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Research Report

Science and Technology Stakeholders' Ranking of Graduate Competencies Part 1: Employer Perspective[†]

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In this paper we report the views of science and technology sector employers about the importance of a variety of workplace competencies. Employers of students from the University of Waikato's cooperative education program completed a questionnaire (n=172) in which they rated the relative importance of a list of 24 workplace competencies (using a 7-point Likert scale) for new graduates entering the workforce now, and for new graduates who will do so in 10 years time. The survey instrument, taken from the literature, was that used to investigate the views of business sector stakeholders (employers, graduates and students) and science and technology students. According to science and technology employers, the top competencies required for new science and technology graduates are; *ability and willingness to learn*, *teamwork and cooperation*, *initiative*, and *analytical thinking* with *concern for order, quality and accuracy*, *computer literacy*, and *written communication skills* rated next most important. As with employers of business students, the science and technology employers considered all competencies to be important but the latter saw little change in the importance of these competencies in 10 years time. The results of the present work show that the science and technology employers rated both 'hard' skills and 'soft' skills as important, but they placed more emphasis on hard skills than science and technology students or business sector stakeholders (*Asia-Pacific Journal of Cooperative Education, 2002, 3(2), 19-28).*

Keywords: New Zealand; employers; ranking; competencies; science; technology; hard skills; soft skills; technical skills

There have been recent calls in the literature for more research into employers' views of aspects of cooperative education. Given the importance of employers in cooperative education (it is hard to imagine how any sucessful program can function without the support of employers) such calls for more research seem more than justified. Some authors suggest that the fact that many employers show considerable loyalty to programs is an indicator of employer satisfaction (Varty, 1996). However, others (e.g., Hurd & Hendy, 1997) point out that employers need to base employment decisions on hard data. Hence, it is our view that it makes sense for cooperative education researchers and practitioners to conduct research regularly to ensure that employer needs are met by cooperative education programs.

The overall aim of cooperative education programs worldwide is to prepare students for the workplace by developing specific and generic competencies that they believe will be useful to employers in a number of ways (Rainsbury, Hodges, Burchell, & Lay 2002). Some skills may be obtained in the classrooms on campus; others are best developed in the workplace via the work-based

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learning that forms an essential part of cooperative education programs.

The authors acknowledge the importance of employers' needs, and the research reported here seeks to address employers' needs, with specific reference to developing an understanding of what employers think are desirable competencies for science and technology graduates. Hence, in this work we have sought the views of employers of science and technology students and graduates on the importance of some specific workplace competencies.

Competency

In order to investigate employers' views of competency we first sought to develop an understanding of this and other related terms such as capability. Competency may be defined as the underlying personal characteristics of an individual that facilitate superior performance in a given situation (Boyatzis, 1982; Spencer & Spencer, 1993). Competency may also be viewed in terms of inputs and outputs: an input measure being any aspect of the inner person, normally displayed as behaviors, which allows them to perform competently, resulting in an output or outcome measure (Boam & Sparrow, 1992). Competency also is related to the manner in which individual attributes – such as knowledge, skills and attitudes – are drawn on in performing tasks in specific work contexts and which results in overall job performance. However, according to Birkett (1993, p. 4), "neither contextual task performance or individual attributes constitute competence; it is the relation between the two that does."

Competency and Capability

It appears that there is some interchange and contrasting views of terms such as competency and capability in the literature. For example, Stephenson (1997) sees capability as the integration of knowledge, skills, personal qualities and the ability to learn, to deal effectively with unfamiliar and familiar situations or tasks: a view similar to that which Birkett (1993) terms competency. Stephenson states (pp. 9-10): "Competence delivers the present based on the past, while capability imagines the future and helps to bring it about...competence is about dealing with familiar problems in familiar situations." Rudman (1995) views capability as a precursor to competency, where an individual has the capability to perform a specific task because they have the necessary knowledge and skills, but they do not become fully competent in the task until they have had some experience. However, capability is generally seen as a more a holistic concept than competency; the former being an integration of knowledge, skills and personal qualities used effectively and appropriately in unfamiliar as well as familiar situations (Birkett, 1993).

Skill Development

Taking action where outcomes are uncertain requires courage, initiative, intuition, creativity, emotional stability and a belief in one's power to perform. Hence, staying capable in a world of change requires confidence in one's ability to manage one's own learning. The development of capability is best achieved, the authors here would argue, by improving the processes by which people learn. A competent individual is one who has skills and attributes relevant to tasks undertaken, or more generic in nature. Individual attributes that are drawn on to perform tasks competently consist of cognitive skills and behavioral skills. Cognitive skills are skills such as technical knowledge, skills and abilities, which are a function of the job requirements, whereas behavioral skills are built up from personal characteristics such as principles, attitudes, values and motives, which are a function of an individual's personality (Birkett, 1993). Birkett developed a taxonomy of cognitive skills and behavioral skills in which he considered cognitive skills to comprise technical skills, analytical skills and appreciative skills. Technical skills represent the ability to apply technical knowledge with some expertise. Analytical and constructive skills are concerned with problem identification and the development of solutions. Appreciative skills refer to the ability to evaluate complicated situations and make creative and complex judgments. Similarly, behavioral skills comprise; personal skills – how one responds and handles various situations; interpersonal skills – securing outcomes through interpersonal relationships; and organizational skills – securing outcomes through organizational networks. For both cognitive and behavioral skills, the skills may be ordered according to increasing complexity, and be considered to be cumulative in that the skills build upon each other. For example, if an individual applies technical skills well, the next level would be to develop analytical and problem-solving skills. The development of skills typically occurs over a period of time, with appreciative and organizational skills required at the advanced stage of a professional career. Any successful performance, while dependent on a number of skills, will likely require both cognitive and behavioral skills (Birkett, 1993).

Hard and Soft Skills

Skills such as those described above are also referred to as 'soft' and 'hard' skills. There is evidence in literature to suggest that soft skills as well as hard skills are critical for successful performance (Ashton, 1994; Caudron, 1999; Georges, 1996; Strebler, 1997). The literature also suggests that there is a lack of emphasis placed on the development of soft skills in many educational organizations. Hard skills (i.e., cognitive skills to use Birkett's 1993 terminology) are those associated with technical aspects of performing a job and usually include the acquisition of knowledge (Page, Wilson, & Kolb, 1993) and are, according to some authors, influenced by an individual's *Intelligence Quotient* (IQ). Spencer and Spencer (1993) describe technical skills and knowledge as containing a threshold in that they represent a minimum level necessary to be able to perform a job with basic competence. Soft skills (i.e., behavioral skills according to Birkett's terminology) also referred to as interpersonal, human, and people skills; place emphasis on personal behavior and managing relationships between

people. They are primarily affective or behavioral in nature and have recently been associated with the *Emotional Quotient* (EQ) popularized by Daniel Goleman (see, Caudron, 1999; McMurchie, 1998). EQ is regarded to comprise a blend of innate characteristics and human, personal and interpersonal skills (Kemper, 1999).

Many authors believe that hard and soft skills are complementary, with successful individual performance requiring both types of skills and superior performers having high EQ ratings (e.g., Kemper, 1999; McMurchie, 1998). Research by Spencer and Spencer (1993) suggests that superior performers are not distinguished solely on the basis of technical skills, but also by the demonstration of certain motives, values, traits and attitudes, in other words, behavioral skills. Hackett, Betz and Doty (1985) identified a number of skills that subserve the broader function of soft skills. These include the ability to communicate well, to relate effectively to others, to plan and manage the demands of one's job, to exercise leadership, and to cope with stress effectively.

Some authors believe that employers commonly neglect the development of soft skills because of the difficulty in their measurement, or difficulty in demonstrating a link between them and desired work outcomes (Arnold & Davey, 1994; Georges, 1996). Furthermore, soft skills are seen by some to be more difficult to develop than hard or technical skills (Caudron, 1999).

Methodology

Theoretical Basis for the Study

We decided to focus on competency rather than capability in this study as we believe that the concept of competency is consistent with the aims of our cooperative education programs, since in our view co-op seeks to develop individuals with specific competencies and skills as detailed above. According to Spencer and Spencer (1993) a number of generic competency categories account for 80% to 95% of the distinguishing features of superior performers in technical and managerial positions (Appendix A). These are the competencies investigated here and they were classified into hard and soft skills utilizing Birkett's (1993) taxonomy with cognitive skills being equated to hard skills, and behavioral skills to soft skills

Research Objectives

The overall aim for this study is to complement a similar study involving business sector employers (Burchell, Hodges, & Rainsbury, 1999) and we thus sought to identify science and technology sector employers' views of the importance of specific graduate competencies. Based on the literature definitions of competency, the research utilized a theoretical framework derived from the notion of competency, specifically the competencies identified by Spencer and Spencer (1993). In addition, we wished to compare science and technology employer's views with those of science and technology students. The authors felt this would be of interest since some academics in the institution involved in this study believed that a different culture exists between business and scientific sectors of New Zealand industry. Hence it is of interest to see if business and science employers perceive the importance of specific competencies in different ways.

The Survey Instrument

The participating employers were asked to rate the importance of the list of 24 competencies in Appendix A (using a 7-point Likert scale with 1 = unimportant and 7 = important), and four additional competencies the authors deemed to be significant. The four additions were, *ability and willingness to learn*; *written communication*, *personal planning and organizational skills*, and *computer literacy* (Meade & Andrews, 1995; Sweeney & Twomey, 1997). The competencies were listed in random order on the instrument and the employers were asked to rate the importance of each competency, both now and what they think it might be in 10 years time (the latter was added to allow employers to say if they imagined some competencies, e.g., computer skills, would become more important in the future). Participants also were able to provide written comments on the survey form, and to add other competencies they deemed important. The survey form also contained definitions for each of the 24 competencies listed and the full instrument used in the study – including the definitions of the competencies – is provided in Appendix B.

Oral communication was not included as a separate competency because the authors regarded it as a key component within a number of other competencies. Rainsbury et al. (2001) likewise omitted oral communication from their instrument and as we wished to compare our findings directly with their study, we chose to omit this item also.

Context of the Study

At the University of Waikato cooperative education is primarily offered in the form of the BSc(Technology) degree, one of four undergraduate programs offered by the School of Science and Technology. The degree consists of a full BSc degree, with two additional management papers and a total of 12 months relevant work experience (Chapman & Kirk, 1992). The work experience is normally carried out as two placements, one of three-months duration at the end of the second year, and a second of nine-months duration at the end of the third year. Student selection and admission to the program is carried out on a case-by-case basis, with students screened on the basis of their academic record and personal interviews. The program has been offered for over 20 years and has experienced a steady increase in enrolments (Coll, 1996), although this growth has leveled off somewhat since the mid-1990s. Recently the School has introduced BTech and BE degrees, four-year engineering-oriented degrees, that incorporate two three-month placements. Presently numbers in this degree are modest (<50), although they are expected to increase

rapidly in the next few years due to promotional activity. At the time of writing some 60% of the students in the School are enrolled in the BSc(Technology), BTech and BE cooperative education programs. The Cooperative Education Unit (CEU), a team of academic staff who hold joint appointments between the subject discipline and the Unit, facilitates student placements and due to the long history of the program, a large number of potential employers are available.

Administration of the Instrument

Participants comprised employers of the University of Waikato's cooperative education students across all the disciplines and undergraduate co-op specified programs (multi-disciplinary programs like biochemistry and animal behavior) offered by the School (n=172). The total number of employers surveyed was 410, resulting in a response rate of 42%. The questionnaire was administered via a mail-out procedure, with a follow-up letter and questionnaire provided approximately one month after the first mail-out (resulting in almost double the original response). A third mail-out was considered, but deemed too costly and following the law of diminishing returns likely to produce less cost-effective returns (Cohen, Manion, & Morrison, 2000). This is a lower response rate than that for science and technology students, but acceptable for mail-out surveys of this type and better than other similar mail-out surveys (see, e.g., that reported in Rainsbury et al., 2002). The science and technology students were surveyed in routine meetings or in laboratory classes, which, being a captive audience, likely resulted in the higher response rate (Coll, Zegwaard, & Hodges. 2002).

Data Analysis

Estimated mean values were calculated for all of the competencies, and in addition competencies were categorized into hard and soft skills – according to Birkett's (1993) taxonomy. The mean importance for the latter two categories determined by summing the mean importance of each competency within that category, and dividing by the number of competencies for each category. The differences in the means were tested for statistically significant differences via one-tailed t-tests using conventional statistical methods (Statistical Package for the Social Sciences [SPSS], 2001).

Research Findings

Employers' Rating of Workplace Competencies

The estimated means for the employers' perceptions of the importance for each competency, both now and in 10 years time are shown in Table 1, and illustrated graphically in Figure 1. As these data are ordinal level,[1] only estimated means can be computed, and the results can be used only to show ranking of competencies. It can be seen that for the science and technology employers, the competencies were rated between 4.22 and 6.07 for the present, and between 4.47 and 6.39 for 10 years in the future. Rainsbury et al. (2002) took a mean of less than 4 to mean that respondents interpreted such competencies as being unimportant. The lack of spread in data is notable, as are the higher means, indicating that the science and technology employers, like business sector employers believe that all of the competencies are important. Employers gave a number of insightful comments, which supported the view that they regarded all competencies as important:

> All the identified competencies are important. More and more emphasis is placed on the ability of engineers and scientists to have a full complement of skills right from the start, so that they become useful to the organization as quickly as possible.

> Because businesses are always wanting more, all competencies listed are very important attributes that are already very important will become even more important.

> [The] competencies list describes the ideal employee. If …science people want to progress to leadership/management roles then they need all these competencies equally.

> Ideally one would like to see high standards in all of the points. [In] reality [we] will rarely achieve this in one person.

> …today and in 10 years [time] one would look for the candidate with the most scores in all of them because they are all important in making up the balanced person.

The science and technology employers rated the top competencies today in order as; *ability and willingness to learn*, *teamwork and cooperation*, *initiative*, and *analytical thinking* with *concern for order, quality and accuracy*, *computer literacy*, and *written communication skills* ranking next most important. This result is different to the ranking provided by business sector employers whose ranking was; *ability and willingness to learn*, *initiative*, *customer service orientation*, *achievement orientation*, and *computer literacy* (Burchell et al., 1999). It is also different to the business students' views who ranked the top five competencies as; *computer literacy*, *customer service orientation*, *teamwork and cooperation, self-confidence,* and *ability and willingness to learn* (Rainsbury et al., 2002). In terms of least important today, the science and technology employers' perceptions of the least important competencies were; *directiveness*, *organizational awareness*, *developing others*, *impact and influence on others*, *team leadership*, and *organizational commitment*. Business sector employers ranking was similar; *directiveness*, *organizational awareness*, *developing others*, *technical expertise*, and *impact and influence on others* – as was the rankings provided by business students*; directiveness*, *organizational*

[1] Ordinal level data is data that is not continuous and can only be ranked – e.g., age is continuous, but Likert style ranking is ordinal

Table 1
Employers' (n=172) ranking of workplace competencies; estimated means based on a 7-point Likert scale where 1 = unimportant and 7 = important

	Today			Ten Year's Time		
Soft Skills	Mean	Std. Deviation	Std. Error Mean	Mean	Std. Deviation	Std. Error Mean
Team Work and Co-operation	5.91	1.06	0.08	6.15	0.91	0.07
Flexibility	5.61	1.00	0.08	5.97	0.95	0.07
Relationship Building	5.31	1.26	0.10	5.75	1.15	0.09
Concern for order, quality and accuracy	5.68	1.07	0.08	5.84	1.02	0.08
Impact and influence on others	4.55	1.24	0.10	4.90	1.31	0.10
Initiative	5.89	0.97	0.07	6.15	0.87	0.07
Customer service orientation	5.31	1.31	0.10	5.87	1.16	0.09
Developing others	4.43	1.39	0.11	4.90	1.35	0.10
Directiveness	4.22	1.28	0.10	4.47	1.37	0.11
Team Leadership	4.56	1.44	0.11	5.04	1.45	0.11
Self control	5.36	1.16	0.09	5.61	1.14	0.09
Organizational commitment	4.79	1.17	0.09	5.02	1.34	0.10
Ability and willingness to learn	6.09	0.87	0.07	6.39	0.77	0.06
Interpersonal understanding	5.31	1.17	0.09	5.58	1.16	0.09
Self confidence	5.22	1.04	0.08	5.54	1.01	0.08
Information seeking	5.54	1.02	0.08	6.02	0.93	0.07
Achievement orientation	5.64	1.00	0.08	6.01	0.90	0.07
Organizational awareness	4.30	1.29	0.10	4.74	1.38	0.11
Hard Skills						
Computer Literacy	5.67	1.04	0.08	6.17	1.04	0.08
Conceptual Thinking	5.47	1.16	0.09	5.95	1.01	0.08
Technical expertise	5.44	1.15	0.09	5.71	1.12	0.09
Analytical thinking	5.86	0.95	0.07	6.13	0.85	0.07
Personal planning and organizational skills	5.62	0.96	0.07	5.93	0.87	0.07
Written communication	5.65	0.99	0.08	5.83	1.04	0.08

awareness, *developing others*, and *impact and influence on others*. The most notable difference in views for science and technology employers and business sector employers and students is their ranking of the importance of *technical expertise*. Science employers ranked this at 13, compared with a ranking of 21 by business employers. For science and technology employers *order, quality and accuracy* is seen as being less important in 10 year's time (ranking drops from 5 to 12). Similarly, *written communication* is perceived to be les important in 10 year's time (ranking of 7 dropping to 13). Relatively more important in 10 year's time is *computer literacy* (from 6 up to 2), and *information seeking* (from 11 up to 6).

Comparison of Hard and Soft Skills

Comparison of the employers' rating of the overall importance of hard skills (overall mean = 5.62) against soft skills (overall mean = 5.21), found there a statistically significant difference in the rating of importance between the two categories ($p<.05$), with employers rating hard skills overall as more important. Therefore, it seems that the science and technology employers, unlike their students (see, Coll et al., 2002) and counterpart business sector employers, students, and graduates (Burchell et al., 1999; Rainsbury et al., 2002), do not perceive soft skills to be as important as hard skills.

The employers made little difference in their rating of the importance of workplace competencies in the future, but none were deemed likely to be less important in the future. The largest changes were for *conceptual thinking*, *team leadership*, *self-confidence*, and *customer service orientation* (differences range 0.48 - 0.56).

Discussion

The research findings show that the employers of the University of Waikato's science and technology students and graduates perceive *ability and willingness to learn* to be the most important workplace competency. It is interesting that this is the same as for the science and technology students and business sector students (Coll et al., 2002; Rainsbury et al., 2002) and business sector graduates and employers (Burchell et al., 1999). This result is perhaps a reflection of the shifting-sands view in that modern employees are confronted with a complex and ever-changing working environment. Consequently, employers want employees who are able and willing to pick up new skills quickly. Such an idea was mooted by Sweeny and Twomey (1997) who noted that "employers are looking beyond content and focusing more on attributes and skills that will enable graduates to be adaptive, adaptable and transformative" (p. 299).

Interestingly, the science and technology employers in this work did not rate *customer service orientation* highly – but they did they see the importance of this and some management competencies (such as *team leadership* and *developing others*) as increasing in the future (see above). This along with the high ranking for *analytical thinking* and

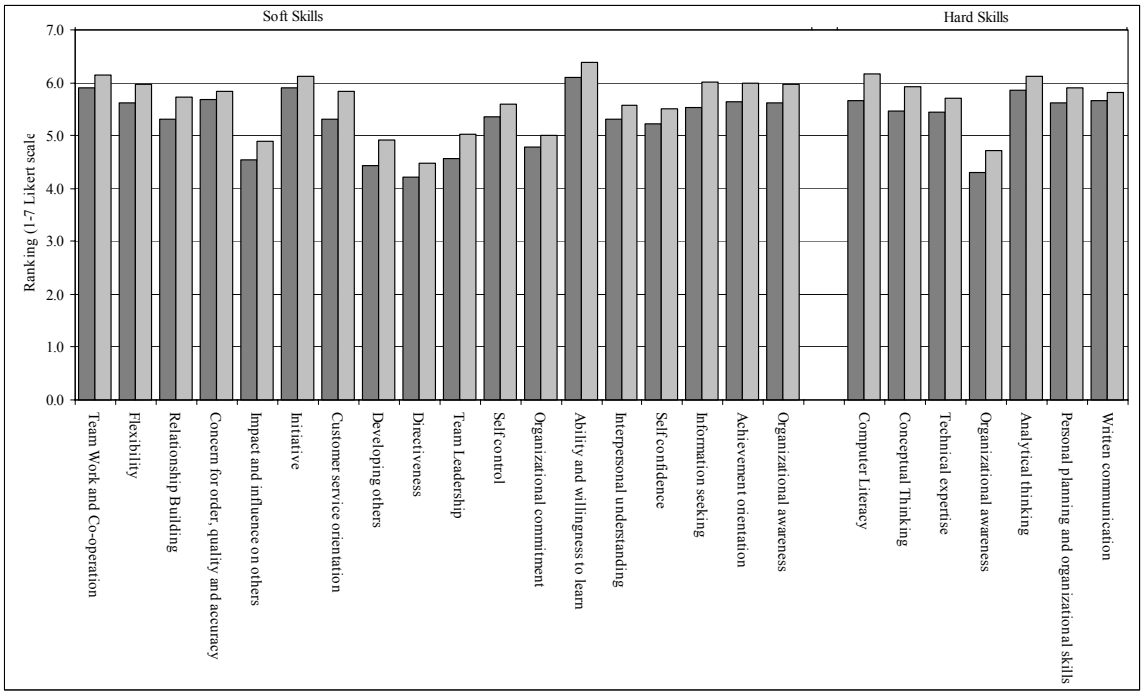

Figure 1
Histogram showing employers (n=172) ranking of workplace competencies now (dark gray) and in 10 year's time (light gray); estimated means based on a 7-point Likert scale where 1 = unimportant and 7 = important

technical expertise suggests that the science and technology employers have a clear picture of the students' and graduates present role in their organizations; namely, in the conduct of science work rather than interfacing with customers, or involved in the management of science and technology. This is perhaps not that surprising given that the study investigated employers' views of *new* graduates entering the workforce. However, these data also seem to suggest that these employers see a change in role for science and technology graduates/students in the future, becoming more customer-focused and becoming more involved in leadership roles.

One comment made by a respondent in the study of science and technology students suggests, however, that this interpretation need to be treated with some caution (Coll et al., 2002): "After 10 years some experience should have been gained therefore competency in these areas would be more important." This comment may mean that this participant has misinterpreted the question – in other words, it seems that he/she thinks the task was to say how a new graduate would 'have gained' more experience 10 years after entering the workforce. If this is the case, then it is possible that some other participants also were confused about the task, which would undoubtedly affect the reliability of these findings. Such a situation likely holds for the other studies for employers and business sector counterparts. The fact that similar overall trends were seen in other studies suggests that it is reasonable to conclude that the bulk of the participants here have interpreted the task correctly.

A number of authors have emphasized the importance of a balance of soft and hard skills (see, e.g., Kemper, 1999; McMurchie, 1998) and Spencer and Spencer (1993) suggest that superior performers are not distinguished by the technical skills that they possess, but also by the demonstration of behavioral skills. Hackett, Betz and Doty (1985) claim the ability to communicate well, to relate effectively to others, to plan and manage the demands of one's job, to exercise leadership, and to cope with stress effectively are all crucial in modern employees. These skills are soft skills, that is, interpersonal skills. Only some of these skills ranked highly with the science and technology employers, and the research findings for this study suggest that whilst employers of science and technology students see some specific soft skills as important, they are at variance with views of other employers as found by Burchell et al. (1999) (see also, Coll et al., 2002).

Conclusions and Implications

This study has shown that there are close similarities between science and technology employers and business sector employers in what they perceive as the most important competencies required of graduates. While there were differences in order, the two employer groups shared in common eight of the top 10 competencies. Given the diversity in discipline between science and business sectors, these findings seem to suggest that there are certain competencies that are expected of graduates regardless of

their career choice. The findings do suggest that science and technology employers see a slightly different role for new graduates, more reflective of the tasks to be undertaken in the workplace. The challenge for curriculum designers and practitioners is to help students maximize the opportunities provided by cooperative education programs to develop the critical competencies that they will need in the workplace from day one.

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Appendix A

Generic competencies that account for 80-95% of the distinguishing features of superior performers (Spencer & Spencer, 1993)

Competency	Description	
Achievement and action		
Achievement orientation	Task accomplishment, seeks results, innovation, competitiveness, impact, standards, efficiency	Soft
Concern for order, quality and accuracy	Monitoring, concern for clarity, reduce uncertainty, keeping track	Soft
Initiative	Bias for action, decisiveness, strategic orientation, proactive, seizes opportunities, self motivation, persistence	Soft
Information seeking	Problem definition, diagnostic focus, looking deeper, contextual sensitivity	Soft
Interpersonal understanding	Empathy, listening, sensitivity to others, diagnostic understanding, awareness of others feelings	Soft
Customer service orientation	Helping and service orientation, focus on client needs, actively solves client problems	Soft
Impact and influence		
Impact and influence on others	Strategic influence, impression management, showmanship, persuasion, collaborative influence	Soft
Organisational awareness	Understands organisation, knows constraints, power and political astuteness, cultural knowledge	Soft
Relationship building	Networking, establish rapport, concern for stakeholders e.g. clients, use of resources, contacts use	Soft
Managerial		
Developing others	Training, developing others, coaching, mentoring, providing support, positive regard	Soft
Directiveness	Assertiveness, decisiveness, use of power, taking charge, firmness of standards, group control and discipline	Soft
Teamwork and co-operation	Fosters group facilitation and management, conflict resolution, motivating others, good climate	Soft
Team leadership	Being in charge, vision, concern for subordinates, build sense of group purpose, group motivation	Soft
Cognitive		
Analytical thinking	Thinking for yourself, reasoning, practical intelligence, planning skills, problem analysing, systematic	Hard
Conceptual thinking	Pattern recognition, insight, critical thinking, problem definition, can generate hypotheses, linking	Hard
Technical expertise	Job related technical knowledge and skills, depth and breadth, acquires expertise, donates expertise	Hard
Personal effectiveness		
Self control	Stamina, resistance to stress, staying calm, high EQ, resists temptation, not impulsive, can calm others	Soft
Self confidence	Strong self concept, internal locus of control, independence, ego strength, decisive, accepts responsibility	Soft
Flexibility	Adaptability, ability to change, perceptual objectivity, staying objective, resilience, behaviour is contingent	Soft
Organisational commitment	Align self and others to organisational needs, business-mindedness, self sacrifice	Soft

Appendix B
The Survey Instrument Used in the Study

SECTION B
COMPETENCY DESCRIPTIONS

Please read the following descriptions of each competency before completing question B.1.

Teamwork & cooperation (fosters group facilitation and management, conflict resolution, motivation of others, creating a good workplace climate)
Flexibility (adaptability, perceptual objectivity, staying objective, resilience, behaviour is contingent on the situation)
Relationship building (networking, establish rapport, use of contacts, concern for stakeholders eg clients)
Computer literacy (able to operate a number of packages and has information management awareness)
Conceptual thinking (pattern recognition, insight, critical thinking, problem definition, can generate hypotheses, linking)
Technical expertise (job related technical knowledge and skills, depth and breadth, acquires expertise, donates expertise)
Organisational awareness (understands organisation, knows constraints, power and political astuteness, cultural knowledge)
Concern for order, quality & accuracy (monitoring, concern for clarity, reduces uncertainty, keeping track of events and issues)
Impact & influence on others (strategic influence, impression management, showmanship, persuasion, collaborative influence)
Initiative (bias for action, decisiveness, strategic orientation, proactive, seizes opportunities, self motivation, persistence)
Customer service orientation (helping and service orientation, focus on client needs, actively solves client problems)
Developing others (training, developing others, coaching, mentoring, providing support, positive regard)
Directiveness (assertiveness, decisiveness, use of power, taking charge, firmness of standards, group control and discipline)
Team leadership (being in charge, vision, concern for subordinates, builds a sense of group purpose)
Analytical thinking (thinking for self, reasoning, practical intelligence, planning skills, problem analysing, systematic)
Self control (stamina, resistance to stress, staying calm, high Emotional Quotient, resists temptation, not impulsive, can calm others)
Organisational commitment (align self and others to organisational needs, businessmindedness, self sacrifice)
Ability and willingness to learn (desire and aptitude for learning, learning as a basis for action)
Interpersonal understanding (empathy, listening, sensitivity to others, diagnostic understanding, awareness of others' feelings)
Self confidence (strong self concept, internal locus of control, independence, positive ego strength, decisive, accepts responsibility)
Personal planning and organisational skills
Written communication
Information seeking (problem definition, diagnostic focus, looking deeper, contextual sensitivity)
Achievement orientation (task accomplishment, seeks results, employs innovation, has competitiveness, seeks impact, aims for standards and efficiency)

Appendix B *Continued*

B.1 Please complete the table below, indicating from your perspective the *importance* for science and technology graduates entering the workforce, of each of the competencies listed. Please circle the number of your choice. (Refer attached description of each competency.)

COMPETENCY	**IMPORTANCE TODAY**							**IMPORTANCE IN 10 YEARS TIME**						
	Unimportant →						**Important**	**Unimportant** →						**Important**
	1 →						**7**	**1** →						**7**
Teamwork & cooperation	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Flexibility	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Relationship building	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Computer literacy	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Conceptual thinking	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Technical expertise	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Organisational awareness	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Concern for order, quality and accuracy	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Impact and influence on others	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Initiative	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Customer service orientation	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Developing others	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Directiveness	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Team leadership	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Analytical thinking	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Self control	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Organisational commitment	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Ability and willingness to learn	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Interpersonal understanding	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Self confidence	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Personal planning and organisational skills	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Written communication	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Information seeking	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Achievement orientation	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Please add others, if required:														
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
	1	2	3	4	5	6	7	1	2	3	4	5	6	7