percentages of students who believe that they have a High degree of knowledge regarding various possible careers. As can be expected for a sample with such a large number of students taking financial management degrees (see "Methodology"), many NCM students consider themselves particularly well informed about Accounting. However, quite a lot of CM students also report that they know a lot about Accounting. Equally interesting, taking a simple average of the percentages for both groups, Computer Science is as well known as Financial Management. Again using that average, the two entries most closely linked to Information Systems departments, namely Business Analyst and Information Systems scored far lower than Computer Science (approximately 23% compared to approximately 40%). This is an important finding, particularly as the majority of students in the sample (CM and NCM) are taking business-related (B Com) degrees in the faculty where the Information Systems department is located, while Computer Science is a B.Sc. degree in a different faculty.

Self-Efficacy—Own Career Choice

As discussed earlier, students' assessments of their own ability in the chosen field has been indicated in the literature as a very important factor in choosing a future study direction. (Note that these questions do not refer to *computer* self-efficacy but to the chosen career.) The responses to questions related to this are given separately in Tables 4 and 5 as they have a slightly different focus. However, all six questions were checked for reliability and consistency using Crombach's Alpha and a score of 0.68 obtained. This is considered acceptable although lower than is ideal, but indicates that all six questions can be considered to refer to a related measure.

It is important to note that the questions asked *how important* the student considers the issues related to self-efficacy to be in relation to choosing a career and not how confident the student is of his own ability. This is a subtle but important difference and we cannot be sure that students interpreted the question correctly. Nevertheless, it is still appropriate to discuss the student's opinion as to how important issues related to ability are under the heading of self-efficacy.

The scores for all of the questions in Table 4 differ significantly between CM and NCM groups at $p < 0.01$. However the question "Performance in High School subject matter course" stood out. It was the question that the largest percentage of students in both the CM and NCM groups considered highly important, but CM(High) = 63.3% compared with NCM(High) = 50.7%. Qualitative data would make this easier to interpret but this result may be due to the fact that, although students are generally not required to have taken computer-related subject at secondary schools in order to enroll for a computer-related degree at South African universities, the students themselves believe that this would be advisable.

The scores for the two questions in Table 5 are significantly different between the two groups at $p < 0.05$. A higher percentage of CM students than NCM students selected the High option in both questions. Once again, the wording of question is important. It could be restated as "It is important to me that I could easily cope with my future career", "It is important to me that it be un-stressful". Therefore, provided the students read this in this way, we interpret the findings as saying that CM students are more worried about difficulty and stress in their chosen career than NCM students are, but this is still a minority of students.

Career Outcome Expectations

Table 6 lists the results for twelve questions reflecting expectation of outcomes (and hence their importance when selecting a career). Differences (CM vs. NCM) were significant at least at $p < 0.05$ in nine cases (three had no significant difference, namely starting salary, prospects of getting a first job, and different tasks at different times). In only two cases did a higher percentage of CM students than NCM students select High importance. This was highlighted by calculating the Difference, shown in the last column of Table 6 and calculated by NCM(High) minus CM(High). It is negative in only these two questions. The first case was for the importance of a flexible work schedule (NCM(High) = 46.4% versus CM(High) = 51.1%) and the second for different tasks at different times (variety) (NCM(High) = 58.3% versus CM(High) = 61.4%).

The questions that appear in Table 6 were used again in Table 7 but they are in a different sequence as they are sorted according to CM rankings which were assigned according to CM(High) values in Table 6. NCM rankings were assigned according to NCM(High) values, also from Table 6. Values that were close (within 3% of each other, but usually within 1%) were given equal ranking.

Although the variances (difference value in Table 6) for flexible work schedule and for different tasks at different times (variety) are not large compared to the Difference values for other questions, and these two items do not appear very high up in the ranking table (Table 7), they go against the trend. The interpretation is that, in this research sample, CM students rate the importance of a less constrained or regimented career (flexibility factors) more highly than the other students do. It is interesting that "opportunities to work in different kinds of businesses" and "opportunities to work overseas", both of which are

also related to variety and flexibility, are not rated more highly by the CM students than the NCM students. The proposed explanation is that the latter two questions relate to context or macro issues (work environment), while the first two are more to do with the nature of the working day and the nature of work, (which we refer to as work content).

The largest variation in high scores is for: "A stable career with fairly guaranteed employment no matter what the general economic climate" with NCM(High) = 68.4 whereas CM(High) = 48.4 (fewer than half)[5] (see Table 6). This is confirmed to some extent by the question with the second biggest difference: "Good prospects for promotion and professional development" with NCM(High) = 85 compared with CM(High) = 69. Job security has a Difference = 11.

Regarding the other outcomes expectations, the two groups are largely motivated by the same factors but these were more pronounced in the NCM group (considerably higher % values in Table 6). For example, "Good long term salary prospects" was a primary issue for both groups (rank 1 in Table 7 for CM and for NCM), but NCM(High) = 85.5 compared with CM(High) = 75. Of the other top motivators, (job satisfaction, good prospects for promotion and professional development, and opportunities to work in different kinds of businesses) there was more than 10% positive difference (NCM saw them as more important) in all cases except the last.

Interest

According to the SCCT model, self-efficacy and outcomes expectations together account for interest to a significant extent. In the research reported here, two questions were asked that refer to interest. They ask about the importance of the two factors that follow in choosing a career:

- Interest in the subject—you know that this is the kind of work you want to do
- Interesting challenges to be mastered

Both groups considered this very important with both CM(High) and NCM(High) for the first question = 83 and both for the second = 72 (Table 8). The "Interest in the subject" CM score is higher than any other scores for questions regarding importance. The "Interesting challenges" CM score is close to the highest other scores for CM (these are in Table 6, within the set of Expected Outcomes questions). For the NCM group there are comparable NCM(High) scores within Table 6. This indicates that Interest is considered extremely important for students majoring in computer-related subjects and amongst the most important considerations for the NCM group.

The results show no significant difference between the two groups (the Pierson Chi-square for the first was 0.965 and for the second 0.482). Hence, despite the fact that there were consistent differences between the two groups in the questions related to self-efficacy and aspects of outcomes expectations, these did not seem to affect Interest. This will be discussed further in "Discussion".

Discussion

Sources of Advice

H1: CM and NCM students will rank and value sources of career advice similarly in terms of importance.

H2: CM and NCM students will have equal knowledge about the listed careers.

Both hypotheses have been rejected. According to SCT, external sources of advice impact on affective, personal aspects and, most relevant to this study, on the individual's assessment of career desirability. In terms of SCCT these primarily affect outcome expectations.

Universities often arrange events where prospective students in engineering and technology visit the university but these are intended more to provide information about courses than information about job prospects and they do not provide additional tuition. There seems to be a clear need to make information available to school children regarding the full spectrum of computing professions and qualifications. Since the Internet was seen as an important source for CM students in preference to the educators and education-linked sources, we should capitalize on this by linking career-oriented pages to the existing university sites.

There are a number of similarities between the Accounting profession and computer-related "professions". Both are considered scarce skills worldwide and this is also true in South Africa (SA DoL 2007) and both tend to have imbalances in terms of representation of female and minority students (http://www.saica.co.za/Learners Students/Thuthuka). Specifically in South Africa, a request should be made immediately to have a computer-related stream added to or strengthened in the DST/Thuthuka Maths and Science development camps project [although it does already aim "to assist students from disadvantaged backgrounds with entry into accountancy, science, engineering, mathematics and technology professions" (SA DST 2005)].

[5] The ranks assigned to the CM and NCM groups do not cover exactly the same range of percentages. For example, rank 1 for NCM has high values between 86.3% and 85% whereas rank 1 for CM includes high values from 75 to 76.3%. Hence rankings for the two groups may be similar while their high values vary considerably.

A deliberate effort, led by national ICT professional bodies rather than universities separately, and possibly learning from other professions that seem to have similar successful initiatives (such as the SAICA initiative on behalf of the Chartered Accountants in South Africa), seems a useful way of improving ICT enrollments. There are three related aspects, namely, (a) improving self-efficacy by providing extra classes, (b) improving information to support realistic overall career outcome expectations and (c) making information available regarding the wide variety of possible computer-related careers

The big difference in importance of University Student Advisors as a source of advice might be unique to the universities studied, and in particular to the larger of the two (University A) as the data is heavily biased towards that university. No South African academic papers have been identified that identify this factor.

Self-Efficacy

H3: CM and NCM students will perceive self-efficacy regarding their chosen careers as important to the same degree.

This hypothesis has been rejected. The majority of CM students, and noticeably a larger percentage than the NCM students, consider that the performance of a student in High School is very important. The question does not state explicitly that these should be computer courses and computer courses are seldom a prerequisite for entry into university computer courses. However, it is possible that the students' responses support the view of Slonim et al. (2008: 69) that universities should "Change university admission policies to recognize CS as a formal part of the academic high school curriculum". This could be extrapolated to propose that computer skills including, but going beyond computer literacy, be taught at all schools and be a pre-requisie for all computer-related majors. Such a policy would have major implications in South Africa and other countries where educational opportunities are not equal for all and it could result in currently under-represented groups being excluded to an even greater extent from studying computer-related subjects at university, as the less well-resourced schools that they attend cannot offer these courses. However there is a suspicion that the under-representation of less advantaged students attempting, let alone successfully majoring in computer-related university courses does in any case have some relationship to the quality of their earlier education and experience using computers even without this pre-requisite being made explicit. This is, however, beyond the scope of this paper.

Further, as discussed in "Computer Self-Efficacy", there is evidence that computer-related courses offered at secondary schools are in fact dissuading students from enrolling for IT courses. Hence there is a conflict here regarding the content, quality and feasibility of school computer courses that needs further exploration.

Career Outcomes Expectations

H4: CM and NCM students will assign the same importance to opportunities in their chosen careers.

This hypothesis was rejected although in terms of ranking of importance the two groups had similar perceptions.

The questions regarding career outcomes expectations display interesting differences which might relate to different personal characteristics between the two groups (possibly group personality traits). A preliminary finding is that in terms of work content, rather than work environment, people choosing computer-related careers seek variety and possibly autonomy to a greater extent than other students. They are rather less interested in security than others. If ranking of options[6] is used rather than percentage of group choosing the High option, there is a fairly close correspondence (the same or one place different) for all the outcomes other than for the two flexibility issues. Further research is being undertaken in an attempt to confirm these findings.

Interest

H5: CM and NCM students will assign the same importance to interest in their chosen careers.

This hypothesis was supported. The research findings here are in apparent contradiction with one aspect of those of Lent and of Akbulut and Looney (Akbulut and Looney 2007, 2009; Lent et al. 1994, 2002; Looney and Akbulut 2007) in that the reported importance of self-efficacy and outcomes expectation, which differed significantly between the CM and NCM groups, was not reflected in a noticeable difference in reported importance of interest in career choice. In fact the opposite is true, the percentages of students selecting the three options (High, Medium and Low) for the first question in the 'Interest' set was very nearly identical for the two groups.

On the other hand, the very large number of students from both groups that say interest is highly important supports a different aspect of the SCCT model, namely, the positive relationship between interest and choice goals

[6] In this case options were grouped as small differences were considered immaterial (see Table 7).

which was confirmed by Akbulut and Looney (2007). In our research, this is the most important factor by a clear margin for Computer majors.

Relating Findings to the SCCT Model

The findings are related to the SCCT model in Figs. 2 and 3. Firstly, Fig. 2 highlights the perceived differences between the responses from the CM group and the NCM group. The red, solid lines in this figure show that self-efficacy, knowledge about a range of possible careers and flexibility in the context of work were all factors that influence career choice for the CM group more strongly than for the NCM group. In contrast, the red dotted lines indicate factors that the NCM group considered to be more important than the CM group did. External sources that influence self-efficacy and outcome expectations, and the majority of actual career outcome expectations feature here. A partial least squares analysis for each group that would give an indication of the relative difference between them is proposed for future analysis.

This figure gives a clear indication as to why "Interest" remains the most important factor for both groups, to an almost equal extent, despite the fact that factors that the SCCT model says contribute to "Interest" were not equally important to both groups. There is apparently some compensation between factors. For example, the CM group believe that self-efficacy is more important than the NCM group do, but this might be balanced by the lower importance CM give to sources of advice and information ("Sources of Self-Efficacy and Outcome Expectations"). Within "Outcome Expectations", the CM group also emphasizes different outcomes from those that the NCM group select but this again may even out the overall result.

Figure 3 shows the most important career influences for the two research groups combined, and overlays them on the SCCT model and, hence, this figure allows us to compare them with the relationships that the SCCT model has established (green dotted lines). Since only a subset of the SCCT relationships were investigated in the research being reported on here, these results are exploratory. However, the importance of "Interest" on "Intention/goals for activity involvement" is clearly confirmed. Similarly, "Outcome Expectations" are clearly important although, as noted above, different groups value different aspects of these. The importance of self-efficacy is less clear. The direct influence of "Sources of self-efficacy and outcomes expectations" on "Intention/goals for activity involvement" is not well established.

Further Information on Sources of Advice

As a follow up to the findings on sources of advice derived from the questionnaires, and as noted in "Research Approach", two interviews were conducted with a professor in the Financial Sciences and the head of Student Advice, both at University A. These experts referred to an initiative by the South African Institute of Chartered Accountants (SAICA). The SAICA Thuthuka programmes, which started in 2002, are credited with having a marked

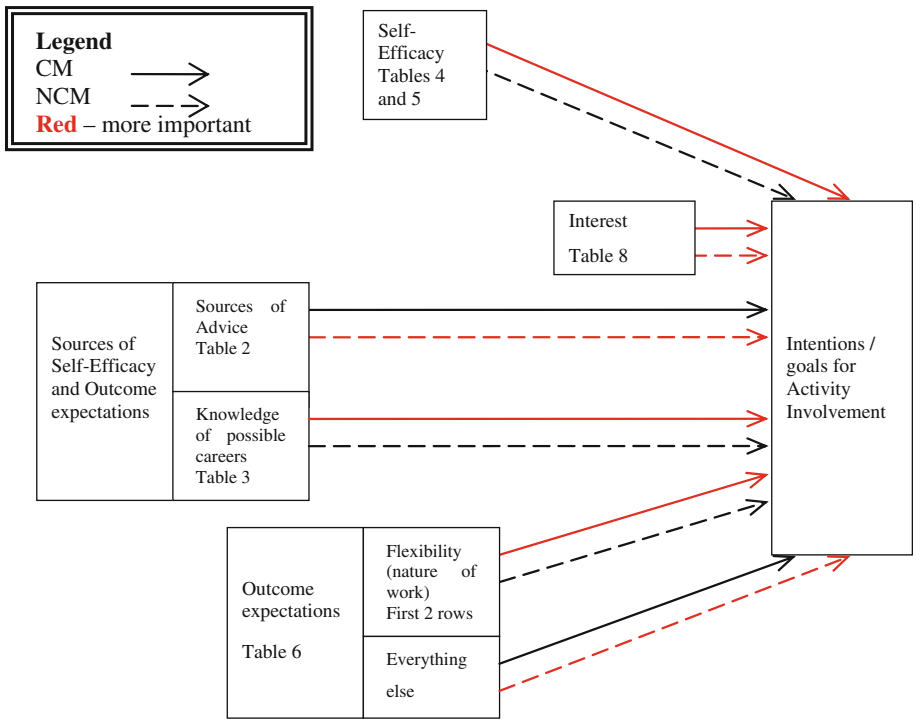

Fig. 2 Comparison of CM and NCM responses regarding importance of selected elements from the SCCT model

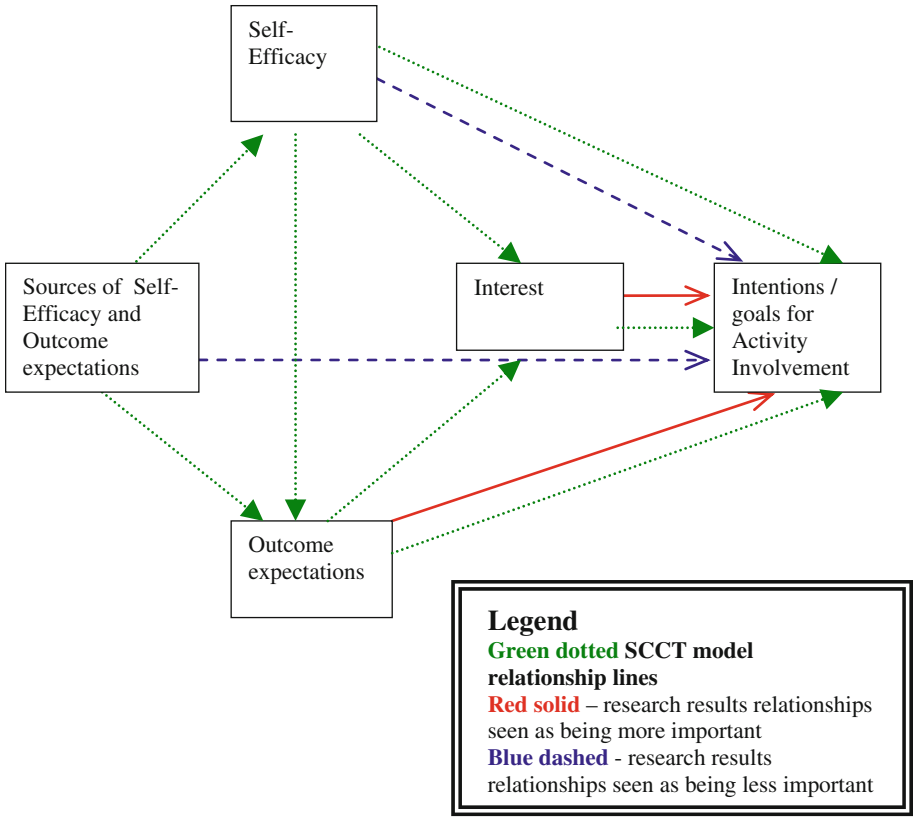

Fig. 3 Comparing the SCCT model influences with the overall research results

effect on the number of black and female charter accountants qualifying (see http://www.saica.co.za/tabid/36/itemid/1448/ language/en-ZA/New-data-reveal-a-dramatic-increase-in-black-chart.aspx and http://www.saica.co.za/LearnersStudents/Thuthuka/ThuthukaEducationUpliftment/SuccessStories/tabid/729/language/en-ZA/ Default.aspx). The Thuthuka camps provide additional workshops in accountancy and mathematics during school holidays for 1 400 Grade 11 and Grade 12 learners per annum, and are considered to have proved to be a huge success (Great Basin Gold Ltd 2009; SA DST 2005). "The main objective of these week long camps is to enhance the skills of Grade 11 and 12 learners in the key areas of Mathematics, Science, English and Accountancy in order to grow the competencies of these bright young minds and position Science related careers, Engineering, Technology and Chartered Accountancy as careers of choice." (Press release provided by University A's careers officer) In addition the Thuthuka programs provide bursaries and joint initiatives with South African universities to support students including: Additional lectures, tutorials and assessments in Financial Accounting; A mentoring and tutoring system in respect of other identified subject modules; Additional academic support in developing skills and competencies to assist students in their studies as well as to prepare students for the work place.

Conclusion

This exploratory study compares two groups of South African students regarding three major factors corresponding with the three-first elements in the SCCT. These have been examined by finding out how important the students considered them to be in influencing their career choices. The study has contributed local, practical strategies for attracting students into the ICT disciplines as well as to a more universal understanding of factors that influence students in making decisions about career choices. It contributes to a more complete understanding of the SCCT model as it indicates that, while the basic relationships are generally confirmed, the extent of the importance or influence of the elements on "Intention/goals for activity involvement" will probably vary depending on as yet unexplained characteristics of different groups of students that have some relationship to the majors selected.

Since there is competition among and within universities to attract the best students and students from under-represented groups, understanding why a student might opt for one of the other, competing, disciplines instead of a computer-related course leading to an ICT career is important for universities, for the industries that the universities feed, and for components of the national economy. These issues are relevant worldwide and further research relating the

relative importance of different factors for different disciplines and groups of students has a great deal of potential importance.

This research was exploratory and raises a number of further questions. The extent to which the different SCCT elements contribute to intentions and goals for career choice needs to be quantified and comparisons between countries could be undertaken to determine whether environment factors explain these differences or whether intrinsic factors are the primary causes. However, more immediate research is in process using data from a more balanced sample from a wider variety of South African universities.

This paper will be of general interest as it allows existing theory to be tested in a new context, namely that of a South African university. The previous contexts have all been in highly developed countries and this new context provides a contrast and allows for a more general theory. Hence extrinsic factors are being tested. However, it also highlights the similarities and differences between the factors influencing two groups of students, both from the same environment currently, who ultimately made different career choices and the paper relates these to the SCCT model. Various intrinsic and extrinsic factors could possibly explain the differences and there is, therefore, scope for future work to determine whether personality factors, earlier education including exposure to computers or sources of advice and information are important reasons for the observed differences.

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