Understanding the career development and employability of information technology students

Citation of the final article:

McKenzie, Sophie, Coldwell-Neilson, Jo and Palmer, Stuart 2018, Understanding the career development and employability of information technology students, *Journal of applied research in higher education*, vol. 10, no. 4, pp. 456-468.

DOI: https://doi.org/10.1108/JARHE-03-2018-0033

This is the peer reviewed accepted manuscript.

Understanding the career development and employability of Information Technology students

Abstract

Purpose: The purpose of this paper is to assess the career development and employability needs of undergraduate Information Technology (IT) students' at an Australian University, and their relation to students' career interest. While many factors and stakeholders contribute to student career development, this study focused specifically on the student experience. Social cognitive career theory (SCCT) is used as an approach to understand the students' needs of career development and employability.

Methodology: An online survey was completed by 126 IT students to record information about students' career development and employability background and needs.

Findings: The results demonstrate that SCCT helps understand the factors that impact on IT students' career development, with their outcome expectations and self-efficacy informed by prior studies in IT and their need for access to 'IT professionals' to contribute towards their career interest. In addition, IT students rely on academic achievement and experiential learning, rather than career resources, to guide their career development and employability.

Research limitations: The data collected in this study are limited to one discipline (IT) at one university, which necessarily limits the generalizability of the specific results.

Practical implications: Career development is a complex, life-stage-dependant and discipline-specific process that varies for every decision maker. This research makes an important contribution in presenting the IT student experience and demonstrates how an appropriate career development model can help understand students' needs. This outcome will help educators better support IT students to build the career interest.

Originality: This study explored the often-overlooked student experience of career development, providing valuable insight into IT students' needs.

Keywords: Career choice; career development; employability; Information Technology; higher education.

1. Introduction

A career can be thought of as a multi-faceted, complex, personal process that evolves over a person's life-span, and is influenced by dynamic interactions amongst personal, interpersonal, societal, and environmental factors (Patton and McMahon, 2006). At the heart of career development is personal growth, and when actively included in the curriculum of higher education, it can assist life-long learning and employability (McIlveen *et al.*, 2011). However, preparing graduates for the world of work is difficult. Information Technology (IT) as a discipline is in a state of constant change due to the pace of technological development, resulting in no clear picture of possible professional career opportunities (Koppi and Naghdy, 2009, p. 14; Byars-Winston, 2014; Hajkowicz *et al.*, 2016).

It was reported in the Australian Labour Market Update (Australian Government, 2016a), that 10,000 positions in IT were created between June 2015 and June 2016. The Graduate Outlook report by Graduate Careers Australia (2016) reported that for the sixth consecutive year graduates from IT were in especially high demand. However, it is becoming increasingly complex for IT graduates to negotiate the various and changing job roles that make up the IT industry, with a reported gap between employer expectations and graduate profiles (Webster *et al.*, 2016). According to Meijers and Kuijpers (2014, p. 297) "career paths have become unpredictable and research and practice show that it is no longer possible to make career choices in a purely rational and information-based way". In 2014, approximately 41 per cent of employers had difficulty sourcing enough graduates for open positions and found that IT graduates, while in demand in the employment market, often do not have adequate skills or career maturity to enable them to successfully engage with employers (Graduate Careers Australia, 2015; Australian Government, 2016b; Chlopicki, 2017). Career maturity is the ability to make age-appropriate, informed decisions that contribute to sound career choice decisions (Betz and Luzzo, 1996).

The purpose of this paper is to assess the career development and employability needs of Information Technology undergraduate students'. Understanding factors specific to IT students will inform application of a model of career development that best nurtures their career interests.

2. The Discipline of IT

IT as a profession continues to grow, with approximately eight per cent increase in employment opportunities during the period of July 2016 to July 2017 (Australian Government, 2017b). Deloitte (2017) predicts that for 2017 to 2020 an additional 722,000 workers will be needed in Australia. Employers continue to place a high value on workers who have a mix of technical Information Communication Technologies (ICT) capabilities and general enterprise skills (Deloitte, 2017). In addition, evidence indicates that employers, including those in IT, recruit for skills/competencies and experience as well as grades (Graduate Careers Australia, 2013; Webster et al., 2016). Furthermore, employers are looking for IT graduates with a mix of technical and business skills (Deloitte, 2016). The need for a mix of skills was reinforced by the Australian Chief Scientist in a recent ICT education forum (Australian Government, 2016b). A report by Graduate Careers Australia (2015) concluded that employers value interpersonal and communication skills as highly as discipline-specific skills. This was supported by research conducted by Carbone *et al.* (2015), which investigated employer, student, and academic perspectives on employability skills and found that generic skills were as important as technical skills. This requires graduates to maintain non-technical, as well as technical skills within a complex web of industry requirements, accreditation board statements, and university learning statements on graduate abilities (Jackson, 2009). In terms of roles, the 2017 graduate outcomes survey showed that for IT, 65 per cent of graduates were employed as

IT Professionals (programmers/ developers, business and system analysis, sales etc.) (Australian Government, 2017a)

IT curricula offered at universities focus on a core body of knowledge, with various specialist discipline streams and relevant 'soft skills', such as communication and teamwork. Stemming from the knowledge base of computer science, IT education now addresses many modern technology innovations such as mobile application development, games development, and IT security. Commenting on the Institute of Electrical and Electronics Engineers curriculum guidelines, a globally recognised curriculum framework for computer science and IT, Lunt *et al.* (2008) noted that IT is the newest discipline covered by the computing curricula. Alford *et al.* (2004) detailed the differences between an IT and computer science curriculum, and identified trends relevant in each type of program. For IT, this included skills such as problem solving, project experience in software system integration, system management, end user support, and fundamental principles of science and mathematics. Debate around the core body of knowledge required in IT education is ongoing, but to retain relevance, universities must remain cognisant of industry and professional society recommendations and requirements.

3. Career Development Learning

Career development is the ongoing process of managing life, learning and work (Australian Government, 2013). Implementing and evaluating career development programs for young people and adults has been presented in the National Career Development Strategy (Australian Government, 2013) in the Australian Blueprint for Career Development constructed by the Ministerial Council for Education, Early Childhood Development and Youth Affairs (MCEECDYA, 2010). According to the Blueprint, students at university should be at an advanced stage of career development and be able to self-manage their career so as to understand, and engage a career building process that supports an effective choice/goal setting

in their discipline. To assist students in managing career choice, a career development model should consider: the internal process of decision-making; the developmental and personal characteristics of the decision maker; and the environmental and social-cognitive influences (social interactions, experiences, and outside media influences) (Harren, 1979; Bandura, 1986; Hackett and Betz, 1981; Lent *et al.*, 1994). In addition, Crites (1978) and Super (1980) asserted that different developmental phases impact upon the construction of career maturity. Whiston *et al.* (2015) argued that understanding factors relevant to a person's life-stage is important for informing what opportunities for career counselling should be provided.

A common approach to support career development is social cognitive career theory (SCCT) (Lent et al., 1994). SCCT has been utilised as a way to characterise career development of students and explain both academic and career behaviours (Smith, 2002; Janz and Nichols, 2010). SCCT considers individual cognitions, background, psychosocial states and learning experiences as well as economic and sociological factors to explain the acquisition of career development attributes (Lent et al., 1994). SCCT is a derivative of social cognitive theory, as proposed by Bandura (1986). SCCT is a particularly useful framework as it incorporates environmental and contextual factors to help understand an individual's career development, yet few studies have applied it within the IT discipline (Lent *et al.*, 2008). SCCT outlines that people generate career interests by developing confidence in activities related to the interests (i.e. self-efficacy) and by learning that outcomes for them are contingent on the effort expended (i.e. outcome expectations). In addition, career supports and barriers influence development of career interest. As interests develop, students "(re)conceptualise their strengths, interests and goals" (Bennett, 2012, p. 27) and self-regulate their behaviour towards these goals (Janz and Nichols, 2010; Lent et al., 1994). Increased interest leads to "career curiosity, student engagement and capacity for creativity and problem solving, active agency in the learning domain, and motivation to learn" (Bennett *et al.*, 2016, p. 18). SCCT is relevant as a model of

career development learning in this study because of the way in which it helps us understand the factors that affect student choice regarding career goals or aspirations. In previous studies exploring IT students career aspirations and career development plans, students lack of confidence (or self-efficacy) was identified as a key attribute assisting formation of career choice (McKenzie *et al.*, 2015). Lent et al. (2008) found in their study of undergraduate computer science students that self-efficacy played a major role to either directly or indirectly mediate outcome expectations, career supports and barriers, to form career interest and goals. Overall, it is purported "that career development learning makes higher education meaningful for students by personalising their learning, and enhancing their awareness of the relationships amongst their disciplinary studies, work-related learning, and their personal aspirations" (McIlveen et al., 2011, p. 149). Yet not all students consider career development as an important factor in helping them understand what skills are required for their future careers (Bennett et al., 2016).

4. Employability

There is pressure on higher education institutions to design curricula and learning experiences that provide the greatest chance of employment for graduates (Docherty, 2014; Chlopicki, 2017). In recent years, providers of higher education have focused on the best ways in which courses can develop graduates with skills for employability. Employability skills can be defined as a set of generic and discipline-specific skills or capabilities developed through education and work experience that contribute towards opportunities to secure a relevant job (Australian Government, 2006; van der Heijde, 2014). Watts (2005) asserted that employability is not about employment, but rather the willingness of an individual to maintain and learn new skills regularly. Bennett et al. (2016) argued that employability should have an individual focus, allowing students to determine the requisite skills needed for their chosen career. Models

of employability appear in the literature (Dacre Pool and Sewell, 2007; Qenani *et al.*, 2014; Jollands, 2015; van der Heijde, 2014), however an agreed definition across the disciplines is lacking (Bennett et al., 2016). In IT, employability skills are grounded within institutional graduate learning outcomes (e.g. communication, teamwork) as well as in professional society guidelines (e.g. systems analysis and design, project management) (Australian Computer Society, 2014). By developing employability skills, students are contributing towards building effective career competencies, which are a collection of skills that relate to a chosen profession. For example, in IT, work experience such as programming would contribute to the field-specific competency of a computer systems engineer. As individuals progress through life they build competencies composed of skills learnt from previous experiences or learning activities. To be successful at constructing career-related competencies, interests and goals, an individual needs to reflect upon and self-regulate their activities towards further skill development. To help IT students in developing their career interest, the purpose of this paper is to assess the career development and employability needs of Information Technology undergraduate students'. SCCT is used as a framework to understand the students' needs of career development and employability.

5. Research Questions

To assess IT tertiary learners' career development and employability needs, and how this relates to students' career interest, the following research questions guided this study:

1. What is the career development and employability background of IT students?
2. What career development and employability resources and support do undergraduate IT students need?

6. Methodology

To address the research questions above, an online survey seeking information about career development and employability background and needs was administered to students in an IT program at an Australian university. The survey was advertised to the IT student population through an internal online portal. Student participation was voluntary, resulting in a simple random sample (Everitt and Howell, 2005) of students being obtained. Approval to conduct the research was obtained from the authors' university human research ethics committee. The survey included demographic questions, questions about students' prior education and work experience, and questions about their preferences relating to career and employability resources. Table 1 describes the questions presented in the online survey.

Table 1. Online survey questions on IT students career development and employability

Pre-defined response options in the online survey were based on the results of previous research (McKenzie *et al.*, 2017b) as well as career pathway and development information from Graduate Careers Australia (2015).

The exact, two-sided version of Fisher's test was used to compare the proportions of the demographic variables (gender and mode of study) known in both the respondent group and in the general IT student population. Demographic variables were compared to assess the representativeness of the respondent sample compared to the overall student enrolment. Fisher's exact test makes no assumptions about the source data other than that the variable categories are not associated. The test computes a significance (p) value for the observed proportions of the variable categories in each student group.

The survey response data were analysed to develop a quantitative overview of the prior education and work experience, and the use and needs of career and employability resources for the IT student group under consideration. A composite summary of the descriptive statistics (Creswell, 2014) of respondent data is presented in this paper. Further analysis of survey data

using statistical techniques (such as Fishers Exact Test, and Chi-Square) was undertaken to compare variables. However, comparative analysis is not explored in this paper, with the composite summary used to inform exploration of students' career development and employability needs.

The data collected in this study are limited to one discipline (IT) at one university. The limited group sampling, as well as the particular strategic vision and teaching and learning practices adopted within the university, will limit the generalizability of the results.

7. Results

In 2015, 165 IT students responded to the online survey. Of the 165 student responses, 159 (106 male and 53 female) were completed in full, making them viable for analysis. Within the sample, 126 students reported being enrolled in an IT program, with the remaining 34 students reporting being enrolled in a program from science, education or engineering. Focusing on the students from an IT program, the age range was 18 to 51 years (33 years). Mean age was 26.02 years, Median age was 23 years with standard deviation 7.47 years. Of the 126 students 34 were female, 92 were male.

Table 2 shows cross tabulations of gender and mode of study for the respondent sample and the enrolled population, and the resultant significance values.

Table 2. Fisher's exact test for gender and mode of study

To explore IT students' career development and employability background, prior education and work experience were investigated. 61 per cent of respondents came to university from an alternative pathway (such as from Technical and Further Education (TAFE) studies), with 39 per cent identifying as coming to university straight from secondary school or after a short period of work experience (casual or part-time employment). Of those who identified as coming to university from an alternative pathway, 30 per cent reported TAFE as their highest

level of education, with 21 per cent reporting partial achievement of a university course as their highest level of education. Other forms of education, noted by students included: master's degree, bachelor's degree, associate degree, and diploma. In regards to current employment status, 79 per cent of students identified as not being employed in IT, yet 63 per cent had an IT industry/network connection (know someone who works in IT). Twenty five per cent of students had no IT industry connection, with the remaining 12 per cent not sure if they had any such connections. In regards to who influenced students' decision to study IT at university, 65 per cent reported 'myself' as the primary reason, with 'a general interest' as the second influence for studying IT. Overwhelmingly, 82 per cent of students identified as having no prior work experience before coming to university. In regards to the importance of work experience, 62 per cent of students rated it as 'very important' with 25 per cent as 'important', eight per cent as 'somewhat important', with five per cent rating it as 'of no importance'.

In regards to career and employability resources, students currently use a variety of resources to assist their career development. Students could respond to this question by selecting more than one answer. The results here included: 16.5 per cent used internal online career resources, 16.5 per cent used career activities in class, 15 per cent asked their teachers for career assistance, 15 per cent curated an online career portfolio, 12.5 per cent used resume services. Interestingly, 13.5 per cent did not currently use any career resources. Figure 1 shows that career and employability resources students perceived as being helpful to their career development. Shown as a percentage of responses, the data in Figure 1 are ranked on the basis of required employability resources reported by respondents.
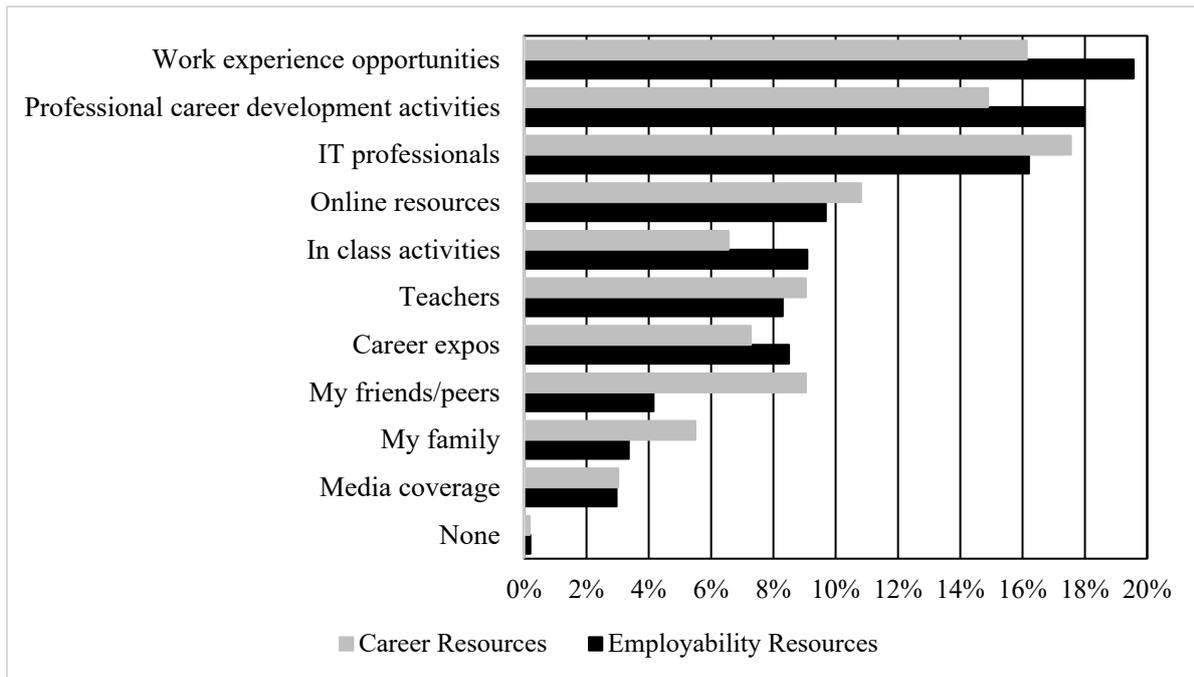
Figure 1. IT students required Career and Employability resources

In regards to the importance of career activities, 40 per cent of students rated them 'very important' with 38 per cent rating 'important', 17.5 per cent rated it 'somewhat important', with four per cent rating it 'of no importance'.

8. Discussion

To explore IT students' career interest, SCCT is used as a framework to understand the needs of career development and employability of the respondent group. Students in this study represented a wide age range (33 years). Furthermore, Table 2 shows that there was a significant difference between the respondent group and the overall program enrolment in regards to the demographic dimensions of gender and study mode. The results show female students and off-campus students were over-represented in the respondent sample. The wide age range and the significant differences observed for the demographic variable leads the results to be treated with caution. Despite the limits in the sample, the results provide a description of the career development and employability background of students.

The results presented in this study address research question one, showing IT students have varied career development and employability backgrounds indicating that career interest is developed in a number of ways. Specifically the results showed that prior IT studies as well as self-interest, directed students to study IT at university. Islam *et al.* (2015) asserted that when a student selects their program of study based on interest, this interest can transform into career choice. SCCT indicates that developing confidence in activities impacts upon interest. Moakler and Kim (2014) argued that domain specific confidence has a great influence on career choice, which highlights that IT students may build career confidence through academic achievement in prior IT studies. To maintain and build on their career development while at university it is important to support IT students' confidence in relation to their learning activities and career efforts.

Further to help address research question one, the results show that many students had not completed work experience before coming to university to study IT, but 87 per cent rated work experience as important to complete as a part of their studies. In addition, Figure 1 shows 'work experience opportunities' recorded as the top employability resource desired by IT students. In relation to SCCT this result indicates that IT students' outcome expectations regarding the labour market are still developing. Undertaking work experience as a way to form realistic expectations regarding work requirements is also supported by the literature (Qenani et al., 2014; Koppi *et al.*, 2010; Australian Government, 2006; Dacre Pool and Sewell, 2007; van der Heijde, 2014; Patton, 2005). Qenani et al. (2014) argued that it is important for students to take advantage of internship opportunities and combine these experiences with career development activities, such as careers counselling, to help them progress their career maturity.

The results presented in this study address research question two, showing that IT students have varied career development and employability resource needs, and indicating that career interest

needs to be supported in a number of ways. Specifically, Figure 1 shows that IT students rated interaction with 'IT Professionals' as an important career resource. 'IT Professionals' as a career resources is defined as a guest lecture or a networking event where students interact with those currently working in the IT industry. Learning from industry professionals can provide a better interface with the labour market (Watts, 2005; Islam et al., 2015) and as Meijers and Kuijpers (2014) found, "networking proves to be related to the development of a career identity and certainty of career choice" (p. 306). In addition, Figure 1 shows that IT students rated 'work experience' as a key employability resource. The results in Figure 1 indicate that IT students do not strongly utilise class-based or university provided career resources to extend their career interest, rather students need their self-efficacy validated by external resources. In relation to SCCT, self-efficacy is a person's belief in their ability to achieve in a specific situation or accomplish a task (Lent et al., 1994). Self-efficacy of IT students is also impacted by other barriers, such as personal and emotional issues (McKenzie et al., 2015). Lent et al. (2008) asserted that self-efficacy plays a large role in mediating IT students' confidence and interest. The result of this study contrast to the findings reported by Bennett et al. (2016) who when exploring the student perspective of graduate employability, found that 63 per cent of students reported that they had looked towards educators for career development.

When developing career choice it is important for students to develop their interests and skills that are relevant for the area/discipline that they intend to work in (MCEECDYA, 2010). McIlveen et al. (2011) argued that career development learning can help students derive more meaning from their disciplinary studies, helping them understand how their studies contribute to the formation of career competencies. Watts (2005) stated that discipline-specific models of career development can provide a more effective form of service delivery that goes beyond providing career advice, but assists students to acquire knowledge, skills, and attitudes that will help them make better career choices and transitions. A discipline-specific model for career

development in IT requires students to navigate a university curriculum, a core body of knowledge specified by professional societies, as well as industry requirements (Lunt et al., 2008; Australian Computer Society, 2014) so as to best prepare themselves for the working world. IT employers are seeking graduates who have generic, discipline and business skills (van der Heijde, 2014). Students also need to build their interpersonal and communication skills (Deloitte, 2016; Graduate Careers Australia, 2016). While the Blueprint (MCEECDYA, 2010) asserts that during their time at university students should be at an advanced stage of career development, the results here demonstrate that the IT students in the group studied need assistance to inform their career interest and may not be at an advanced level.

The results of this study, framed within SCCT, can inform practical strategies for fostering more effective choice behaviour in undergraduate IT students. Appreciating students' backgrounds and assessing their resources requirements helps educators better facilitate IT students' career development and employability needs. Specifically, IT students require activities such as industry interaction, work-place experience and confidence building activities to support their self-efficacy and outcome expectation. The value of career development needs to be embedded within classroom activity, and further engagement by IT students with career development resources provided by the university is likely to be helpful in achieving this. Developing the career interest of IT students, in addition to asking students to reflect on skills, could assist IT students to make their time at university influential to construction of their career identity (Bennett et al., 2016; Meijers and Kuijpers, 2014). Overall, to enable students to make quality decisions and appropriate transitions to support their career and build their employability, career guidance should be made centre stage (Watts, 2005).

9. Conclusion

Limitations of this research is that the data collected were from one discipline (IT) at one university and this approach may influence the generalizability of the results. Despite the limits, the information assists to assess the student experience of career development and employability and highlights their needs in regards to resources to assist building career interest. Koppi and Naghdy (2009) argued that more research is needed that considers IT students' experience of employability and their careers. When exploring the student experience, personal and situational factors such as age and prior experience help to inform career maturity (Meijers and Kuijpers, 2014). This research also builds on prior studies that explored IT students' career aspirations and skill development (McKenzie *et al.*, 2017a). Together the studies paint a picture of IT students' career development and employability needs. IT students have a number of different aspirations and come from various pathways to enter university, with most having limited work experience. The results also show that students study IT due to prior studies and self-motivation and require varied career and employability resources to assist with their career interest. Specifically, IT students anticipate their outcome expectation to be developed during their time at university, and look towards IT professionals to inform their career outlook. In addition, self-efficacy plays an important role for IT students to mediate outcome expectations and interest towards career choice (Lent et al., 2008). Overall, IT students rely on academic achievement and experiential learning, rather than career resources, to guide their career development and employability. SCCT can provide a general and flexible approach to career development of IT students, supporting their varied characteristics and needs.

Future research is required to evaluate the needs and beliefs of students studying IT at other universities to determine the applicability to the career development factors to other situations.

Taking an approach that explores the developmental and environmental characteristics, as well

as required resources, a clearer picture of student need can be developed across the sector.

References

Alford, K.L., Carter, C.A., Ragsdale, D.J., et al. (2004) Specification and managed development of information technology curricula. *SIGITE'04.* Salt Lake City, Utah, USA: ACM, 261-266.

Australian Computer Society (2014), *Skills framework for the information age (SFIA)*, Available at: https://www.acs.org.au/content/dam/acs/acs-skills/The-ACS-Core-Body-of-Knowledge-for-ICT-Professionals-CBOK.pdf (accessed 19th February 2018).

Australian Government (2006), *Employability skills framework*, Available at: http://www.education.vic.gov.au/Documents/school/teachers/teachingresources/careers/employabilityskills1.pdf (accessed 19th February 2018).

Australian Government (2013), *National career development strategy*, Available at: https://docs.education.gov.au/system/files/doc/other/national_career_development_strategy.pdf (accessed 19th February 2018).

Australian Government (2016a), *Australian labour market update*, Available at: https://docs.employment.gov.au/system/files/doc/other/almu_january_2016.pdf (accessed 19th February 2018).

Australian Government (2016b), *Building productive industry-university collaboration in ICT*, Available at: http://www.chiefscientist.gov.au/2016/05/communique-building-productive-industry-university-collaboration-in-ict/ (accessed 19th February 2018).

Australian Government (2017a), *2017 Graduate Outcomes Survey: National Survey*, Available at: https://www.qilt.edu.au/docs/default-source/gos-reports/2017/2017_gos_national_report_final_accessiblea45d8791b1e86477b58fff00006709da.pdf?sfvrsn=ceb5e33c_4 (accessed 12th February 2018).

Australian Government (2017b), *Australian Labour Market Update: July 2017 Hot Topic: The Labour Market Experience of Recent Migrants*, Available at: https://www.employment.gov.au/australian-labour-market-update-publication (accessed 19th February 2018).

Bandura, A. (1986), *Social foundations of thought and action: A social cognitive theory*, Prentice-Hall, Englewood Cliffs NJ.

Bennett, D. (2012), *The TILE Approach: making the link between future selves and learning*, Available at: http://altf.org/wp-content/uploads/2016/08/Bennett_D_TF_Fellowship-report-2013.pdf (accessed 13th February 2018).

Bennett, D., Richardson, S. and MacKinnon, P. (2016), *Enacting strategies for graduate employability: How universities can best support students to develop generic skills:*

Part A, Available at: http://www.olt.gov.au/project-how-universities-can-best-support-students-develop-generic-skills-enacting-strategies-gradua (accessed 13th February 2018).

Betz, N. and Luzzo, D. (1996), "Career assessment and the career decision-making self-efficacy scale", *Journal of Career Assessment*, Vol. 4, pp. 413-428.

Byars-Winston, A. (2014), "Toward a Framework for Multicultural STEM-Focused Career Interventions", *The Career Development Quarterly*, Vol. 62 No. December 2014, pp. 340–357.

Carbone, A., Hamilton, M. and Jollands, M. (2015) Moving towards the future of teaching pedagogies and learning paradigms: Understanding the 21st century employability challenges in the ICT industry. *9th International Conference on Researching Work and Learning RCL2015.* Singapore: Institute for Adult Learning, 1-17.

Chlopicki, K. (2017), *Graduates told they lack the skills for jobs*, Available at: https://www.campusreview.com.au/2017/09/graduates-told-they-lack-the-skills-for-jobs/ (accessed 19th February 2017).

Creswell, J. (2014), *Research Design: Qualitative, Quantitative and Mixed Methods Approaches*, SAGE Publications Inc, California.

Crites, J.O. (1978), *Career maturity inventory*, CTB/McGraw Hill, Monterey, CA.

Dacre Pool, L. and Sewell, P. (2007), "The key to employability: Developing a practical model of graduate employability", *Education + Training*, Vol. 49 No. 4, pp. 277 - 289.

Deloitte (2016), *Australia's digital pulse: Developing the digital workforce to drive growth in the future*, Available at: https://www2.deloitte.com/au/en/pages/economics/articles/australias-digital-pulse.html (accessed 13th February 2018).

Deloitte (2017), *Australia's Digital Pulse: Policy priorities to fuel Australia's digital workforce boom*, Available at: https://www.acs.org.au/content/dam/acs/acs-publications/Australia's%20Digital%20Pulse%202017.pdf (accessed 13th February 2018).

Docherty, D. (2014), *Universities must produce graduates who are ready for any workplace*, Available at: http://www.theguardian.com/higher-education-network/2014/may/22/universities-must-produce-graduates-who-are-ready-for-workplace (accessed 19th February 2018).

Everitt, B. and Howell, D. (2005) Simple Random Sampling. *The Encyclopedia of Statistics in Behavioral Science.* John Wiley & Sons, Ltd.

Graduate Careers Australia (2013), *Graduate outlook 2012 the report of the graduate outlook survey: Employers' perspectives on graduate recruitment*, Available at: http://www.graduatecareers.com.au/wp-content/uploads/2013/02/GOS12_Report_FINAL1.pdf (accessed 19th February 2018).

Graduate Careers Australia (2015), *Snapshot: Graduate outlook 2014*, Available at: http://www.graduatecareers.com.au/wp-content/uploads/2015/06/Graduate_Outlook_2014.pdf (accessed 13th February 2018).

Graduate Careers Australia (2016), *Graduate Outlook 2015*, Available at: http://www.graduatecareers.com.au/wp-content/uploads/2016/07/Graduate-Outlook-Report-2015-FINAL1.pdf (accessed 19th February 2018).

Hackett, G. and Betz, N.E. (1981), "A self-efficacy approach to the career development of women", *Journal of Vocational Behavior*, Vol. 18, pp. 326-339.

Hajkowicz, S., Reeson, A., Rudd, L., et al. (2016), *Tomorrow's Digitally Enabled Workforce: Megatrends and scenarios for jobs and employment in Australia over the coming*

twenty years, Available at: https://www.acs.org.au/content/dam/acs/acs-documents/16-0026_DATA61_REPORT_TomorrowsDigiallyEnabledWorkforce_WEB_160128.pdf (accessed 12th February 2018).

Harren, V. (1979), "A model of career decision making for college students", *Journal of Vocational Behavior*, Vol. 14, pp. 119-133.

Islam, T., Ahmed, I., Khalifah, Z., et al. (2015), "Graduates' expectation gap: the role of employers and Higher Learning Institutes", *Journal of Applied Research in Higher Education*, Vol. 7 No. 2, pp. 372-384.

Jackson, D. (2009), "An international profile of industry-relevant competencies and skills gaps in modern graduates", *International Journal of Management Education*, Vol. 8 No. 3, pp. 29 - 58.

Janz, B.D. and Nichols, E.L. (2010) Meeting the demand for IT employees: Can career choice be managed? *SIGMIS-CPR'10, May 20–22.* Vancouver, BC, Canada: ACM.

Jollands, M. (2015) A framework for graduate employability adapted for discipline differences. In: Thomas T, Levin E, Dawson P, et al. (eds) *HERDSA Research and Development in Higher Education: Learning for Life and Work in a Complex World Vol. 38.* Melbourne, Australia: Higher Education Research and Development Society of Australasia.

Koppi, T., Edwards, S., Sheard, J., et al. (2010) The case for ICT work-integrated learning from graduates in the workplace. *12th Australasia Computing Education Conference ACE 2010.* Brisbane Australia: Australian Computer Society.

Koppi, T. and Naghdy, F. (2009), *Managing educational change in the ICT discipline at the tertiary education level: Final report*, Available at: http://www.olt.gov.au/resource-library?text=ICT (accessed 13th February 2018).

Lent, R.W., Brown, S.D. and Hackett, G. (1994), "Towards a unifying social cognitive theory of career and academic interest choice and performance", *Journal of Vocational Behavior*, Vol. 45, pp. 79-122.

Lent, R.W., Jr, A.M.L., Lopez, F.G., et al. (2008), "Social cognitive career theory and the prediction of interests and choice goals in the computing disciplines", *Journal of Vocational Behavior*, Vol. 73 No. 1, pp. 52-62.

Lunt, B.M., Ekstrom, J.J., Gorka, S., et al. (2008), *Curriculum guidelines for undergraduate degree programs in information technology*, Available at: https://www.acm.org/education/curricula-recommendations (accessed 13th February 2018).

MCEECDYA (2010), *Blueprint: Australian Blueprint for Career Development*, Available at: https://docs.education.gov.au/system/files/doc/other/australian_blueprint_for_career_development.pdf (accessed 13th February 2018).

McIlveen, P., Brooks, S., Lichtenberg, A., et al. (2011) Career development learning frameworks for work-integrated learning. In: Billett S and Henderson A (eds) *Developing learning professionals: Integrating experiences in university and practice settings.* Dordrecht: Springer, 149-165.

McKenzie, S., Coldwell-Neilson, J. and Palmer, S. (2015) Developing career aspirations of Information Technology students at Deakin University. In: Thomas T, Levin E, Dawson P, et al. (eds) *Research and Development in Higher Education: Learning for Life and Work in a Complex World.* Melbourne, Australia 6 - 9 July 2015, 331-343.

McKenzie, S., Coldwell-Neilson, J. and Palmer, S. (2017a) Career aspirations and skills expectations of undergraduate IT students: Are they realistic? *Research and Development in Higher Education: Curriculum Transformation.* Sydney, Australia, 28 - 30 June 2017

McKenzie, S., Coldwell-Neilson, J. and Palmer, S. (2017b), "Informing the career development of IT students by understanding their career aspirations and skill development action plans", *Australian Journal of Career Development*, Vol. 26 No. 1, pp. 14-23.

Meijers, F. and Kuijpers, M. (2014), "Career learning and career learning environment in Dutch higher education", *Journal of Applied Research in Higher Education*, Vol. 19 No. 6, pp. 700-717.

Moakler, M.W. and Kim, M.M. (2014), "College Major Choice in STEM: Revisiting Confidence and Demographic Factors", *The Career Development Quarterly*, Vol. 62 No. June 2014, pp. 128–142.

Patton, W. (2005), "Coming of Age? A review of career guidance policy and practice in Australia", *International Journal for Educational and Vocational Guidance*, Vol. 5 No. 2, pp. 217-227.

Patton, W. and McMahon, M. (2006), *Career development and systems theory: Connecting theory and practice*, Sense Publishers, Rotterdam.

Qenani, E., MacDougall, N. and Sexton, C. (2014), "An empirical study of self-perceived employability: Improving the prospects for student employment success in an uncertain environment", *Active Learning in Higher Education*, Vol. 2014, pp. 1-15.

Smith, S.M. (2002), "The role of social cognitive career theory in information technology based academic performance", *Information Technology, Learning, and Performance Journal*, Vol. 20 No. 2, pp. 1-10.

Super, D.E. (1980), "A life-span, life-space approach to career development", *Journal of Vocational Behavior*, Vol. 16, pp. 282-298.

van der Heijde, C.M. (2014), "Employability and self-regulation in contemporary careers", *Psycho-social Career Meta-capabilities*, Vol. 2014 No. Dynamics of contemporary career development, pp. 7-17.

Watts, A.G. (2005), "Career Guidance Policy: An International Review", *The Career Development Quarterly*, Vol. 54 No. September 2005, pp.

Webster, G., Smith, S. and Smith, C. (2016), "Supporting students' transitions to placement and work", *New Directions in the Teaching of Physical Sciences*, Vol. 11 No. 1, pp. 1-7.

Whiston, S.C., Feldwisch, R.P., Evans, K.M., et al. (2015), "Older Professional Women's Views on Work: A Qualitative Analysis", *The Career Development Quarterly*, Vol. 63 No. June 2015, pp. 98–112.