

The role of universities in preparing work ready information technology graduates

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The role of universities in preparing graduates for the workforce is a longstanding and controversial issue. In the business world, employers are increasingly interested in what their employees can do and less interested in what they know. There is an uneasy relationship between universities and their curricula and employer expectations of graduates. In the field of IT (Information Technology), minimal research literature exists on understanding graduate perspectives of their work experiences or how to relate their formal study to their work experiences, especially during the early employment years. When we studied the work experiences of recent IT graduates we found that certain professional skills can be developed only during employment. However, universities could be responsible for preparing IT graduates to face unknown, unknowable supercomplex situations, ensuring IT graduates learn how to learn, increasing knowledge and awareness of workplace environments and setting initial job expectations of, and for, IT graduates. We also found that in their degrees, IT faculties need frameworks beyond graduate attributes for the development and inclusion of IT specific professional skills.

Keywords: work ready graduates, IT professional education, IT workplace experience

Introduction

There is an increasing expectation amongst students and employers in professional fields such as information technology (IT) that university studies will provide sufficient skills to enable graduates to find employment in the industry. However, minimal research, particularly in the IT field, has been carried out in following graduates into their professional practice. Understanding IT graduates' perceptions of the practical relevance of their courses to the skills required in workplaces is important information for both higher education and the information technology community. Hence, our research studied the professional work experiences of recent Australian IT graduates. By professional work skills, we refer to skills such as communication, teamwork, etc, i.e., non-technical skills. In comparison, previous research showed few concerns about technical skills, which were assumed to have been acquired through the graduates' IT studies. Our study was motivated by:

1. many IT graduates with good technical skills do not get jobs, mainly because of their poor professional skills and
2. in the IT education literature there are studies on technical skills that focus on the employers' viewpoint but few on professional skills and none from the graduates' viewpoint.

Our main research question is: What do the professional work experiences of recent Information Technology graduates in professional practice tell us about their preparation for the profession?

An exploratory, qualitative methodology that used a grounded theory approach was employed. The goal was not to make sweeping generalisations but to present contextual findings grounded in data, staying as close as possible to the construction of the world as participants originally experienced it. Hence, a grounded theory approach became a natural choice over other qualitative research methods. Interviews and qualitative online surveys were the research methods chosen. Twenty four graduates, mostly from NSW participated. All had an Australian bachelor's degree in IT, had graduated within the last three years and studied as a full-time local or international student. They were employed in a paid IT professional position from 0.5 - 3 years. Some had completed work experience as a part of their degree but had not had any other previous paid IT work experience. Eleven were interviewed (six males and five females) and the other thirteen responded to the in-depth online survey. Participants came from a broad spectrum of cultural and ethnic background, worked for small,

medium and large sized companies that were either multinational or local and were employed across a variety of IT roles (consulting, software development, network management, business analysis, project management etc..).

The research findings provided a rich description of:

1. the challenges faced by IT graduates at workplaces;
2. the professional skills IT graduates believe they need at their workplaces;
3. the sources of these professional skills; and
4. the most useful aspects of their university studies that contributed towards professional skills development.

Many of the challenges in early graduate employment revolved around working with people. Other major categories of professional skills that IT graduates believe are required for their work are communication, time management, teamwork, working across cultures, project management, business skills and personal attributes. These professional skills are developed by multiple sources including academic, social, personal, professional and other work experiences or a combination of these. IT graduates believed the most useful components of their university studies for developing the necessary professional skills were work placements and “real life like” projects. The findings from this study raise many questions for IT educators and employer groups. More detailed discussion and analysis of the findings are available in (Nagarajan and Edwards, 2008; Nagarajan and Edwards, 2009).

The Australian Technology Network defines graduate attributes as:

the qualities, skills and understandings a university community agrees its students would desirably develop during their time at the institution and consequently shape the contribution they are able to make to their profession and as a citizen.

The employability skills framework (DEST, 2002) developed by the Australian Chamber of Commerce and Industry and Business Council of Australia named eight employability skills and broad personal attributes across all industry sectors. They are communication, teamwork, problem solving, self-management, planning and organizing, technology, lifelong learning and initiative and enterprise. However, the higher education sector has no systematic framework to embed these employability skills. It relies on the view that employability skills are a subset of graduate attributes (Oliver et al., 2007a). Different IT departments adopt different approaches to embedding graduate attributes in their subjects and courses and adopt different strategies to teach these attributes. For example, many IT undergraduate degrees have a capstone course. The aim of most capstone projects is to integrate students into the IT profession so they often include real workplace assessors and sometimes real or simulated interviews with clients and supervisors. The assessment of these projects should take into consideration not just the technical content based on the project deliverables but also the development and use of professional skills. Ideally the problems are open, ambiguous and designed so that students from different cultures and languages can interact with workplace supervisors and university supervisors.

Our argument is that the development of professional skills is a distributed responsibility and different players (such as professional faculties at universities, employers and graduates) have different contributions to make. Table 1 provides some details of these roles. In this paper, we focus on the role of universities and the areas where they can assume some responsibility for professional skills development.

We discuss the underlying theory of supercomplexity that is relevant to the issue of preparing graduates to face the complex world of work. Next, we examine the specific role of universities in the development of professional skills of IT graduates. Using an example, we indicate that the graduate attributes approach currently used by Australian universities is inadequate for the development of

some professional skills in IT graduates. Our study findings show that work placement and work experience opportunities are believed to present the maximum opportunities for the development of professional skills of IT graduates. Thus, we discuss how certain IT professional skills appear to be acquirable only in the real world.

Table 1: The role of different players in the development of professional skills of IT graduates

What could universities be responsible for?	What could employers be responsible for?
Preparing IT graduates to face new, unfamiliar, unknown and unknowable situations Preparing graduates to cope with complex and dynamic work requirements Preparing graduates to learn how to learn Increasing students' knowledge and awareness of workplace environments Assisting IT graduates with initial job expectations Developing well-rounded global graduates Maximising and using diversity in university environments to assist IT graduates develop social and cultural skills	Training IT graduates when they commence work Facilitating workplace learning and organisational learning Increasing work socialisation
IT graduates' responsibilities	Shared responsibilities: Certain professional skills can be developed only in practice sites
Developing professional skills both within and outside university studies Managing their career Managing themselves Self assessing in the workforce	Linking theory and practice and learning on the job Developing employability and work ready skill sets Facilitating work placement experiences Encouraging part time employment (in IT or otherwise) in parallel to university studies Providing work based learning

Preparation of IT graduates for a supercomplex world

Our study findings uncovered complex relationships amongst the categories of professional skills and the possibility that they could be developed from a variety of learning, social and work environments. This complex nature leads to a shared responsibility between universities, employers and graduates. Barnett (1998) states that we live in a supercomplex world not just a complex world, and defines a supercomplex world as *one in which we have the very frameworks by which we orient ourselves to the world are themselves contested* (Barnett, 2000). He believes that university curricula will be unlikely to yield the human qualities that the current age of 'supercomplexity' requires. Hence, he thinks the challenge is not to prepare students for a complex world but to prepare them for a supercomplex world. Some of the ways in which universities could prepare students for supercomplexity are to

equip them with the power of reflection, the capacity to act in the world, a greater awareness of self and metacapacities that generate personal and interpersonal resources not just for coping with supercomplexity but also a mode of effective being within it (Barnett, 2000). Preparing graduates to face a supercomplex world is not an easy task for universities and the difficulty is compounded by the ever-changing needs and expectations of employers.

Universities are not solely responsible for developing work ready IT graduates

The results from our study indicate that IT graduates acquired the necessary professional skills from a variety of sources in and outside the university including on-the-job and personal life experiences. Some professional skills were developed their IT studies but became more meaningful when graduates practised then in their workplaces. Those work skills were acquired from university studies, general university experiences, internships and work placements. A significant proportion of skill development also occurred after formal studies during graduate employment. Thus, in addition to universities' responsibilities, there is also some responsibility on employers and graduates themselves. Many professional skills take a longer time to develop than the length of a university course and a lack of time as well as a lack of certain opportunities in universities suggests challenges for the development of many professional skills. Further, IT graduates have a responsibility for their personal and social development both within and outside their university studies. Similarly, employers have a responsibility to assist graduates with adequate customised training, mentoring and peer support during the initial years of employment.

What could universities be responsible for?

Preparation of IT graduates to face new, unfamiliar, unknown and unknowable situations

One of the major issues highlighted by our research is the lack of preparation of IT graduates to face new, unfamiliar, unexpected, unknown and unknowable situations. Professional faculties in universities have some responsibility to prepare graduates to learn how to learn in such situations. Crebert et al. (2004) describe some major challenges faced by graduates concerning how to learn and function in unfamiliar unpredictable situations and how to cope with multifaceted, multi-skilled, multinational work that requires collaboration, cooperation, flexibility and inter-cultural awareness.

Universities could use workplace socialization theories as a means to understand the behavioural patterns of new or recent graduates and how they respond to uncertain situations. Feldman and Brett (1983) believe there are two such behavioural perspectives namely: stress and career perspectives. The stress perspective helps graduates to perceive and evaluate if unfamiliar situations are a threat to old valued outcomes or an opportunity to achieve new valued outcomes. Many people are able to develop new behavioural patterns to deal with stress. The career perspective helps graduates face uncertainty in new job situations and focuses on expectations they might have about their new job. They are able to respond based on the information they have about their new job and this enables or inhibits their ability to socialize with others at work. Although the IT graduates in the study found it difficult to cope with uncertain and unfamiliar situations they responded to such situations reasonably well and developed their own strategies to deal with the stress and the unfamiliar tasks on hand. Graduates' survival depends on self-confidence, learning on the job, extent of support, learning opportunities, supervision and mentoring or collegial induction and enculturation (Crebert et al., 2004).

Bennett et al. (2000) believe that for new graduates, adjusting and adapting to the workplace environment results in the form of a "culture shock". This is where universities could assume some responsibility and better prepare graduates to face new, unfamiliar situations when they first enter the workforce. However, there is a limitation in that the educational experiences of graduates can provide

them only with propositional knowledge (that is knowledge derived from discipline-based theories and concepts) (Eraut, 1994). But there are also other experiences from which people learn from unexpected situations where there is no direct educational purpose. As a result, graduates are expected to develop their own personal cognitive frameworks and their propositional knowledge becomes personalized through the process of being used in different work situations.

Preparation of graduates to learn how to learn

IT workplaces are diverse and this suggests that requirements for work performance are not uniform across workplaces. Brown and Hesketh (2004) argue that professional skills developed during a degree will be of little value if not needed by an employer for a particular job. However it is important to be conscious that the skills needed for a small company are different from those needed by larger ones. Universities cannot design to such a broad spectrum of requirements. Hence employers' expectation that universities should better prepare graduates to fit immediately into IT workplaces are unrealistic. However, universities have the capacity and the potential to educate graduates about diversity, and unfamiliar and uncertain and unknowable situations and prepare them to live in such a world.

Rather than struggling to develop professional skills in IT graduates to suit all IT workplaces, universities could use an alternative approach which fosters flexible attitudes, self-autonomy, learning capacity and personal entrepreneurship in graduates (Meager, 2001). For example, simulated projects, internships, work placement experiences, role plays, team work and problem-solving tasks during project work or assignments could be strategies used to develop 'self-learning' skills. Many Australian IT degrees contain some or all of these approaches but many do not.

In the IT workplace, the graduates in our study sometimes learned to deal with workplace issues through support from peer groups and supervisors. But on most occasions they found themselves in situations they had to resolve themselves. While most of them coped with it well, they believed that it would have been beneficial if they had had exposure to such real work experiences during their university studies. This observation from the findings suggests that students needed more preparation on how to learn while at work. Work placements provide opportunities to develop situational knowledge.

According to Eraut (1994), situational knowledge is knowledge about how people 'read' the situations in which they find themselves. People learn about situations by being in them rather than studying them. For example, it might be difficult to achieve cultural diversity within assignment or project groups within a university project subject. This diversity in (age, gender, culture, hierarchy) is naturally present in many workplaces. Hence work placements have the ability to enhance the quality of the studying experiences for graduates and assist them to gain first hand experience with working in diverse groups of people from IT and other sectors.

IT graduates understood they have to learn many things at work to carry out their daily tasks. However they found that the concept of 'learning' at work was different from the 'learning' they did at university. Eraut (1994) says one has to be a professional learner to become an effective learning professional. He states that how people use the knowledge they have already acquired depends on learning knowledge and using knowledge and that these two are not separate processes but a single process. Therefore, universities have a responsibility to assist graduates to become professional learners so they can learn effectively while at work, acquire knowledge and use this knowledge.

Increase students' knowledge and awareness of workplace environments

IT graduates in the study liked to work with groups or friends of the same age. They did not like open problems. Graduates need to realise that the real world is not often like this. A university approach is to put IT project students groups that mix diverse personalities and skills to resemble project teams at

workplaces. Project work and assignment problems could be open and intentionally ambiguous. Problems that have multiple solutions force graduates to think hard, justify how they make their choices, require them to consult and cooperate with their team members in decision-making and, more importantly, to learn that real world problems do not always have a single simple solution. Students should realise that the choice of solutions depends on the context, resources and individuals involved. Sometimes, even when small changes to a problem occur, large changes are required to the solution. In such situations, it is important for graduates to rely on known strategies and not engage in speculative problem-solving strategies (Eraut, 1994). In IT courses, academics or the project supervisor can revise the scope, time and budget of IT projects for student teams. Such situations can help students develop skills to deal with project changes and enhance their problem solving abilities. Eraut (1994) believes students must be able to develop broader vision, view or analyse different perspectives, see many courses of action and be in a position to handle multiple interpretations. He says that courses should avoid being too narrow or prescriptive. Crebert et al. (2004) state that problem solving skills can be enhanced in graduates if universities take input from employers as to their needs and in setting open problems for university projects where several solutions may exist (as in the real world).

Assist IT graduates with initial job expectations

Several studies into graduates' initial job expectations show there is a mismatch between their expectations and reality. Losyk (1997) and Montana and Lenaghan (1999) asked generation Xers about expectations of employers. The graduates in their studies wanted the freedom to work with minimal supervision, wanted guidelines and access to management if they had questions or needed direction. They also preferred a highly unstructured, flexible work environment but wanted basic guidelines such as month by month learning and outcomes to the year. They prefer their fellow workers to be like them. Crebert et al. (2004) believe that graduates' expectations have increased rapidly because recruitment agencies often exaggerate some of the extra benefits and offers (world travel, club memberships, etc.) attached to job opportunities. However, graduates often have routine poorly paid less interesting jobs and, as a result, the graduates feel frustrated. Universities should use internships, practical work examples, simulated project work, business speakers, and career services to provide graduates with knowledge about the nature of the IT workplaces and what to expect during their first few years of employment. Many IT faculties at Australian universities have been using all or some of these approaches successfully.

Development of well-rounded global graduates

Universities could also be responsible for developing graduates who can fit into global workplaces. Fuller and Scott (2009) discuss the need for global graduates and the development of job-readiness and employability skills in a global context and not just the local context. They claim job-ready and employable graduates are those who possess strong generic skills as well as strong professional qualifications through completion of a university degree. This is very relevant for the IT industry. IT graduates need the ability to work across different cultures and understand the global nature of business. Furthermore, information technology has now permeated all other industry sectors and the professional skills required for IT graduates are not just restricted to the IT sector but must be transferred across many different industries and sectors. Universities can encourage students to cross their discipline boundaries and learn to embrace other disciplines and then to explore the relevance of their own course learning outcomes beyond university because this is the attitude employers are increasingly seeking.

Maximise and utilise diversity in the university environment to assist IT graduates develop cultural awareness and social and cultural skills

Graduates need skills to work with people from different industry sectors, people from different age groups and with different experience levels in the workplace hierarchy. Universities should encourage

collaboration between students in different disciplines and promote and facilitate socialization between students from different courses both on academic as well as cultural and social issues. While forming IT project groups it is ideal to have a good mix of students from different age groups, with or without previous work experience either related or unrelated to IT. Diversity teaches students that other students arrive at university with different stages of maturity and that they react differently to different experiences and that there might be similar encounters in real work situations.

Within Australian universities, particularly in IT departments, both staff and students come from a diverse range of ethnic and cultural backgrounds. It is important to utilize this diversity to help develop the social and cultural skills of IT students during their university studies. Cultural awareness and being able to work with cultures is a professional skill that many IT graduates believe that they need at their work. This is because the IT industry is global, multi-national and involves clients and peers from around the globe from different cultures. Universities should do more to develop cultural awareness and the ability of graduates to work in a global environment. Oliver et al. (2007b) found that employers surveyed in their study highlighted that their graduates lacked an international perspective and intercultural understanding. They state that graduates with international perspectives are able to consider how issues might impact on people in other parts of the world and graduates with intercultural perspectives are able to consider how issues might impact on people from other cultures. Encouraging participation of students in planning and conducting major events on campus, inter cultural events or cross cultural groups in sports, social events, debates, etc. while at university will provide graduates with some opportunities to increase their cultural understanding and development of socio-cultural and professional skills.

Overcoming language barriers and using appropriate communication styles are also essential skills required when working with people from different cultures. In addition, IT graduates need to be aware of local customs and practices when they go on overseas business trips. The majority of IT graduates who participated in the study highlighted the significance of these cultural skills. However it is surprising to notice that there is no direct reference to the development of skills required to work across different cultures in the graduate attributes used in many universities. Even in the case where there is an indirect mention, there is no assurance that such skills are translated into learning and assessment resources. IT faculties need to ensure that the IT curriculum prepares graduates to work with people from different cultures and beliefs. As outlined above, IT departments need frameworks beyond the current common graduate attributes to assist the development of well-rounded global graduates.

Certain IT work skills can be developed only in practice sites

IT graduates in our study indicated that they need many business skills at work and that those skills were not developed sufficiently at university. Some business skills such as understanding business needs and knowledge of organization procedures can be developed only when at the graduates are in the workforce. It is hard for such skills to be developed at university. Work placement experiences might assist in the development of these skills to some extent. While many employers see such placements as a potential source of staff, others may need incentives perhaps for their development of senior supervising staff to take on such placements. However, Business skills are still more likely to be developed when IT graduates are in employment following graduation.

Most employers value teamwork, interpersonal, spoken communication, ability to prioritise tasks and problem solving skills in graduates. Many of these skills can be developed at university through individual subjects, project work and work placement. However, contextualising those tasks that involve generic skills to a profession is important so a student sees the relevance of those tasks to their future employment. Also many employers assume these skills are sufficiently developed at university. However, many of these skills such as critical thinking and conflict resolution take a long time to develop and need some years of job experience.

IT graduates believe that more exposure to the industry through multiple work placements is vital to pick up many work ready skills. Opportunities could be provided within work placements while at university to develop teamwork skills through project work, group work, presentations and debates. Other strategies such as the use of case study exercises and problem-based learning provide problem solving skills (Fallows and Steven, 2000). Some universities need to increase their industry connections and expose students to the business world throughout their university studies so students do not experience 'culture shock' when they commence work. Rather than expecting that IT graduates must have work ready skills, employers have a responsibility to assist in the development of these skills when graduates first commence work. It is not sufficient to assess such skills in a subject at university and decide that the students have acquired those skills (Yorke and Knight, 2006).

Conclusion

University IT faculties, employers and graduates have different contributions to make to the development of professional skills of IT graduates. IT education needs each of the players to accept its responsibility and cooperate with the others. This paper discussed the role of universities and how they can contribute to the development of professional skills of IT graduates. However, employers as well as graduates also have a major role as some professional skills can be acquired only from practice sites over time. An issue highlighted by our research is the lack of preparation of IT graduates to face new, unfamiliar or unknown situations. Professional faculties in universities have a responsibility to prepare graduates to learn how to learn in such uncertain situations, to assist with the development of a knowledge of work environments and initial job expectations, and the skills for self-directed learning beyond graduation. A discussion on the inadequate coverage of some skills such as cultural awareness illustrated that IT faculties need frameworks beyond existing graduate attributes in their IT degrees for the development and inclusion of specific professional skills for the IT workplace.

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