Skills Action Plan V3 2015

Australian Council of Deans of Information and Communications Technology (ACDICT)

Revised ACDICT Action Plan on ICT Skills

Executive Summary and Recommended Actions

While many factors contribute to the shortage of skilled ICT workers in Australia, improved education at all levels of the educational spectrum is key to addressing the shortage. As the peak academic body representing ICT education in Australia, ACDICT's role in responding to the ICT skills shortage lies in the contribution it can make to education in a range of areas. The relevant areas and ACDICT actions are summarised as follows.

1. To maximise ICT capabilities of K–12 teachers, ACDICT will identify and disseminate best practices employed by universities to support the professional development of ICT teachers in years K–12.
2. To improve perceptions of ICT careers, ACDICT will support effective practices that inform students about careers in ICT in an exciting and meaningful way.
3. To engage secondary schools with industry ICT projects, ACDICT will investigate ways of facilitating collaborative projects between schools and industry.
4. To address the shortage of female students in ICT, ACDICT will identify best practice in attracting and retaining more female students into ICT and disseminate effective strategies among schools and universities.
5. To optimise the ICT student learning and teaching experience at universities, ACDICT will continue to identify and disseminate best practices.
6. To better educate the general public about the various types of ICT Professions, ACDICT will work with ICT Professional bodies (such as ACS, ACSF, and AIIA) to help clarify the definitions of the different ICT Professions.
7. To remedy industry ICT skills gaps, ACDICT will work with industry to determine the optimal solutions that universities could develop to help address the gaps.
8. To ensure government support for ICT education, ACDICT will continue to work with the Office of The Chief Scientist and other agencies to bring about more explicit widespread recognition and support for ICT education.
9. To ensure efficiency, consistency, and broad impact, ACDICT will align its actions, with this policy and relevant government policies including the National Science and Technology Strategy, and the Australian Workplace and Productivity Agency policy on ICT skills.
10. To keep abreast of global trends, ACDICT will liaise with relevant groups overseas and continue to maintain established relationships.

Introduction

Little has changed in 2015; there is still a shortage in the availability of skilled ICT workers in Australia (Australian Computer Society [ACS], 2012; Australian Industry Group [AiG], 2012; Australian Workforce and Productivity Agency [AWPA], 2013). This shortage manifests itself at different levels and includes the lack of:

- skilled teachers of ICT from K–12
- students electing to study ICT in high schools
- enrolments (particularly females) in ICT higher education
- high-performing students engaging with ICT studies
- graduates (particularly females) with the ICT skills and experience demanded by industry
- existing industry workers with the required current ICT skills (skills gap)

A common thread between these shortages is education; education at different levels. ICT is an integral component of Science, Technology, Engineering and Mathematics (STEM) (AiG, 2012) and there is a shortage of secondary school teachers in STEM subjects (West, 2012). Students in Australia and overseas do not seem interested in STEM subjects at school (Chubb, 2012a; 2012b); thus, improvement in the teaching of STEM subjects in secondary schools is highly desirable (Goodrum, Druhan & Abbs, 2012). The secondary school student experience undoubtedly contributes to fewer students, especially females, engaging with the study of ICT subjects. In turn, this has led to fewer students enrolling in ICT disciplines in higher education (Department of Education, Employment and Workplace Relations [DEEWR], 2011) and consequently fewer graduates to enter the ICT job market and meet industry demands (ACS, 2012).

The education thread applies to industry not only through the lack of skilled and experienced graduates, but also through a growing skills gap in existing ICT workers. Thus, industry will contribute to the education effort through the training of new graduates to maximise their ability to be useful in their new workplace environment and through the continuous up-skilling of existing ICT staff.

This Action Plan on the ICT skills shortages focuses on one of ACDICT's key strengths: that of education and the ways in which ACDICT can contribute.

Key education areas

1. Maximising capabilities of K–12 teachers of ICT

It has been recognised that lifting the quality of skilled STEM (including ICT) teachers is necessary in Australia (AiG, 2012) and various initiatives are currently underway to help upskill the teachers of ICT in schools (Noble, 2012). The same can be said for UK and Europe (Thakurdas, 2013) and the US (e.g., Harris & Farmer, 2012; Petit, 2012).

All members of a modern society need to be digitally literate and many people need to be able to use computational thinking to solve the complex problems that are encountered in all forms of work. The useful and necessary problem-solving skill of computational thinking (which usually involves programming) needs to be embedded in the study of all disciplines from an early age and not just seen as an esoteric part of computer science at university level. The digital designers and creators of the future will emerge from an education system that promotes and supports ICT creativity rather than from a system that merely teaches digital literacy of existing tools. Australians are strong adopters and users of technologies and much of the population is digitally literate. However, innovative solutions to complex problems in all areas of work require the problem-solving skills afforded by computational thinking.

The Australian Curriculum, Assessment and Reporting Authority (ACARA) is addressing these issues in the revision of the ICT curriculum for K–12 about which ACDICT has been consulted and which has been made available to teachers while it awaits ministerial endorsement in 2014 . .

ICT represents a number of subjects in their own right and is an essential part of many disciplines including health, science, engineering and business, in that computational thinking is necessary to solve discipline challenges and find innovative solutions to today's problems. Just as the secondary mathematics and science teachers could benefit from improved pre-service professional development (Office for Learning and Teaching [OLT], 2013), so could the teachers of ICT. Most secondary school teachers are not up to date with the technologies or computational thinking necessary to help students with ICT innovations and to have computation thinking embedded in all disciplines. ACDICT can help with the development of these skills by stronger liaison with the training of teachers by universities, mentorships and with greater involvement in student and industry projects.

The need for skilled ICT K–12 teachers has increased recently with many calls from government, industry, professional bodies and academia to include computational thinking and coding in the junior school years (Turnbull, 2014; Miliszewska 2015a,b; Shorten, 2015; Sterling 2015,)

Action/Recommendation: To maximise ICT capabilities of K–12 teachers, ACDICT will identify and disseminate best practices employed by universities to support the professional development of ICT teachers in years K–12.

2. Improving perceptions of ICT careers

Student enrolments in ICT higher education are influenced by the student experience of ICT studies in K–12. Additional factors include the student perceptions of an ICT career, and the advice they receive from career advisors and parents (this advice often reflects their own perceptions of an ICT career). Improving perceptions of ICT is a matter of education: educating students and the public at large about the reality of working in ICT.

Student attitudes to ICT careers have been well documented by the Victorian Government (VG) between 2004 and 2012 (VG, 2004–2012) and show that there are persistent attitudes (likely to be held also by parents and careers advisors) that an ICT career is for 'geeks' and involves boring work behind a computer all day. Macpherson (2013) found similar attitudes amongst Australian teenagers. Attempts have been made to influence these perceptions by bringing students and industry practitioners together to reveal the reality of ICT careers. A notable example of this effort is videos of young ICT graduates describing their jobs and showing the variety and opportunities afforded by an ICT career (ACS Foundation YouTube Channel). Another useful national ACS Foundation initiative is the 'Big Day In' event during which industry practitioners inform potential students of the benefits of an ICT career. National ICT Careers Week (http://www.ictcareersweek.info/) is another activity supported by ACDICT where ICT careers are highlighted. Digital Careers (managed by NICTA) is also offering a range of ICT activities for students and teachers in schools.

Improving the perceptions of ICT of minority participants, including that of females and Indigenous people also needs to be addressed. The revised MoU (2015/16) between ACDICT and the ACS will address many of these issues.

Action/Recommendation: To improve perceptions of ICT careers, ACDICT will support effective practices that inform students about careers in ICT in an exciting and meaningful way.

3. Engaging secondary school students with industry

Secondary school students have limited interest in ICT studies perhaps partly because they cannot see the relevance of theoretical studies – similarly to university students (Koppi & Naghdy, 2009), or desirable career prospects (Macpherson, 2013). Engagement with authentic industry projects would help demonstrate relevance and career prospects and enable the development of skills useful to students and teachers, thereby further contributing to their professional development. Industry would also benefit by having access to a talent pool for a range of projects. Collaboration between schools and industry would also promote technology innovation and computational thinking amongst students and teachers.

Several organisations already promote industry engagement with students, such as the ACS Foundation (http://www.acsfoundation.com.au/), Digital Careers, which supports ICT education in Australian schools. Students aged 5–10 appear to be the most receptive to considering an ICT career (Macpherson, 2013). An effective strategy seems to be engagement of secondary students with young ICT graduates with whom they can readily relate. Several universities also provide such opportunities, often linked with National ICT Careers Week.

Action/Recommendation: To engage secondary schools with industry ICT projects, ACDICT will investigate ways of facilitating collaborative projects between schools and industry.

4. Addressing the shortage of ICT female students

The general lack of interest in ICT by female students needs to be addressed. It is evident that current experiences with ICT in many schools do not appeal to females (e.g., Macpherson, 2013) and alternative approaches need to be developed. Studies have shown that females tend to have a different attitude towards ICT than males, as they are generally more concerned with the benefits that ICT can bring to society at large rather than the technology *per se* (Margolis & Fisher, 2002; Koppi et al., 2010; 2013). Changing the perceptions of female secondary students towards ICT seems to require a structured approach (Lang et al., 2010).

Action/Recommendation: To address the shortage of female students in ICT, ACDICT will identify best practice in attracting and retaining more female students into ICT and disseminate effective strategies among schools and universities.

5. Maximising the student learning and teaching experiences at universities

Whilst increasing student enrolments in ICT higher education is necessary, it is also important to retain enrolled students to maximise completion rates. Students of ICT disciplines generally do not rate their learning and teaching experiences as highly as desirable (University Experience Survey, 2012), and several Australian studies have made suggestions for improvements (e.g., Carbone et al., 2013a, 2013b; Koppi & Naghdy, 2009; Koppi et al., 2013).

ACDICT has created the ACDICT Learning and Teaching Academy (ALTA) to help improve the ICT student experience in universities. An ALTA strategy is to support collaborative learning and teaching projects and the dissemination of good practices.

Action/Recommendation: To optimise the ICT student learning and teaching experience at universities, ACDICT will continue to identify, support and disseminate best practices.

6. Clarifying the perceptions of ICT Professions

Erroneous perceptions of ICT careers are exacerbated by the lack of clarity of what ICT Professionals do. This lack of clarity of the ICT industry and profession impacts adversely on attracting capable people to ICT careers (Bailes, 2013). DEEWR describes three types of ICT occupational groups: Professionals, Support Technicians, and Managers. The ACS Foundation identifies 65 ICT careers in four different areas: Content and Design, Technology Services, IT Engineering and Architecture, and Business and Information Systems. However, neither of these categorisations provides a simple and clear understanding of what an ICT Professional does.

The revised MoU (2015/16) between ACDICT and the ACS includes addressing the issue of the perception of ICT professionalism.

Action/Recommendation: To better educate the general public about the various types of ICT Professions, ACDICT will work with ICT Professional bodies to help clarify the definitions of the different ICT Professions.

7. Up-skilling the existing workforce

The ICT skills gap of existing workers, with or without an existing ICT degree, can be met through a variety of university qualifications: Certificates, Diplomas, Bachelor Degrees, and Master's Degrees. These programs vary in duration, can be delivered online, and could be tailored to meet industry requirements. On-going consultations with industry will be necessary to ensure universities are meeting industry requirements.

Action/Recommendation: To remedy industry ICT skills gaps, ACDICT will work with industry to determine the optimal solutions that universities could develop to help address the gaps.

8. Ensuring ICT education support by government

ICT is an integral part of STEM, as recently emphasised by the Australian Industry Group (AiG, 2012). ACDICT has participated in government consultations concerning ICT education and skills issues, such as National and State Government working parties, ACARA, AWPA, and Office of the Chief Scientist.

Whilst a former Australian Prime Minster described Information Technology jobs as the quintessential jobs of the future (Moses, 2013), the Government is yet to deliver programs and support specifically for improving ICT capabilities amongst secondary teachers (parallel to those funded for mathematics and science teachers).

It seems that both sides of the Federal Government are aware of critical ICT education issues (Turnbull, 2014; Shorten 2015) and effective actions are anticipated.

Action/Recommendation: To ensure government support for ICT education, ACDICT will continue to work with the Office of The Chief Scientist and other agencies to bring about more explicit widespread recognition and support for ICT education.

9. Aligning ACDICT activities

As noted in this document, many organisations are pursuing related strategies, or offering recommendations, to address issues concerning ICT skills.

Action/Recommendation: To ensure efficiency, consistency and broad impact, ACDICT will align future activities, such as those of ALTA, with regulatory authorities and the national science and technology strategy developed by the Office of the Chief Scientist, and the ICT skills policy of the Australian Workforce and Productivity Agency.

10. Keeping abreast of global trends

Other developed countries have similar issues concerned with ICT (Koppi et al., 2013) and to keep abreast of developments, ACDICT will continue to monitor global trends.

Action/ Recommendation: To keep abreast of global trends, ACDICT will liaise with relevant groups overseas and continue to maintain established relationships (such as the e-skills Institute South Africa, and exploratory relations with Informatics Europe)

Conclusion

The shortage of skilled ICT workers in Australia will be best addressed by education at several levels and ACDICT is able make a contribution at all levels. By focusing on a key strength of education, targeted ACDICT activities will impact on the experience and perceptions of students regarding ICT and result in improvements of ICT skills required by the Australian workforce.

References

Australian Computer Society. (2012). ACS Statistical Compendium 2012. http://www.acs.org.au/news-and-media/news-and-media-releases/2012/acs-statistical-compendium-2012 (accessed 2 January 2013)

Australian Computer Society Foundation YouTube Channel: http://www.acsfoundation.com.au/youtube.cfm

Australian Industry Group. (2012) Australian Industry Group report: Lifting our Science, Technology, Engineering and Maths (STEM) Skills. http://www.aigroup.com.au/portal/binary/com.epicentric.contentmanagement.servlet.ContentDeliveryServlet/LIVE_CONTENT/Publications/Reports/2013/Ai_Group_Skills_Survey_2012-STEM_FINAL_PRINTED.pdf (accessed 21 May 2013)

Australian Workforce and Productivity Agency. (2013) ICT Workforce Study. http://www.awpa.gov.au/our-work/sector-specific-skill-needs/Pages/Professional,-Scientific-and-Technical-Services.aspx (accessed 21 May 2013)

Bailes, P. (2013). Perceptions of ICT. *In:* Koppi, T., Ogunbona, P, Armarego, J., Bailes, P., Hyland P., McGill, T., Naghdy, F., Naghdy, G., Pilgrim, C. and Roberts, M. (2013). Final Report on: Addressing ICT curriculum recommendations from surveys of academics, workplace graduates and employers, pp 27–47. http://www.olt.edu.au (accessed 2 June 2013)

Carbone, A., Ross, B. and Ceddia, J. (2013a). Five Years of Taps on Shoulders to PATS on Backs in ICT. Conference on Innovation and Technology in Computer Science Education (ITiCSE 2013), University of Kent, UK, 1-3 July 2013.

Carbone, A., Ceddia, J., Simon, D'Souza, D., Mason, R. (2013b) Common Concerns in Introductory Programming Courses, Proceeding of the Fifteenth Australasian Computing Education Conference (ACE2013), Adelaide, South Australia, 29 January – 1 February, 2013.

Chubb, I. (2012a). Keynote address at the Tertiary Education Facilities Management Association – Annual Directors' Forum. http://www.chiefscientist.gov.au/2012/08/speech-tertiary-education-facilities-management-association-annual-directors-forum/ (accessed May 30 2013)

Chubb, I. (2012b). Speech at the Annual Conference of the Science Teachers' Association of Victoria. http://www.chiefscientist.gov.au/wp-content/uploads/Science-Teachers-Assoc-Nov-29-3.pdf (accessed 30 May 2013)

Department of Education, Employment and Workplace Relations. (2011). Overview of Higher Education statistics collections. http://www.deewr.gov.au/HigherEducation/Publications/HEStatistics/Publications/Pages/Home.aspx (accessed 22 May 2011)

Goodrum, D., Druhan, A., & Abbs, J. (2012). The status and quality of year 11 and 12 science in Australian schools. Australian Academy of Science report prepared for the Office of the Chief Scientist. http://www.science.org.au/publications/documents/Year11and12Report.pdf (accessed 30 May 2013)

Harris, P., & Farmer, R. (2012) Time to make computer science part of schools' core curricula. http://www.chron.com/opinion/outlook/article/Time-to-make-computer-science-part-of-schools-4100712.php (accessed 30 December 2012)

Koppi, T., & Naghdy, F. (2009): Managing educational change in the ICT discipline at the tertiary education level. http://www.olt.gov.au/resource-managing-educational-change-ict-discipline-uow-2009 (accessed 2 January 2012)

Koppi, T., Ogunbona, P, Armarego, J., Bailes, P., Hyland P., McGill, T., Naghdy, F., Naghdy, G., Pilgrim, C., & Roberts, M. (2013). Final Report on: Addressing ICT curriculum recommendations from surveys of academics, workplace graduates and employers. http://www.olt.edu.au (accessed 2 June 2013)

Koppi, T., Sheard, J., Naghdy, F., Edwards, S.L., & Brookes, W. (2010). Towards a gender inclusive ICT curriculum: a perspective from graduates in the workforce. Computer Science Education, 20(1), 1-18.

Lang, C., Craig, A., Fisher, J., & Forgasz, H. (2010). Creating digital divas: scaffolding perception change through secondary school and university alliances. *Proceedings of the 15th Annual Conference on Innovation and Technology in Computer Science Education,* Ankara, Turkey.

Macpherson, K. (2013) Digital Technology and Australian Teenagers: Consumption, Study and Careers. The Education Institute, University of Canberra. http://www.theeducationinstitute.edu.au/eduinstitute/sites/default/files/Digital%20Technology%20and%20Teenagers%20Report%20May%202013.pdf (accessed 23 June 2013)

Margolis, J., & Fisher, A. (2002). *Unlocking the clubhouse: women in computing*. Cambridge, Massachusetts: MIT Press.

Miliszewska, I (2015a,b) Computational skills: the 4th literacy of the 21st century http://au.educationhq.com/news/15367/computational-skills-the-4th-literacy-of-the-21st-century/ and http://issuu.com/tempomedia/docs/atm-april-2015

Moses, A. (2013). Gillard accused of 'desperate vote-mongering'. http://www.smh.com.au/it-pro/government-it/gillard-accused-of-desperate-votemongering-20130314-2g2pa.html (accessed 30 May 2013)

Noble, A. (2012). Science the key to seize control of the future. http://www.smh.com.au/opinion/politics/science-the-key-to-seize-control-of-the-future-20121225-2bv55.html (accessed 27 December 2012)

Office for Learning and Teaching. (2013). Enhancing the Training of Mathematics and Science Teachers Program: http://www.olt.gov.au/maths-and-science-teachers (accessed 30 May 2013)

Petit, S. (2012) State moving ahead with STEM initiatives. http://times-news.com/local/x983019476/State-moving-ahead-with-STEM-initiatives (accessed 31 December 2012)

Shorten, B, (2015) Labor's plan for coding in schools http://billshorten.com.au/labors-plan-for-coding-in-schools

Sterling, L. (2015) An education for the 21st century means teaching coding in schools, http://theconversation.com/an-education-for-the-21st-century-means-teaching-coding-in-schools-42046
Thakurdas, Y. (2013) UK Computer Science Education in the 21st Century – Restoring Turing's Legacy. Presentation to House of Lords 20 March 2013. http://docs.media.bitpipe.com/io_10x/io_102267/item_673999/YvaT%20UK%20Computer%20ScienceEducation.pdf (accessed 20 May 2013).
Turnbull, M. (2014) The Importance of Tech Education in Our Schools, http://www.malcolmturnbull.com.au/media/speech-the-importance-of-tech-education-in-our-schools
University Experience Survey. (2012). University Experience Survey: http://www.innovation.gov.au/HigherEducation/Policy/Pages/UniversityExperienceSurvey.aspx (accessed 30 May 2013)
Victorian Government. (2004–2012). Attitudinal studies of 14–19 year old students in Victoria. http://www.business.vic.gov.au/industries/information-and-communication-technology/skills-and-careers/career-awareness (accessed 23 May 2013)
West, M. (2012). STEM Education and the Workplace. Office of the Chief Scientist Occasional Paper 4. http://www.chiefscientist.gov.au/wp-content/uploads/OPS4-STEMEducationAndTheWorkplace-web.pdf (accessed 30 May 2013)

June 2014

Revision Plan

Action Plan launch	July 2013
Revision schedule	Annual, prior to ACDICT Annual Council Meeting
Revised Skills Action Plan V2	June 2014
Revised Skills Action Plan V3	June 2015