Changing Career Choice Factors as the Economic Environment Changes

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ABSTRACT

This paper reports on a longitudinal study carried out amongst students at one South African university over three years. The research identifies changes in perceptions regarding the factors that these students consider important in choosing a career and pays attention to four groups, namely female non-computing major students, male non-computing major students, female computing major students and male computing major students. Interest in the subject remains the most important factor. Major changes were identified regarding how important self-efficacy is considered to be and the importance of career progress. Another important finding is that male computing major students appear to be totally re-evaluating their beliefs regarding what is important in choosing a career. The third finding relates specifically to changes regarding self confidence in using computer technology amongst male students regardless of whether they are intending on taking computing and non-computing third year courses.

Categories and Subject Descriptors

K.7 The Computing Profession

General Terms

Human Factors

Keywords

Career choice, Computing disciplines, Gender

1. INTRODUCTION

This research has been done in order to study two problems that have been identified in South Africa but that are also prevalent throughout much of the world particularly in emerging economies. These are commonly referred to as "the ICT skills shortage" and the "unemployed graduates problem" (where we are assuming that the graduates being referred to are generally not people with ICT-related, university degrees). Both of these problems could be reduced if more young adults entering the tertiary phase of education elected to learn specialist ICT skills. Therefore, we need to understand why students who have the potential to pass such a course decide against studying it or what would persuade suitable students to take such a course.

Indeed there is a third problem that is related to those already mentioned and has been experienced worldwide, in very well established economies as well as the emerging and underdeveloped economies. This is the downward trend over the last ten years in the numbers of students registering at universities for computing related courses. Although student numbers have started stabilizing they have not recovered to the levels of 2001 and therefore this has left us with excess capacity in computing classes while the country has a shortage of suitably qualified people entering the work place.

This paper will focus on attracting new entrants to one specific part of the eSkills spectrum, people with specialist ICT skills sometimes referred to as e-Practitioners. This is arguably the group that is best catered for in terms of education and training and employment but insufficient numbers of people are joining this fortunate group. There are a number of good reasons to pay attention to the skills needed, the availability of these skills and the employment opportunities offered by the formal ICT sector, i.e., whether the supply of e-practitioner skills meets the demand.

Firstly, there is a great deal of evidence that a healthy ICT sector contributes significantly to the economy of a country and therefore we should ensure that there is a continuous input of suitably skilled people working in this field. Secondly, since there is an ever increasing demand for ICT products and services, e-practitioners need to make up an increasing percentage of the workforce of most countries.

> "Part of the problem [of unemployment] is the strong move to highly skilled work as there has been a 36 percent reduction since 1960 in the number of workers needed to produce a given level of output."[11: 16]

In developing countries the demand for e-practitioner skills should be even more pronounced since ICT-related services are easily exported and off-shoring from developed to developing countries offers us an important opportunity. New e-practitioner jobs can be created in countries that are geographically distant from markets but easily reached by communications technology without that work force having to emigrate. Thirdly, each highly skilled e-practitioner is supported by numerous less skilled technicians and technologist, and is very likely to offer considerable on-the-job training to more junior colleagues. The ICT workforce is unusual in that people enter it via a variety of routes and not all have formal ICT qualifications [5]. Those with a solid foundation of academic knowledge complement those with mostly practical and experiential skills.

It is important to note that in South Africa there is believed to be an excess of e-practitioners with entry level, narrow scope ICT-related qualifications and no experience [11] whereas the major shortage is for experienced people who have the learning skills that allow them to continuously update their knowledge with little

outside assistance [11]. Of course it is not only university computing graduates that make up the second group but they do have an advantage in getting entrance into particular ICT-related jobs, particularly those requiring business analysis, programming, software, hardware, systems and database design skills. The MICT SETA[i] (previously the ISETT SETA) have been mandated to determine the skills gap in the ICT sector in terms of current demand and supply as well as forecasting future requirements and the ISETT SETA Sector Skills Plan for 2011–2016 provides a very credible analysis of this.

2. PROBLEM STATEMENT

Insufficient numbers of students are graduating from South African universities with advanced qualifications in Computer Science, Information Systems, Computer Engineering, Multimedia studies and other computing-related disciplines. Whereas the pipeline model is over simple (that is, the number of graduates is not solely dependent on the number of entrants), an increase in the number of students choosing to study computing and who have the required entrance requirements, could contribute to an increase in number of graduates. Increasing the number of entrants into the system is a necessary if not sufficient condition for obtaining more graduates. In order to investigate this, this research will look at various factors that have influenced students who have recently started studying at one particular university. The research will attempt to identify differences regarding these factors over a period of three years. Four distinct groups will be studied and, to a limited extent be compared. These are female non-computing major students, male non-computing major students, female computing major students and male computing major students.

3. FACTORS AFFECTING CAREER CHOICE IDENTIFIED IN RESEARCH LITERATURE

3.1 Economic conditions

The strength of the economy has an obvious influence on employment (the health of the economy is often measured in terms of unemployment data) and employment opportunities can in turn be expected to affect the attitude of students and those advising them regarding career choices. Researchers sometimes suggest that enrolments for all courses can be shown to follow a fairly regular cycle and that this is closely linked to the economy.

Sometimes there is a downturn or a boom that particularly affects a specific part of the economy and the ICT sector has been particularly prone to this and is affected by the overall economy to a somewhat lesser extent. For example, there was a sudden, and quite short lived demand for specific skills in response to the predications of malfunction of systems when the year changed from 1999 to 2000 (the so called, Y2K problem affecting legacy systems) [19]. Other examples of boom and bust were related to the massive increase in interest in business presence on the web, the dot.com bubble, and the subsequent failure of many ICT businesses. Sudden downturns continue to influence potential students negatively long after the industry has recovered and the dot.com bust has frequently been given as a reason for the drop in student enrolments in computing courses at universities over the past ten years [14; 19].

The current worldwide recession has negatively affected employment in most components of the economy. In South Africa official figures for overall unemployment rose to 25.7% for the second quarter of 2011 (http://www.tradingeconomics.com /south-africa/unemployment-rate). However, as the following quotations show, predictions regarding employment in the ICT sector remain generally optimistic.

> "That spending growth means that employment in the IT industry and of IT professionals in IT-using organizations will rise by 321,000 jobs in the four years from the end of 2009 to the end of 2013, up from a 2009 base of 1 million. That represents growth of 5.5% a year from now through 2013, which compares to 2% growth for total employment." [10]

> "However, employment in the IT industry is forecast to grow rapidly (2.2%) over the next decade, nearly five times faster than UK average employment, and attracting high quality recruits from a vibrant, well-skilled recruitment pool from multiple sources will be critical." [6]

MICT SETA are, however, much less optimistic, forecasting only a 1.6% per annum increase in employment for the period 2012 – 2016 within organisations who specifically locate themselves as falling in the sector [11]. The SETA acknowledges that this prediction is probably conservative and it is also important to stress that many ICT graduates are employed outside of the group of companies registered by MICT SETA.

The importance of the belief that there are job opportunities in the ICT sector or that these are decreasing has been noted in the academic research literature and there is evidence that students and their advisors are not always well-informed [8; 9]. Another important point is that, by the time students graduate (three or four years after choosing their university degree and major courses) the economic conditions are likely to have changed. Therefore future students need not only to be given accurate information about what people who take up the different computing careers do, and what qualifications they require, but also need access to reliable forecasts regarding job opportunities.

3.2 Social Cognitive Career Theory

Social Cognitive Career Theory (SCCT) has proven to be a good predictor of career choice including choosing computing careers. SCCT investigates three aspects of career development and the factors underlying them. These are 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 …" [1: 68].

As can be seen in Figure 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 outcome expectations contribute directly to goals to some extent [19]. Self-efficacy impacts on the ultimate choice of career not only because it contributes directly to goal formation, but to a greater extent because it contributes to the development of interest. Self-efficacy affects outcome expectation, as belief in one's ability to achieve in
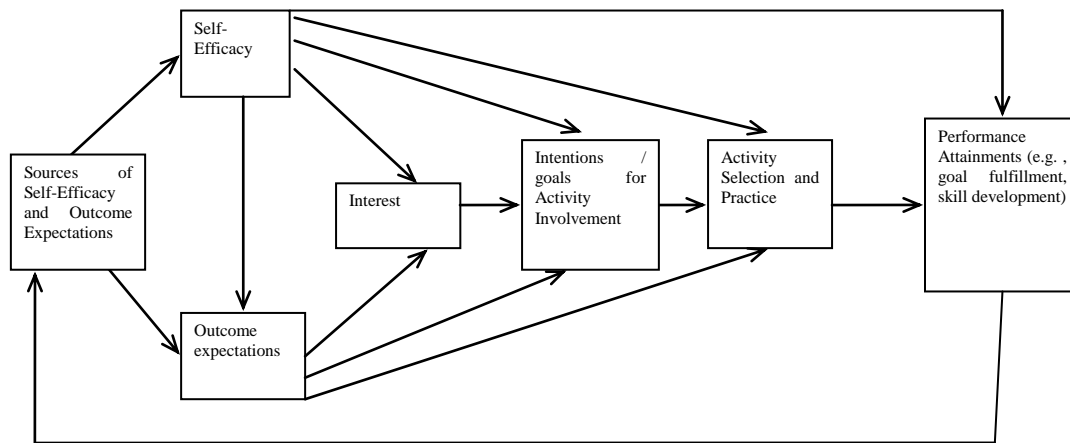
Figure 1: Model of how basic career interests develop over time (copy right Lent and Brown, permission obtained from the authors to reproduce the diagram).

a particular field makes one more hopeful of benefiting in a meaningful way from the rewards that one associates with the career. Outcome expectations also contribute to development of interest and, somewhat less directly to goal formation.

3.3 SCCT and computer careers
The SCCT model has been verified by empirical studies related to careers in various types of computing (i.e., Computer Science, Information Systems and more generally, IT) [1; 2; 12; 13; 17].

3.3.1 Computer self-efficacy
As noted above, self-efficacy is considered to be the most important mechanism in career choice and, even in cases where SCCT has not 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 females have noticeable lower computer self-efficacy scores than men both at school and university and this is considered to be a major reason for the lower number of female students deciding to take up computing [4; 7; 19].

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 [7; 12; 16]. Although students who have had a lot of exposure to ICT at school tend to have high confidence in their ICT skills [4] 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 [5]. An appropriate assessment standard, combined with sufficient feedback, assists students in setting their own, realistic goals [16; 18].

3.3.2 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 looking at the impact of 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 8; 18]. 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. A South African study amongst secondary school pupils, by Seymour et al [16], found that job availability was significantly associated with interest in ICT.

US studies that looked at the reasons why students were not taking up computer-related jobs found that lack of employment opportunities was not the reason [Lomerson and Pollacia, 2006 and Lee and Lee, 2006 both cited by 8; 18]. Instead these studies identify self-efficacy issues (for example, the subject is too difficult or too technical) and interest as being primary reasons for not selecting computer-related courses and careers.

3.3.3 Sources of advice
People at home and at school influence learners in terms of self-confidence and what they expect from possible careers – shown as Sources of Self-Efficacy and Outcome Expectations in Figure 1. Parents feature prominently both as sources of advice and as motivators [8; 9; 19]. Teachers and other career guidance advisors seem to be rated poorly in terms of how important their advice is.

4. RESEARCH QUESTIONS
This research sets out to answer some specific questions that are considered to be relevant to the problem statement given earlier. The main question is:

Which career choice factors are of greater importance to students at times of economic downturn and do these differ in a meaningful way from other times? This could also be stated as: What trends can be noted over a three year period of slow economic growth regarding the factors influencing the career choice of new university students?

Sub-questions

What are the differences over this period between computing majors and non-computing majors in terms of different career choice factors?

What are the differences over this period between males compared with females in terms of the perceived importance of different career choice factors?

5. RESEARCH METHODOLOGY

This research used data collected from twenty-nine questions included in questionnaires (see Table 2 for the questions) administered over the three years immediately subsequent to the worldwide economic downturn (i.e., 2009, 2010 and 2011). The respondents were first year students who were registered for introductory computing courses within a Computer Science department and an Information Systems department at one South African university (see Table 1).

Table 1: Responses

	2009	2010	2011	Total
CM (m)	108	323	211	642
NCM (m)	537	419	422	1378
CM (f)	71	133	74	278
NCM (f)	667	398	462	1527
Total	1383	1273	1169	3825

Students who indicated that they intended to take computing courses up to final year level are considered to be computing majors (CM). However, there are large numbers of students taking first year computing courses who do not intend to major in these courses (NCM). For example, at this university there are large numbers of students in the first year Information Systems classes who are planning on majoring in Accounting, Auditing or some other subject that belongs to the Financial Sciences.

Many of these non-computing degrees have a requirement that students take one or more computing course beyond the computer literacy courses that are also required. A very high percentage of the students in these classes qualify in terms of admission criteria to take Computer Science or Information Systems (that is, computing courses) so this is not a reason why they are not planning to major in computing. This research has divided the results into four groups, as shown in Table 1, namely female non-computing major students (referred to hereafter as NCM(f)), male non-computing major students (NCM(m)), female computing major students (CM(f)) and male computing major students (CM(m)). The 3825 students who participated in the three surveys had all recently started university studies as each survey was done within the first three months of the year. The intention was to find out what factors had influenced their choices of major subjects and to do so before their experience at university had a major effect on their perceptions regarding courses and careers. This data is a subset of that collected from a group of universities in

Table 2: Question set

Category		Question	
1	Interest	Interest in the subject - you know that this is the kind of work you want to do	1
		Job satisfaction: there will be a sense of accomplishment	2
2	Security	Job security	3
		A stable career with fairly guaranteed employment no matter what the general economic climate	4
		Good prospects in obtaining a first job without any prior experience	5
3	Self-efficacy	The fact that I am able to master this subject and others find it too difficult will give me a career advantage	6
		I expect to do well at university	7
		My performance in high school subjects	8
4	Computer Self-Efficacy	I have lots of self-confidence in working with computers	9
		I am confident I could teach someone to use a software package	10
5	Status	Good prospects for a better than average starting salary	11
		Good long-term salary prospects	12
		A good image / status in the chosen profession	13
6	Flexi-bility	A flexible work schedule	14
		Opportunities to work overseas	15
		Different tasks at different times (variety)	16
		Opportunities to work in different kinds of businesses	17
7	Quality Of Life	Balance between social and family activities and work	18
		My chosen career will be quite easy	19
		My chosen career will not be very stressful	20
		Having a job where I work with people	21
		Opportunity to "give back" to my community in some way	22
		Being able to combine career and family	23
		My career will give meaning to my life	24
		Balance between social and family activities and work	25
8	Career Progress	Good prospects for promotion and professional development	26

South Africa. The intention has been to collect a considerable amount of data that is representative of all South African students. Unfortunately this has proved difficult and the data used for this longitudinal study is limited to that obtained from one large research university located in a city. This university has traditionally catered for relatively advantaged students although it now has a diverse student body.

The individual questions (that is, the item referred to in the question) were grouped by Category as also shown in Table 2. The data values were combined as low importance (responses 1 and 2), medium importance (responses 3 and 4) and high importance (responses 5 and 6).

When questions are grouped together it is necessary to check statistically whether they belong together and this is done using Cronbach's Alpha. The Status and Quality of Life categories passed this test. However, another test needs to be used for groups made up of smaller numbers of questions (non-parametric correlation using Kendall's tau-B). These groups were also found to be consistent (significantly cross correlated in all cases with $p < 0.000$). Once the composition of the groups was validated, means per group of questions were calculated for each student and the analysis was carried out using these. In addition, individual questions were analyzed within gender to check for differences between the age groups. These individual results will be referred to but are not discussed in this paper in full.

6. FINDINGS
Four separate correlations were carried out for each group of

questions to compare the data for the three years. In Table 3 a value with $p < 0.05$ indicates differences in mean values between the groups that are very unlikely to be due simply to chance and are therefore worthy of attention. These results are supported by graphs (profile plots) of mean values over the years (Figures 1a to 8b) so that we can easily see how the means change.

It has been observed widely that females tend to give higher scores to questions in questionnaires than males do (they are more likely to agree). This universal finding is also noticeable in our results and should not be interpreted to mean very much. It is important to note that we are primarily comparing results over the three years for each group separately and are not comparing the groups directly.

The four columns showing NCM(f), NCM(m), CM(f) and CM(m) need to be read individually. These values are all p (i.e., significant difference) values and a low p value is highlighted by adding **. As an example, in the Interest row, the value for CM(m) is 0.01. This shows that if we compare the three mean values calculated for the years 2009 to 2011 for Interest and for males majoring in computing, there is a noticeable difference between the values that cannot be explained as just due to chance. Interesting the p value = 0.46 for CM(f) still related to the Interest row is high. For this group there is no clear evidence of a change over the three years in how important they think Interest is. In the sections that follow the data will be interpreted with additional help from graphs for each of the eight sets of questions and the four groups of students.

Table 3: Correlation (p values1) across years of Mean values for four groups of students

Question category	NCM(f)	NCM(m)	CM(f)	CM(m)	2009		2010		2011		Total	
					Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank
Interest	0.76	0.87	0.46	0.01**	4.65	1	4.65	1	4.64	1	4.64	1
Security	0.00**	0.88	0.01**	0.00**	4.22	4	4.26	3	4.24	3	4.24	3
Self-Efficacy	0.78	0.75	0.33	0.00**	4.00	6	4.34	2	4.31	2	4.21	3
Computer Self-Efficacy	0.45	0.00**	0.18	0.02**	3.48		3.75		3.50		3.58	
Status	0.08	0.00**	0.28	0.05*	4.45	3	4.26	3	4.26	3	4.33	2
Flexibility	0.00**	0.00**	0.06	0.00**	4.18	5	3.97	5	3.86	5	4.01	5
Quality Of Life	0.00**	0.00**	0.11	0.00**	3.84	7	3.61	6	3.50	6	3.66	7
Career Progress	0.00**	0.00**	0.00**	0.00**	4.64	1	3.31	7	3.36	7	3.80	6

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[1] ** indicates highly significant since $p <0.01$; * indicates significant since $p < 0.05$
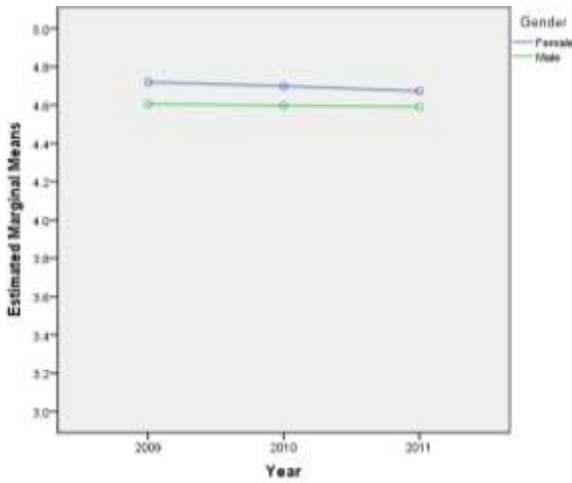
6.1 Interest

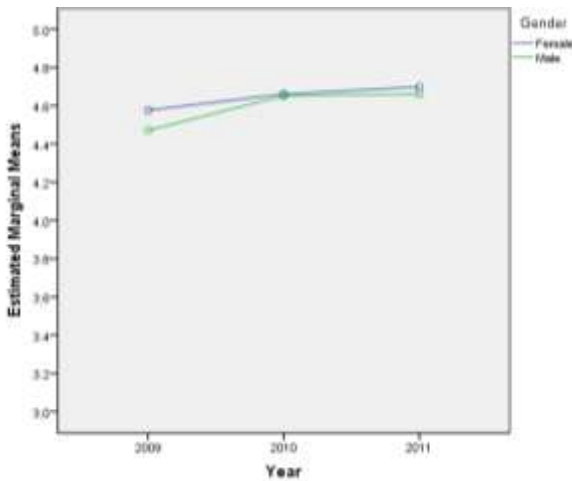**Figure 1a NCM importance of Interest per year**

Figure 1b CM importance of Interest per year

Table 3 shows that for all three years all the students together think Interest in the subject which they choose to study is most important. This clear because it was given the highest average score every year (Mean = 4.64 or 4.65) and hence has Importance ranking by mean for whole sample = 1. Over all three years the third most important in choosing the career was the group of questions which we labeled Status. However, in 2009 Career Progress was as important as Interest (ranked 1) but this dropped dramatically in 2010 and 2011 to least important. Self-efficacy also changed ranking very dramatically between 2009 and 2010. In the sections that follow this will be discussed in greater detail.

Table 3 shows that the only group whose perception of interest in the subject changed significantly over the three years was the CM(m) group. This is also evident in Figures 1a and 1b as the plotted lines are nearly horizontal for the three other sets of students. As explained earlier, all four groups consider interest in the chosen field to be the most important factor in career choice and looking at the graphs we can see that whereas in 2009 the CM(m) seemed to consider this less important they have

subsequently started agreeing very much with the NCM(m) and CM(f) groups.
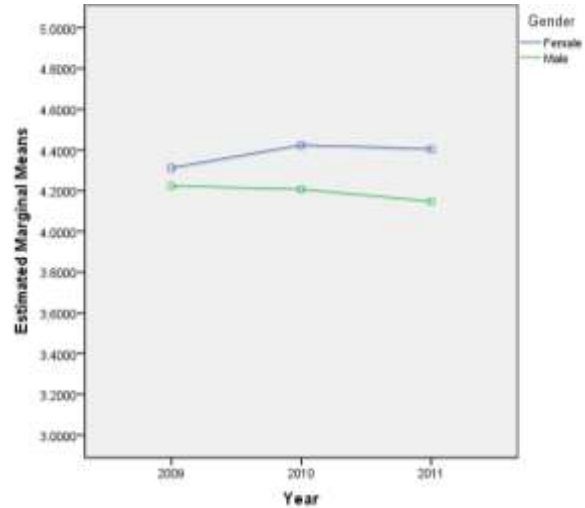
6.2 Security

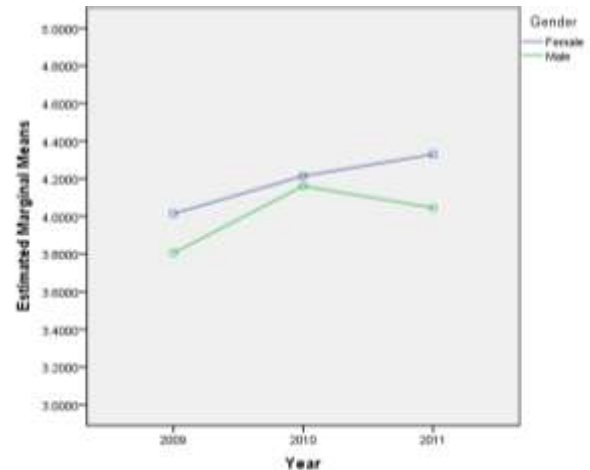**Figure 2a NCM importance of Security per year**

Figure 2b CM importance of Security per year

Three of the four groups changed their perception of the importance of job security over the three years (shown in Table 3 by the ** next to the p values) and all three gave security increased importance. We believe that this is due to the economic down turn. Only NCM(m) remained consistent over this time (more or less a flat line in Figure 2a). These results can be interpreted as showing that men who are not going into computing related careers assume that their jobs will be relatively secure despite the current economic circumstances and that all women are less confident about job security than men. This may indicate that women naturally value security more highly than men or it might indicate that women still believe that discrimination on grounds of gender exists in all fields and that this will be a problem when jobs become more difficult to find and retain. The

computing sector is also seen as being less secure. Security is the 2nd most important factor looking at the complete sample (2nd highest mean in Table 3).
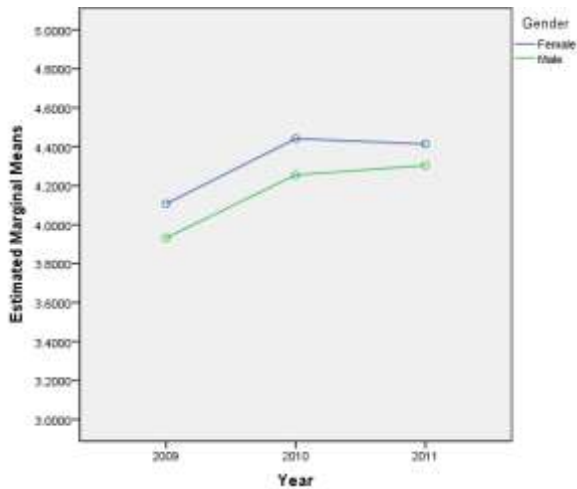
6.3 Self-efficacy

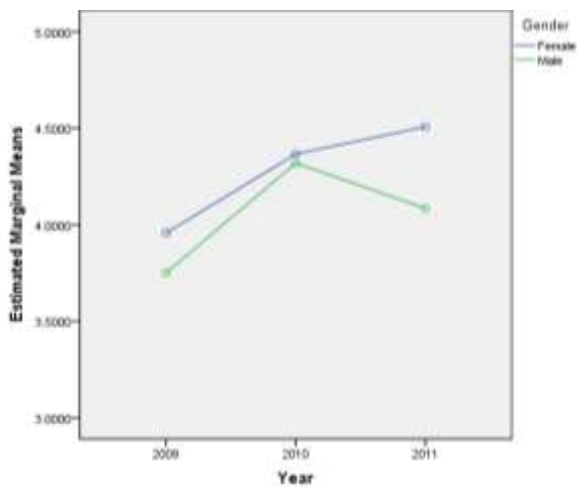**Figure 3a NCM importance of Self-efficacy per year**

Figure 3b CM importance of Self-efficacy per year

The following two sets of questions to be considered are related to self-efficacy. The results for the first set are shown in Figures 3a and 3b. This is general career self-efficacy that relates to belief in one's ability to succeed in one's chosen courses and career no matter what the courses and career are. These questions asked how important various indicators of success, like school results but also one's own assessment of one's ability, are when deciding on a career. All four groups showed an upward trend. That is, compared with 2009 in 2011 students generally considered that school and university marks are important evidence that you will be successful and that this evidence is important when deciding on a career. Overall this factor is considered as important as job security (ranks third across the full sample over the three years – see Total columns in Table 3). In all cases the biggest change was between 2009 and 2010 when the down turn was quite new and shocking. The change in ranked importance from 6th in 2009 to 2nd in both 2010 and 2011 shows this clearly. This might indicate a feeling that there is greater competition for jobs now and that

you need to excel in order to gain employment. This interpretation is only tentative.

What is evident from the correlation results in Table 3, as well as the graphs (Figures 3a and 3b), is that CM(m) have the least consistent view of this factor with significantly different results over the three years. This group seem to have got a big fright in 2010 and are now partially recovering. Alternatively, they now have a more realistic view of their abilities.
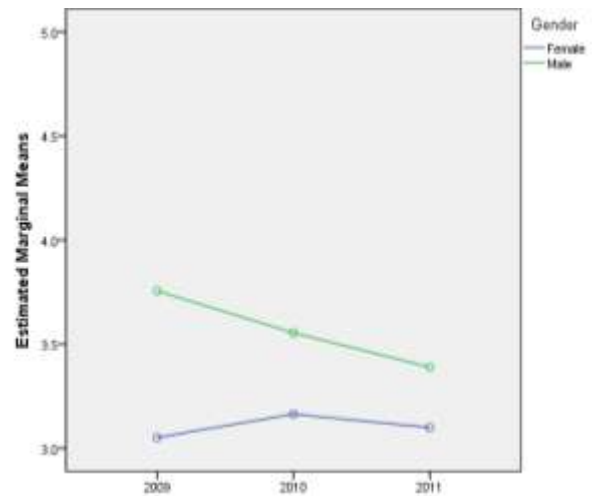
6.4 Computing self-efficacy

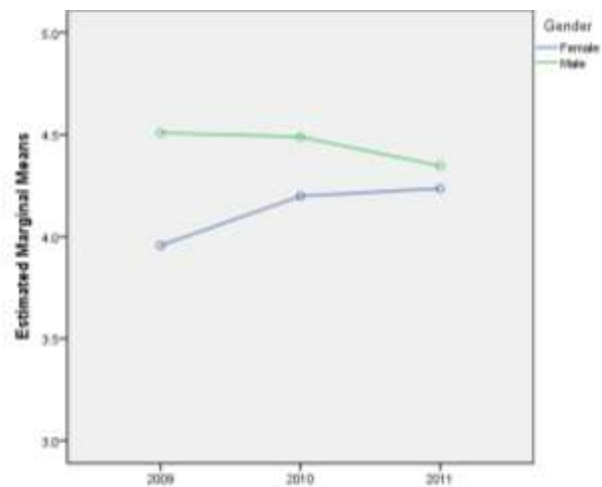**Figure 4a NCM importance of Computing Self-efficacy**

Figure 4b CM importance of Computing Self-efficacy

The second set of self-efficacy questions relates to a particular type of self-efficacy, namely, computer self-efficacy. This is confidence in one's ability to use a computer (Figures 4a and 4b). In contrast with all the other questions, these questions did not ask how important computer self-efficacy was for career choice but rather how confident the respondents are in their ability to use computers. Hence the mean for this set was not used for importance ranking in Table 3.

As noted earlier, females are widely reported to have lower computer self-efficacy than males. It is for this reason that this is an extremely interesting set of results as in this large sample both

amongst the CM students and the NCM students the difference between males and females is decreasing. Of course there is still a wide difference between the NCM students and the CM students. A second very important finding comes from looking at the indications of significant difference with a sub group over the three years. Line 4 of Table 3 shows that it is the male students, both in the CM and NCM groups, whose computing self-efficacy is declining significantly. This result also confirms and is confirmed by the similar entries for CM(m) and CM(f) in the general self-efficacy results. Therefore, it is not only that the CM females are narrowing the gap but that the males are losing confidence in their ability. This has serious implications as self-efficacy is an extremely important factor in career choice.
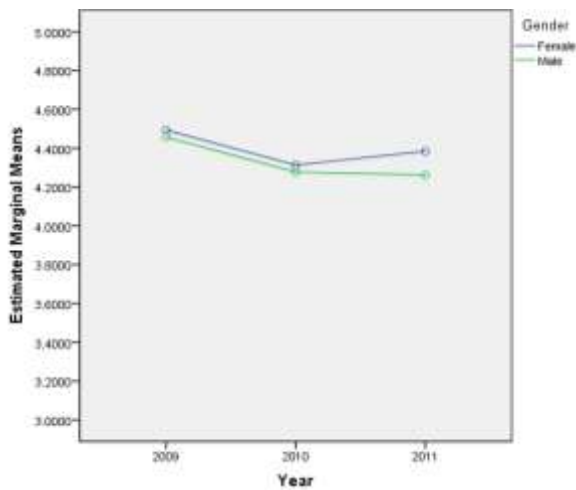
6.5 Status
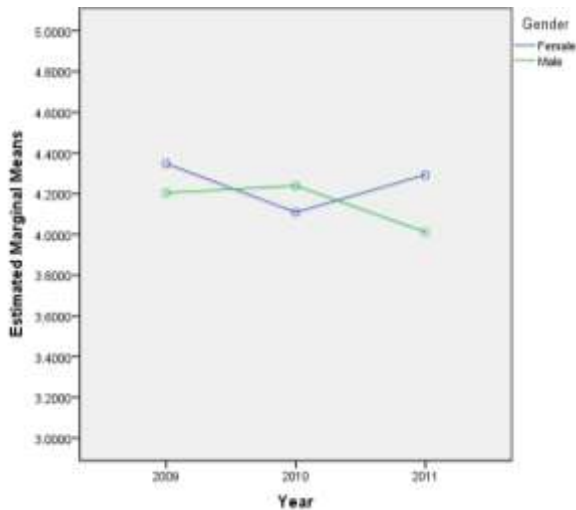

Figure 5a NCM importance of Status per year

Figure 5b CM importance of Status per year

As was the case with computer self-efficacy both the NCM(m) and CM(m) groups have significantly changed their views of the importance of status associated with a career as a factor in career choice (see line 5 of Table 3 and Figures 5a and 5b). Both now think status is rather less important than they did in 2009 but this remains the second most important factor overall and has been the third most important issue each year for the combined group of

students. Status incorporates questions regarding salary which other research has consistently found to be very important in career choice. It seems, therefore that some small compromises in terms of salary would be acceptable to students, and particularly as a change of heart for male students.
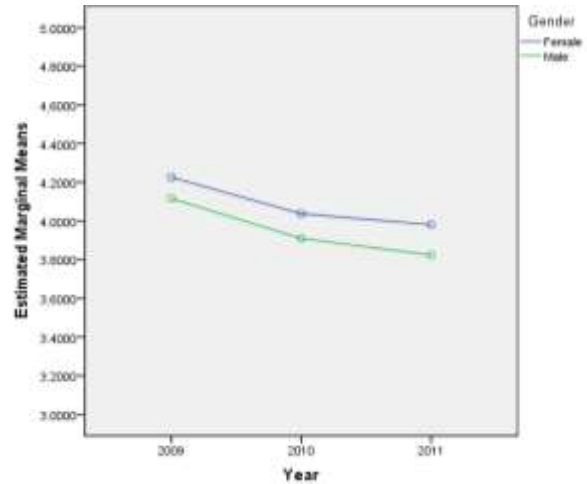
6.6 Flexibility

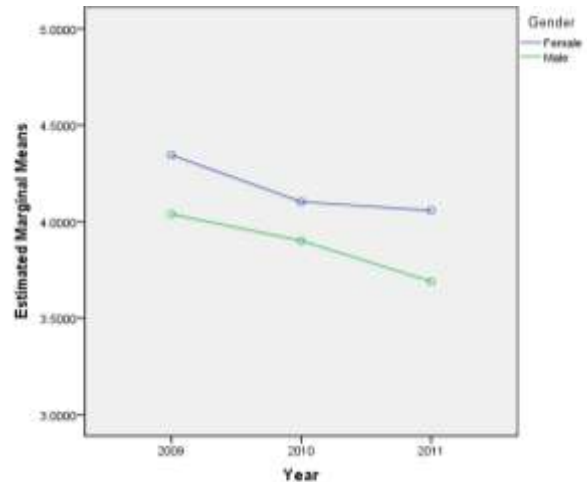**Figure 6a NCM importance of Flexibility per year**

Figure 6b CM importance of Flexibility per year

Figures 6a and 6b, together with line 6 of Table 3 show that all except the CM(f) group have revised their views of the importance of flexibility in a job downward although this has not affected the comparatively less sensitive importance measure ranking at all. This seems to be a "nice to have" factor rather than a "must have" and is consistently ranked 5th out of seven factors. Although this research is not attempting to compare the groups, it is noticeable that there is a quite wide difference regarding perceived importance of this factor, over all three years, between CM(f) and CM(m) groups with females considering this more important. This might indicate that computing careers are considered to be family unfriendly (working hours are long and inflexible, there is little attempt to accommodate employees who have small children, etc.) and hence that the CM(f) will continue to look particularly for work relating to computer skills where there is more flexibility. Other reported research says that females

prefer to work at bigger ICT firms and to firms who need IT skills but whose core business is not ICT as working conditions are more flexible there [15].
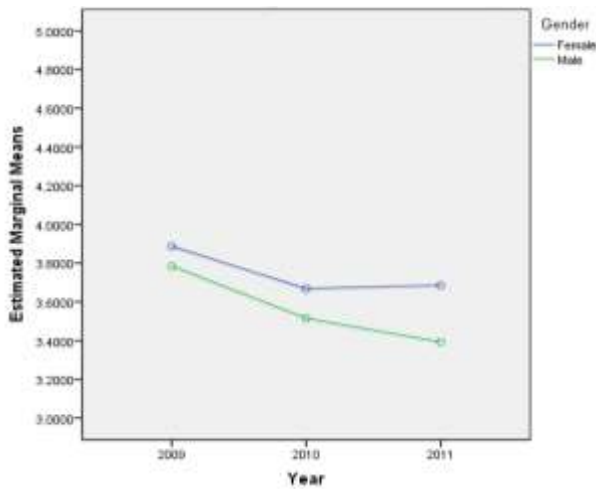
6.7 Quality of Life

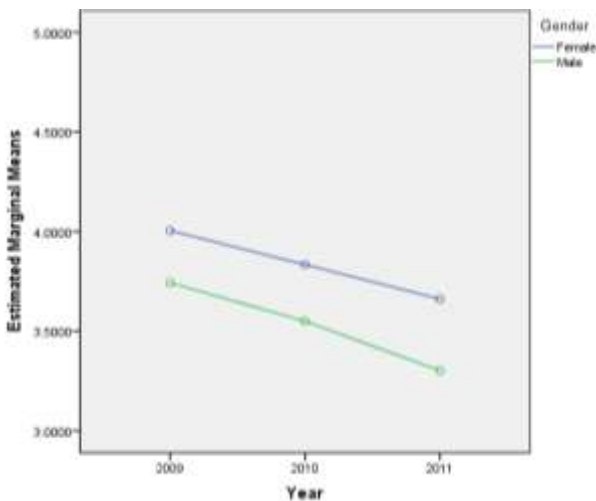**Figure 7a NCM importance of Quality of Life**

Figure 7b CM importance of Quality of Life

This is one of the least important factors each year and over the whole sample (Table 3). As was the case for Flexibility, it showed a significant drop in importance for all groups other than CM(f) over the three years (Figure 7a and b). This seems to be a "nice to have" factor rather than a "must have" and hence something that all except CM(f) will re-evaluate when times are hard and getting a job cannot be taken for granted.

6.8 Career Progress

Career progress was ranked as almost as important as Interest in 2009 but as least important in the following two years (Table 3). As Figures 8a and 8b show, between 2009 and 2010, when the shock of the sudden decline in the economy was most acute, there was a dramatic drop regarding how important this was perceived to be. The differences were highly significant for all groups (Table

3). This rapidly stabilized (in the case of males improved slightly). Again this seems to be a "nice to have" factor rather than a "must have" and as it is not of immediate concern (changing jobs can be delayed and promotion or getting a job cannot be taken for granted) but the change in perceived importance and ranking is very clear for this factor and may indicate that the problem of job hopping that has plagued the ICT sector in the past will be reduced in the current economic climate.
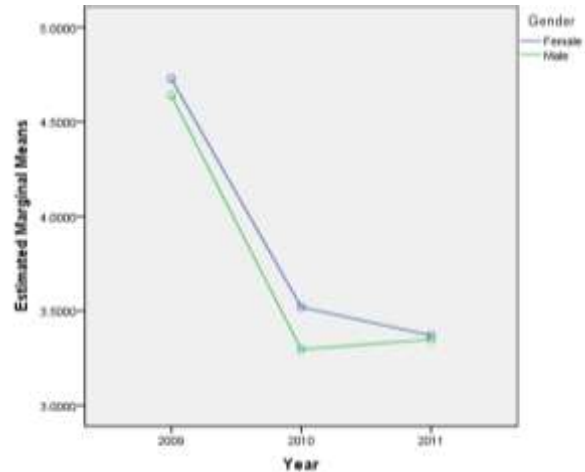

Figure 8a NCM importance of Career Progress
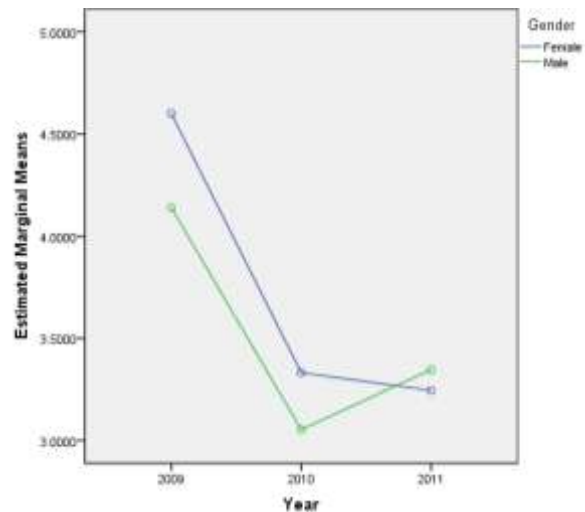
Figure 8b CM importance of Career Progress

7. Discussion

7.1 Interest and security

Despite the less favorable economic climate, all students appear to continue to believe that both genuine interest in their career subjects and job security are very important. There has, however been some change regarding how the four subgroups view these two aspects. We believe that these changes indicate that CM groups are feeling less secure regarding work opportunities compared with the NCM groups. Possibly the current CM students believe that there other more secure careers should be followed unless you are passionate about computing.

The implications for an e-skills strategy is that, at the time they make their decisions regarding possible careers and again when they submit applications to tertiary institutions, pre-tertiary students and their parents need recent, accurate and credible information about the kind of work, the likely job satisfaction and the stability of the job market in a computing career. This particular paper has not explored the issue of career advice although the data set does include information regarding this. We will limit our remarks here to say that computing is a relatively new subject area compared to most other career choices and may be suffering from limited career guidance at school with the result that potential students depending on information from the media and advice from friends and family regarding computing careers while relying on school and university far more for advice on other careers [3]. Our research results calls for an ICT career guidance partnership with high schools and tertiary institutions.

Three of the four groups of students studied are increasingly anxious about job security and this includes getting a first job. However, as noted earlier, what ICT industry needs is people with experience and students obviously do not have this when they start out. The issue of learnerships and other entry mechanisms becomes important in this context. Many of the issues regarding businesses being held to ransom in terms of salaries and other requirements by their experienced staff can only be reduced if there is a larger pool of skilled e-practitioners. Our research results calls for continued partnerships with employers of ICT graduates to look for creative and practical ways to facilitate entry into the ICT work force.

7.2 Computer self-efficacy
The notion of e-Skills goes beyond being an e-practitioner to include the innovative use of ICT in business and other careers. Computing self-efficacy for NCM is, as expected, much lower than the CM group. As discussed earlier, the literature shows that it is highly likely that NCM groups do not choose to major in computing because they are not confident about their own ability. Also, existing research suggests that this is at least in part because of a lack of exposure to computing. Giving pre-tertiary students experience in using computers (learning how to use packages or to programme) but also a better understanding of what a variety of computing careers entail and how computers are used in various fields is needed to improve computing self-efficacy. This is also extremely important for developing a passion for computing.

The drop in computing self-efficacy for NCM(m) is also surprising. This is an area which needs further investigation but might indicate that students now have a more realistic perception of their abilities because they have more actual experience using computers (refer to the Literature Survey above and research by Hart et al and Galpin and Saunders).

The findings point to a necessity for e-Skills to be promoted to a greater extent at pre-tertiary levels. The differences in results between CM and NCM students may point to a need to ensure that more students are sufficiently confident in their computing skills so that this career option is seriously considered. Teachers at pre-tertiary level (and parents) need to be trained in e-skills so that they are confident of their own computing abilities and can pass this on.

7.3 Alignment of results with the SCCT model
Our results agree with the SCCT model in part, as Interest has remained the most important fact over time and regardless of economic climate. However, perceptions of computer self-efficacy and of the importance of self-efficacy in choosing a career have shown very interesting changes over the period studied. The SCCT model has previously found that self-efficacy is a major factor affecting all other components of the model but in 2009 the students considered it relatively unimportant. Our results for 2010 and 2011, however, have now once again aligned with SCCT. There is therefore a need to confirm whether it has in fact been economic climate that has been the source of these changes or whether there have coincidentally been changes in basic education in South Africa that have produced this result.

In our analysis of results obtained over the three years we have analysed components of Outcomes Expectations rather than looking at these as a single indicator. Status and Security have consistently been the most important components of Outcome Expectations and both outweighed self-efficacy in importance in 2009 but this seems to have been as a result of an anomaly in the students' perception of the importance of self-efficacy. Career progress is another component that has shown very clear changes over the period studied. This is a significant finding.

7.4 Conclusion
Which career choice factors are of greatest importance to students at times of economic recession and do these differ in a meaningful way from other times?

All four of these groups are important to us but the groups who are participating least in the ICT work force in South Africa need particular attention. Hence we need to look at the concerns of female students and those who are not intending to follow a career in computing with a particularly critical eye. The sub-questions posed and the analysis did this. We have noted that the four different groups studied seemed to react rather differently in terms of the different factors over the three year period. The attitudes on CM(m) changed significantly with respect to every one of the factors over the three years. It appears that this group are re-evaluating their motives and the way in which they select careers in a far reaching way. This might be a window of opportunity for employers and people recruiting ICT graduates as the best time to bring about change is when the situation is already fluid. Strategies that worked in the past for attracting the best graduates into employment in the ICT sector may not work for the newer entrants into our universities.

In contrast with the CM(m) group, the CM(f) have reassessed only two factors, namely security and career progress. Those wishing to recruit or retain qualified females into the ICT work force should pay particular attention to these two aspects.

As far as the two NCM groups are concerned we need strategies that are applicable before they choose their careers and start studying. Self-efficacy and Interest are the two factors where both female and male students are extraordinarily unchanging. These are key factors in career choice and it will take major career guidance programmes to both raise the necessary interest in computing careers and to give these students the required computing self-efficacy to make this real option.

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[i][i] "… note that the ISETT SETA Sector does not comprise all organisations in the Information and Communications Technology (ICT) Sector because there are companies that have defined themselves to be in other sectors, such as professional services, despite these companies being recognised as ICT companies. There are also organisations, such as the banks, which have a large ICT skill component but which belong to other industry sectors and Setas. The ISETT Sector should therefore be viewed as a sub-sector of the whole ICT Sector." [11: 9]