



**THE AUSTRALIAN COMPUTER
SOCIETY**

**SUBMISSION TO
THE REVIEW OF AUSTRALIAN
HIGHER EDUCATION**

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INTRODUCTION

The ACS is the recognised professional association for those working in Information and Communications Technology, attracting a large and active membership from all levels of the ICT industry. As a member of the Australian Council of Professions, the ACS is the public voice of the ICT profession and the guardian of professional ethics and standards in the ICT industry, with a commitment to the wider community to ensure the beneficial use of ICT and to support and develop the local ICT sector.

In developing this submission, the ACS has drawn upon the direct expertise of its membership, in terms of the skills they consider necessary for graduate ICT professionals, particularly:

- those who work in academia, ICT curriculum and course development;
- members who work in industry; and
- the views of firms that hire ICT professionals.

As well as addressing the specific issues raised by the terms of reference for the Review, it covers issues and recommendations associated with:

- professional development and ICT course accreditation offered by the ACS;
- ACS programs for enhancing the work readiness of graduates;
- skills shortages;
- greater articulation between VET and higher education providers; and
- the ACS Foundation model for work integrated scholarships.

BACKGROUND INFORMATION AND DATA

PROFESSIONAL DEVELOPMENT

The ACS has, as an integral part of its mission, a role to advance professional excellence in information and communication technology. ACS achieves this by:

- accrediting tertiary ICT courses;
- providing accreditation of ICT professionals;
- providing ongoing professional development for its members, such as the ACS Computer Professional Education Program; and
- through providing high quality education programs such as the ACS Diploma in Information and Communication Technology.

The ACS has also recently implemented a Professional Year Program for recent international student ICT graduates to improve their job readiness and employability. This program will be made available to domestic students who wish to improve their work readiness.

The ACS puts significant effort into developing courses and professional skills development programs that match the changing needs of employers and meet market needs. The ACS also brings together industry, government and academia to facilitate information exchange on higher education course development.

Through its professional development programs, the ACS plays a significant role in higher education ICT courses, skilling Australian ICT graduates and ensuring Australian ICT professionals have and maintain the skills they need to be successful in the workforce.

The primary goal of our professional development programs is to encourage and mentor Australian ICT professionals to keep abreast of technology developments, upgrade their skills or retrain in new ICT specialisations and remain responsive to the skills needs of employers.

Accreditation of ICT Courses

A vital component of the ACS professional development and professional standards program is the accreditation of ICT courses offered by higher education providers. The ACS provides accreditation for all 39 of Australia's higher education providers.

Accreditation provides:

- a partnership between the ACS and tertiary education providers in establishing a professional basis for the ICT industry;
- a process whereby courses are evaluated as meeting the requirements of a professional body;
- a statement to students, employers and governments that the basic educational requirement for professional ICT practitioners are being met;
- a basis for national and international benchmarking of ICT professional education and reciprocal recognition with other countries.

Accreditation considers specific course content and structure and course infrastructure. ICT courses offered by higher education providers are assessed for the suitability of graduates as ICT professionals through:

- an assessment of the content and structure of the course against the ACS's core body of knowledge;
- an assessment of the staff and educational resources used in the delivery of the course;
- an assessment of the quality assurance processes that the University has in place for admission standards, assessment and the ability of the profession to influence the course content, structure and teaching methodology.

The accreditation process is not intended to inhibit creativity or the development of new initiatives in the education of ICT professionals, rather the ACS seeks to encourage and facilitate such initiatives and accreditation ensures ICT higher education courses meet national and international standards for quality.

The ACS accreditation process examines:

- the objectives and graduate profiles of a particular course, the methods adopted to achieve those objectives and the measures of effectiveness;
- the duration of the course, having regard to the standards for entry and course objectives;
- the breadth, depth and balance in subjects offered and the amount of intellectual effort required by the course;
- methods of assessment of student progress and measures of efficacy of those methods;
- means of industry/profession input into the course and other advisory mechanisms;
- relative emphasis on teaching skills relating to the study of the discipline;
- the teaching staff conducting the course, including numbers, professional qualifications, experience, research and educational expertise; and
- accommodation and facilities including equipment, library, laboratories, workshops and other instructional resources necessary for the course.

Accreditation is conducted by an Accreditation Panel formed from a panel of assessors available to the ACS and is valid for a period of 5 years.

There are two levels of program Accreditation provided by the ACS:

- Professional Level Accreditation – includes advanced computing topics that satisfy the Core Body of Knowledge and is designed primarily to produce ICT professional graduates;
- Associate Level Accreditation – courses that include ICT components, but do not meet the requirements of the Core Body of Knowledge.

All tertiary ICT courses in Australia have been or are currently seeking accreditation by the ACS. The ACS also recognises those ICT courses in the VET sector by accredited RTOs that have been accredited by IBSA to certificate 5 and diploma 6 levels.

Core Body of Knowledge

The ACS core body of knowledge provides the basis to facilitate the design of degree programs that produce graduates with the skills required for defined ICT roles. It aims to ensure there is a bridge between what ICT courses teach and what ICT professionals actually do in their careers.

The core body of knowledge includes both technical and professional knowledge areas and is used as the basis upon which the ACS accredits tertiary education ICT courses.

The ACS is currently redesigning the core body of knowledge with extensive input from academia, the ICT industry sector and ICT professionals.

1. Graduate Skills Set for given ICT Role(s) (e.g. as defined in Skills Framework for the Information Age)	
2. ICT Role Specific Knowledge (eg. core body of knowledge for ICT roles in Software Engineering)	4. Complementary Knowledge
3a. Core Body of Knowledge (ICT Knowledge Area) <ul style="list-style-type: none"> • Problem solving using modelling and abstraction • Hardware and software fundamentals • Data and info management • Networking • Programming fundamentals • Human-computer interaction • System development and acquisition • ICT project Management 	3b. Core Body of Knowledge (Professional Knowledge Area) <ul style="list-style-type: none"> • Ethics • Professionalism • Governance and organizational issues • Teamwork concepts and issues • Communication • Society issues
Depending on ICT role(s), might include knowledge from: <ul style="list-style-type: none"> • Business • Science • Engineering • Mathematics • Health • Humanities • Arts 	

ICT Program Design Framework with CBOK shown in grey

(Note: Boundaries between components are not hard, overlaps are expected.)

The above framework sets out the new proposed core body of knowledge and how it fits into the overall knowledge and core skill sets that should be acquired as part of an ICT degree. It is proposed that this common framework be used to design new ICT programs and as the basis for future accreditation assessments after the ACS formally adopts the new core body of knowledge specifications.

The Skills Framework for the Information Age (SFIA) provides an internationally recognised model for identifying the skills needed to develop information systems using ICTs. SFIA defines ICT **skills**, but does not list underlying **knowledge** areas, which may be ICT discipline/course dependant. These knowledge areas include methodologies, technologies, programming paradigms or specific ICT tools, libraries or languages that may be specific to a given ICT discipline, position description or academic study program. These knowledge areas are specified by the ACS core body of knowledge.

Key components common to the proposed framework, as shown above, are:

- 1: the technical and professional skills developed during a given program of study that qualifies graduates to undertake one or more ICT roles;
- 2: knowledge that is specific to a particular degree program or ICT discipline, and that is necessary to undertake the intended ICT roles(s);
- 3(a) & (b): the Core Body of Knowledge (CBOK) shared by all ICT programs, encompassing both ICT Concepts (3a) and Professional Concepts (3b); and
- 4: Complementary Knowledge that broadens a student's education enhances employability and prepares graduates for ICT careers in the global economy, and to be of service to society and the local community.

The ACS core body of knowledge adopts an approach to ICT course design that focuses on the development of professionals rather than taking a traditional curriculum driven approach.

The approach takes into account the skills graduates will need for the jobs they will be undertaking in the workforce and can often mean developing 'blended' degrees that encompass study across traditional disciplines.

Industry Views of Higher Education Programs and Graduates

As part of the core body of knowledge review, the ACS has been consulting widely with key education and professional development stakeholders around Australia to better define the ICT profession, gain a perspective on the work readiness of ICT graduates and feed stakeholder views into the development of ICT courses to ensure graduates are better prepared to meet the needs of Australia's ICT labour market.

A collation of the key and most common views expressed by stakeholders is listed below:

- the ICT industry sector is subject to continuing change and it is important that ICT courses continue to change in pace with the industry to ensure students graduate with relevant skills.
- complimentary knowledge is now vitally important for ICT graduates and at least as important as technical knowledge. These are the areas that allow graduates to add value to businesses.
- the ICT industry has changed from being technical to business and service delivery focused. ICT infrastructure is now a commodity and innovating and developing solutions to enable business growth is equally, if not more important in the Australian context, to 'back room' ICT functions. ICT courses should better prepare graduates for these roles.
- Students need to obtain a good understanding of business outcomes and an ability to look at their role from a customer perspective.

- ICT graduates need to be aware of change management, project management and risk management as these are key areas for ICT businesses. Other areas raised by industry as important are development and evolution of business solutions and product lifecycle and quality management.
- ICT graduates also need a strong understanding of how they fit within the architecture of the business and knowledge of the impact of their decisions.

The results of the ACS extensive stakeholder consultation program for its core body of knowledge will be transmitted to all stakeholders and importantly, the higher education sector, so they continue to be aware of industry views and requirements for ICT graduates.

The ACS will incorporate these views into its core body of knowledge and accreditation process, where appropriate.

In addition, the ACS will use industry views and requirements to inform the development of its own professional development and education programs.

The ACS believes that increasing the communication channels between academia and industry will improve skills foresighting and allow development of a better nexus between the supply and demand of ICT skills and competencies needed by Australian industry.

Computer Professional Education Program

The ACS Computer Professional Education Program (CPEP) is a postgraduate IT program based on mentored and collaborative learning.

CPEP covers areas of business, legal and ethics issues, new technology alignment, business strategy, project management, adaptive business intelligence and IT service management.

The program is designed to provide some of the more specific skills that employers are looking for in ICT professionals and to provide training in areas considered to be in high demand within the ICT sector.

The program is also designed to allow ICT professionals to achieve ACS accreditation as a 'Computer Professional' as part of a certification program similar to that provided for accounting professionals. The ACS Computer Professional certification is currently being considered for incorporation into an internationally recognised certification program, the International Professional Practice Program, in partnership with the Canadian Information Processing Society, the US Institute of Electronics and Electrical Engineers and the British Computer Society. This will see international recognition of the qualifications and professionalism of accredited Australian ICT professionals.

The ACS believes that short, post graduate education programs such as the CPEP are vital for ICT professionals so that they continue to evolve their skill and knowledge base to keep up with changing industry and technological advances.

Programs such as CPEP allow ICT professionals to re-skill and retrain in new specialisations within relatively short time frames using a flexible approach to delivery that can be adapted to most work situations and locations. They also allow women who are returning to the workforce after career breaks to refresh their knowledge and skill base.

The ACS believes CPEP provides a good model for short, post graduate programs that could be readily adapted by ICT higher education providers and perhaps also the VET sector.

ACS Diploma of Information Technology

The ACS offers a Diploma of Information Technology that is articulated through agreements with a number of Australian higher education providers.

The Diploma comprises eight compulsory subjects: systems analysis, programming, computer organisation, data management, OO systems development, computer communications, professional practice and systems principles.

The program allows students (undergraduates and graduates) to use their own learning resources or to attend lectures at an appropriate university. Exams can be undertaken anywhere in the world and are case study and workplace scenario based.

The ACS believes the level of flexibility and work-based scenarios used in the course ensures a better understanding of the roles and functions that they will be performing in industry.

Professional Year Program

The ACS offers a one year program to improve the work readiness of recent international graduates in ICT who wish to apply for permanent residency in Australia. The program is offered on behalf of the Department of Immigration and Citizenship.

The Professional Year is a 12 month program to help equip graduates with the professional skills and knowledge needed to develop a successful career in the Australian workforce.

It comprises practical training and workshops in areas such as Australian workplace culture, business communication and professionalism.

The program is designed to help international students gain employment upon achieving Australian permanent residency. ACS is also making this program available to domestic graduates that wish to improve their work readiness.

ICT SKILLS SHORTAGES – SUPPLY AND DEMAND

The ICT sector in Australia is currently facing skills issues. These issues have developed around four major parameters:

- an ICT skills gap with job vacancies currently outstripping the number of suitable ICT professionals to fill them;
- long term growth in the ICT job market;
- declining student demand for tertiary ICT study programs (although there is evidence of some recent increase in uptake from a very low base level); and
- students, parents and careers advisers have a poor perception of careers in ICT.

Exacerbating these issues are concerns around:

- a lack of common understanding of the ICT profession and low recognition of what constitutes the ICT profession;
- ICT is often fragmented across university faculties; and
- there is often no clear career path articulated between tertiary ICT study programs and the jobs students are aspiring to, so students are unsure of what study program would best suit their needs.

All sectors of the Australian economy are becoming increasingly dependent on ICT for their effective operations and their future productivity gains. Given this dependence, it is crucial that Australia ensures that it has the relevant ICT skills to carry its economy forward into the future.

A primary element to achieving this will be the effectiveness with which Australian ICT higher education and VET providers respond to the perceptions of students around ICT, student course content requirements and how well they are able to tap into, take account of and incorporate into their courses, the future skills needs of industry, to ensure that we have the people with the skills we will need at precisely the time when they will be needed.

Industry Leadership Group on ICT Skills

Following the release of the report of the Federal Government ICT Skills Foresighting Working Group, 'Building Australian ICT Skills', in May 2006, the ACS and the Australian Information Industry Association (AIIA) jointly convened the National Industry Leadership Group to examine issues around the supply and demand for ICT skills in the Australian market.

The Industry Leadership Group comprises wide ranging membership from industry, industry and professional associations, state and federal governments

and higher education providers. The ILG functions with the support of the Federal Government; however it has been in abeyance since the 2007 Federal Election following the redistribution and changes to Departmental portfolio responsibilities for ICT and skills development.

Prior to going into abeyance, the ILG prepared a ground breaking report compiling substantial research into the supply and demand for ICT labour in the Australian market.

This report provides an analysis of the supply and demand channels for ICT workers and a gap analysis of the ICT labour market in Australia. It highlights the key variables that influence supply and demand. More importantly, it provides a framework for developing a supply/demand model for the Australian ICT labour market.

Supply of ICT professionals

ICT higher education courses are the main source of supply for ICT professionals although by no means the only source. New ICT skills come from a mix of higher education graduates, vocational education and training graduates, migration, workers moving into ICT from non-ICT occupations, current workers upgrading their skills and new entrants into the work force (previously unemployed or not in the labour force), mature workers and women re-entering workforce.

Higher education providers could better address this market by providing short term certification programs that allow current ICT professionals to quickly pick up new skills or to re-train in new specialisations to increase the supply of ICT professionals in areas in strong demand.

The ACS CPEP program is designed to address this need and provide short term certification in a very portable and flexible manner and provides a good model upon which to base short term specialist certification programs. Some post graduate certificates and masters courses currently being offered also assist in this process.

The ACS believes that insufficient attention is paid to the VET sector as a source of ICT skills development for Australia. Articulating ICT career pathways via the VET sector will significantly broaden the career choice for students who do not or can not undertake higher education ICT programs.

Using the VET pathway, the supply of ICT skills in Australia could be improved by government and industry supporting the traditional trades traineeship model for ICT careers. The Government currently has a strong focus on providing traineeships for the traditional trades to address chronic skills shortages in these areas. This model should be extended to ICT careers, allowing school students to move into ICT from year 10 and above through the VET pathway.

For this model to achieve its greatest potential, governments, the VET and higher education sector would need to cooperate to provide a clearly articulated career development and education pathway from traineeship to degree qualification so that a full range of employment and education options are open to students who choose this pathway.

Demand for ICT professionals

Many occupations and skill specialties exist in ICT and these continue to change and evolve with technological innovation, creating new layers and nuances to the skills needed by ICT professionals. Additionally, roles and functions across all sectors of the economy are becoming more 'information intense' and rely on ICT to provide the tools with which people work. This creates continued and ongoing demand for ICT skills that is being exacerbated by declining enrolments in ICT courses and declining interest by students and others in choosing ICT as a career.

The ILG has examined a number of variables to measure and monitor demand for ICT occupations including:

- levels of employment in ICT occupations;
- average hours worked in each occupation; and
- type of work – full time/part time.

In addition, the ILG looked at projected employment growth for ICT occupations to gauge future short to medium term demand for ICT professionals in Australia. A range of other data were also used to provide a guide on emerging/changing demand in ICT jobs.

Gap analysis

In the short to medium term the ILG data indicates a widening gap between demand for ICT skills by industry and the supply of appropriately qualified ICT workers to meet this demand. The pipeline effects of declining enrolments in ICT education programs are going to result in a continued decline in graduates for the next few years. Even if enrolments in higher education courses rose immediately, it would be a minimum of three years before the supply of graduates would begin to increase.

Net migration of ICT professionals, based on recent numbers, will only address a small part of the projected shortfall.

ACS ICT Skills Forecasting Data

The ACS report on ICT Skills Forecasting was released during August 2008.

The report indicates that based on the assumption that ICT graduations remain at current levels, using current migration targets and factoring in economic cycle variations based on underlying growth, there will be a shortfall in ICT

employment in Australia of around 19,000 by 2015. Even if ICT graduations increase by 12.5% pa from 2007 to 2015 (compounded and reaching 2001 levels by 2013), the report indicates there will still be a significant shortfall in ICT employment.

This ACS employment modeling work suggests that government, industry, the VET and higher education sectors must, as a matter of priority, look at ways of increasing Australia's ICT skills base by providing alternative pathways for students into ICT careers, encouraging those in the workforce to consider ICT careers, encouraging women to consider careers in ICT or to return to an ICT career following maternity or other career breaks and also by encouraging mature workers into ICT.

Broadening entry into ICT careers through the VET sector would help to address the widening skills gap and provide workers with specific industry based skills that are being required by ICT employers.

ACS is helping to address this gap by reviewing its CBOK to ensure it remains industry relevant, through ACS reskilling and education programs (such as the Professional Year Program, ACS Diploma of ICT etc) and through our ongoing and close relationships with Australian higher education providers.

ICT Skills Supply/Demand Model

While Australia allocates considerable resources to predictive tools to analyse and plan for roads, schools, hospitals and other essential infrastructure, we do not devote sufficient resources to predicting and building our equally essential ICT skills capability and human infrastructure.

Better supply and demand forecasting would provide a useful means for identifying the technologies and skills that are most likely going to be needed in the future. This could be achieved through an ICT labour market forecasting model that can simulate demand and supply trends, likely demand/supply gaps and the sensitivity of these gaps to key parameters for the supply and demand of ICT professionals and skills in Australia.

The ICT sector is dynamic and as technology changes and advances, so too do the skills and competencies needed by industry to effectively compete and achieve productivity gains. Australia needs to develop mechanisms that allow better forecasting and projection of its future ICT skills needs.

The ACS believes that the Government should continue to support the work of the ILG and take on the challenge of preparing a supply/demand model for the Australian ICT labour market.

ACS FOUNDATION ICT SCHOLARSHIPS

An initiative of the Australian Computer Society, the ACS Foundation was established in August 2001 to encourage greater industry collaboration and contribution to ICT education programs through student scholarships.

The basis for the ACS Foundation program is to create a highly skilled workforce able to effectively access research and industry-specific training and provide a greater connection between students, academia and the work place.

The ACS Foundation runs 2 scholarship programs to achieve this:

- 'work integrated learning' scholarships that combine university education with up to one year of full time work experience; and
- 'grow a graduate' scholarships that assist graduates in developing their specialist areas of study so they can meet identified needs within the ICT sector.

While some candidates are chosen on academic merit, others are awarded to assist geographically isolated students, those with disabilities or to encourage more women and indigenous students into ICT.

The ACS believes the Foundation provides a good model for greater collaboration between academia and the ICT industry sector in Australia to ensuring greater participation of disadvantaged communities and women in ICT higher education programs.

RESPONSE TO TERMS OF REFERENCE

How does the Australian higher education system contribute to the innovation and productivity gains required for economic development and growth?

The ACS believes that its accreditation program for Australian ICT higher education courses ensures that graduates are equipped with a thorough knowledge of technical and professional fundamentals in ICT along with their application to all sectors of our economy allowing graduates to innovate, develop synergies and enhance productivity of the organisations they work for.

The ACS will soon be introducing an international accreditation program for ICT professionals so that their qualifications and experience can be recognised internationally – the International Professional Practice Program. This provides a means to increase productivity through enhanced professionalism and reduced risk for ICT projects by establishing internationally recognised standards for ICT professionals.

ICT has been attributed with up to 85% of the productivity gains in some sectors of our economy over the last 10 years. It forms the basis upon which all sectors of our economy function so it is essential that our higher education providers continue to produce ICT graduates to continue to support this productivity into the future.

As discussed in previous sections, current enrolment levels will not achieve this. Australia's economic future is bound to the quality and number of ICT professionals our higher education providers produce and so it is essential that more resources and effort go into attracting and educating the ICT professionals our economy is going to need to ensure our future productivity growth.

This is not only about attracting more school students to study ICT courses. We must also look at encouraging those who are already in the work force and mature workers to enroll in ICT courses as part of their ongoing career development.

How do we better ensure we have a broad based education system capable of producing professionals for both national and local labour market needs?

The ACS/AIIA Industry Leadership Group (ILG) has looked extensively at this issue and developed a document that addresses the supply and demand of ICT skills in Australia. The ILG has extensive representation from industry, government at state and federal levels and academia and an ability to tap into a high level of experience and expertise to address these issues.

The ACS believes the Government should continue to support the ILG process and use the expertise available within it to provide advice and identify solutions for the ICT skills crisis facing Australian industry.

In addition to supporting the ILG, the Government should devote more resources to skills foresighting to better understand the breadth of skills we will need to underpin our future productivity growth.

A means of doing this is to encourage government and industry to develop three to five year rolling skills forecasting plans as part of their annual reporting cycles. This will allow agencies to better understand and dynamically manage their future skills requirements. This information could be collected by governments and higher education providers to better plan for the skills needs of industry and ensure that education providers are giving priority to training graduates with skills in areas that are going to be in demand.

In addition, the ACS believes that traineeships, cadetships and apprenticeship programs should be introduced for ICT to create more entry pathways into ICT careers. For many students the traditional pathway of studying to grade 12 then going to university is not suitable.

The government, industry, the VET and higher education sectors should cooperate to broaden the entry pathways into ICT with clearly articulated pathways from school student to trainee/apprentice, right through to ICT professional, by offering traineeships/apprenticeships and the like, for training and recruiting students in ICT jobs.

Greater collaboration and articulation between education programs provided by the VET and higher education sector should have as its goal, the development of a post school education system that exists on, essentially, an interoperable continuum. It should also recognise the value of prior learning and work experience. This would bridge the gap between school, VET and university study, rather than continue to foster the two very separate and largely incompatible systems that currently exist.

The ACS believes this approach would vastly improve student choice and flexibility in being able to choose career development pathways that best suited their needs and circumstances. Careers for ICT professionals are currently largely considered to be available mainly for those who undertake university study.

The Government announced as part of its 2007 election platform that it would be halving the HECS fees for mathematics and science higher education students because of chronic skills shortages and declining enrolments in these areas. The ACS believes that this program should be extended to include halving the HECS fees for ICT courses as well, in recognition of the significant fall in enrolments and chronic skills shortages that have developed within this vital area.

Diverse, high performing institutions with a global focus

The ACS considers that the global focus of our higher education system can be improved. The characteristics of higher education in Australia should be expanded so that they not only operate internationally but have systems that are interoperable with those of other nations, allowing greater student and work force mobility. We should emulate the "Bologna Process" being touted in Europe to facilitate international mobility of students.

This would also allow Australian higher education providers better access to the growing international market in higher education and for Australian students to undertake and complete degrees regardless of where they may be located for their work.

Greater interoperability would also enhance Australian students' experience and ability to learn from the many international students that now choose to attend our universities.

While many universities spend considerable amounts of time and money on attracting and retaining overseas students, they do not spend adequate time on ensuring local students benefit and learn from their international counterparts – particularly important for ICT which is one of the most international of careers.

The ACS believes universities should be building the necessary support within ICT programs that will take advantage of and emphasise the global nature of ICT and ensure greater engagement between international and local ICT students.

Productivity and participation

ACS accredits all Australian University ICT courses and the core body of knowledge, which forms the basis of this accreditation, allows and encourages the development of curricula that are responsive to both student and industry needs. Indeed, ACS is currently undertaking a substantial review of its core body of knowledge that includes the outcomes of a substantial industry consultation program.

Achieving greater participation by students in ICT courses has been under consideration by the Industry Leadership Group (ILG). ILG's response to the recent rapid decline in student interest in ICT courses has been the instigation of National ICT Careers Week, the first of which took place from 28 July to 2 August 2008.

National ICT Careers Week is aimed at raising awareness with school students, their parents, teachers and careers advisers of the career prospects available to graduates from taking courses in ICT.

While strongly supported by industry and universities, there was, overall, a disappointing level of support from the Federal Government, suggesting that there is still a lack of recognition and concern over the growing ICT skills shortages in Australia and of the role ICT plays in driving innovation and productivity across all sectors of the Australian economy.

The ACS considers that Government should continue to support the Industry Leadership Group and to commit to a greater level of participation and support for National ICT Careers Week as a means of highlighting the benefits of ICT careers for students, their parents, mentors and careers advisers.

The Government has given an undertaking to halve the HECS fees for Science and Mathematics higher education courses. Given the ongoing and protracted decline in ICT course enrolments, the ACS believes this policy should also be extended to ICT higher education courses to help increase participation.

Effective and efficient investment

Skills shortages, graduate work readiness and employability issues are being addressed by revamping curricula and providing students with the option of

courses that include work placements and work experience programs. These ICT courses are proving very popular with students and employers with students often being employed prior to completing their studies.

The practice of including work placements and work experience programs needs greater support from within universities and government. While these programs have proved beneficial, they come at a higher per student cost than a standard 3 year degree. If this type of higher education program is to become more wide spread, the cost should not be attributed to individual employers and nor should it be recovered from students.

Burdening employers with the costs of work experience programs will reduce the overall number of employers willing to participate in these programs and burdening students will simply reduce the affordability of education even further.

Courses that incorporate work experience programs should be supported by universities and government since the students are being trained and educated at the same time increasing their ability to participate effectively in the work force following graduation.

However, significant thought needs to be given to ensuring that international students are also able to elect to enrol in programs that include work placement. ACS understands that organisations can be reluctant to offer work experience placements to non-residents. International students comprise around 30% of undergraduate students.

Underpinning social inclusion through access and opportunity

According to the Department of Education Science and Training, Indigenous student participation in higher education has declined since 2003. This decline occurs on the back of a drop in Indigenous participation in higher education recorded in 2000 of around 15%. This decline has been attributed to changes in the ABSTUDY support program that resulted in a cut to the income support available for indigenous students.

ACS Northern Territory academic members report that many indigenous students experience considerable hardship while engaging in study and this is often exacerbated by community, family and other commitments. Ensuring all members of our society have access to education opportunities requires implementing the most flexible delivery methods possible to the workplace, home, educational institution or any other location, so that we can maximise participation and access to higher education programs. While these may incur a higher per unit cost, benefits will be realised across the Australian community, not just the indigenous community, in terms of the availability of flexible study programs.

The ACS believes the Government should ensure that appropriate and targeted support is available for indigenous students to encourage their greater participation in VET and higher education.

For many indigenous and low socioeconomic background students, a major problem is the lack of information on available opportunities and how they can access those opportunities. Higher education and VET providers, governments and industry need to work on creating a greater awareness of available opportunities and of the financial and other support on offer to help students realise them.

Delivering information to these students requires opening multiple communication and access channels appropriate to their circumstances.

One means of achieving this might be through higher education and VET providers more actively engaging these communities and students, for example, by:

- engaging communities and their schools in projects to help highlight the benefits and opportunities on offer; or
- engaging students in projects that are of benefit to their communities but that also develop key skills and competencies.

Programs of this nature undertaken by higher education providers, TAFEs and governments would do much to provide information on job opportunities, community and student support programs and courses available.

In addition to the above, the ACS believes that we must broaden the entry pathways into ICT careers by using the traditional traineeship, cadetship or apprentice model. Staying at school until year 12 and then attending university does not suit all students for many reasons and career pathways into ICT professional roles for these students are limited. The ACS believes we need to provide more avenues for these students into ICT through the VET sector and provide a clearly articulated career development and continuing education pathway from ICT traineeship, cadetship or apprentice, right through to accredited ICT professional roles.

Enhanced Quality and high standards

Accreditation of the ICT programs provided by higher education providers is a key means of assurance of quality and that appropriate standards in education and content of courses is maintained.

However, high quality education also requires good support. The technical areas of ICT education that drive high levels of innovation, such as computer systems, software architecture, software engineering and the like, require more support.

These areas of ICT education are akin to experimental laboratory sciences and engineering and need similar levels of funding and support from government.

ICT is currently banded in with education, architecture and mathematics in terms of the level of funding provided. When the bands were established, computing was seen as most closely aligned with mathematics and this determined the level of funding chosen. However, today, ICT is recognised as a laboratory based discipline with teaching, learning and cost of delivery in line with the experimental laboratory sciences and so should be classified in the same funding band.

High performance computing provides the digital tools to support computational modeling, economic modeling, environmental and climate change modeling, resource collection and utility supply networks development, engineering and manufacturing.

ICT is currently funded in Cluster 3 at \$8,217 per student while engineering and science are in Cluster 6 with funding at \$14,363 per student.

In addition to providing the necessary funding to support technical ICT higher education programs, universities also need experienced teaching staff.

The ACS has noted that the number of university academic staff that have significant relevant industry experience has dropped in the past decade. If we are to maintain the quality and industry relevance of our ICT programs and the graduates they produce, then this situation must be reversed.

The ACS believes that universities should be encouraged to develop a healthy mixture of entry pathways for recruiting their academic staff to ensure they have a strong industry as well as academic based experience. Pathways should include secondments from academia to industry and vice versa.

A broad tertiary education and training sector

An area for consideration in ensuring that the Australian higher education sector for ICT programs provides a broad tertiary education that is in sync with Australian industry and culture is the so called 'shop front universities'.

Shop front universities source students primarily from one or only a few international destinations and so do not provide students with adequate opportunity to interact with local students and communities and do not adequately prepare students for work in Australia. Hence the need for organisations like the ACS to provide Professional Year Programs to improve their knowledge of English and local work environments.

Overall, the higher education sector is experiencing a period of sustained change due to industry investment, changing labour market needs and student demand and expectations. The result is that there are many diverse and different higher

education providers in the sector including universities, non-self accrediting providers and vocational education and training providers.

Within this diverse and competitive market, the role universities play in supporting independent research and development and the creation and transmission of knowledge is becoming critical and is running the risk of being diminished because of increased commercialisation pressures.

Independent research is a fundamental characteristic of universities. The new knowledge and innovation generated are a key part of Australia's innovation landscape. In an environment that increasingly emphasises commercialisation of publicly funded research, the ACS believes the government should ensure that the autonomy of independent research is protected so they can continue to foster free inquiry and play a leading role in new discovery and current scientific and social debate.

As previously discussed, the ACS believes that government, industry, the VET and higher education sectors should cooperate to broaden the entry pathways into ICT with clearly articulated pathways from school student to trainee/apprentice, right through to ICT professional status, by offering traineeships, apprenticeships, cadetships and the like, for training and recruiting students into ICT jobs.

The Government should aim to foster greater collaboration and articulation between education programs provided by the VET and higher education sectors to develop an interoperable education continuum that recognises the value of prior learning and work experience. This would bridge the gap between school, VET and university study and vastly improve student choice and flexibility in being able to choose career development pathways that best suited their needs and circumstances.

RECOMMENDATIONS

The ACS puts forward the following recommendations for consideration by the Review.

1. Government, industry, VET and higher education providers must develop a coordinated and ongoing action plan to address the ongoing decrease in enrolments in ICT programs and the subsequent growing gap between supply and demand in Australia's essential ICT skills.
2. Australian post school education should be revamped to achieve greater collaboration and articulation between education programs provided by the VET and the higher education sector to develop a post school education system that essentially exists on an interoperable continuum, rather than the two very separate and largely incompatible systems that currently exist.

This would vastly improve student choice and flexibility in being able to choose career development pathways that best suited their needs and circumstances and provide more opportunities for students to take up careers in ICT.

3. Current trends to provide students with the option to undertake a work experience component as part of their degree should be encouraged. However, these courses need be designed to provide a balance between the fundamental technical and professional skills needed by all ICT graduates and the work experience component. Work experience should not be at the expense of content and needs to be properly designed into the teaching program.
4. Additional costs associated with degrees that have work experience and work integrated learning components should in principle be borne by universities and government in recognition that students are being trained and educated at the same time. Transferring the costs of these programs to industry will result in less industry participation in the program. Transferring the cost to students will further decrease the affordability of higher education.
5. ICT VET and higher education providers should provide more blended degree options for students that encompass study across the traditional disciplines. Blended programs acknowledge the underpinning nature of ICT for all sectors of our economy, the breadth of career opportunities available to those who study ICT and will also help attract more students into ICT study programs
6. There should be greater connection and feedback mechanisms between ICT higher education providers and industry to improve the nexus between the supply and demand for ICT skills and ICT professionals. The ACS is ideally situated to assist in implementing this recommendation by way of setting an industry relevant Core Body of Knowledge to accredit courses against.
7. Higher education providers should be encouraged to provide short term post graduate certification programs aimed at those already in the workforce to help ICT professionals evolve their skill base, retrain and re-skill and develop new specialisations. ICT is a rapidly evolving area and ICT professionals need more avenues to continue to develop their skills to ensure they remain employable and relevant to the workforce.
8. Government should continue to support the Industry Leadership Group process and in particular:
 - the development of a robust supply/demand model for the Australian ICT labour market to allow better prediction of essential ICT skills needs; and

- National ICT Careers Week as an ongoing program designed to attract students to careers in ICT.
9. Entry paths into careers in ICT should be broadened to include the option of traineeships, cadetships, apprenticeships and other VET programs. Government, industry and the VET and higher education sector should cooperate and coordinate their efforts to improve student choice and develop a clearly articulated pathway for career development and continuing ICT education from traineeship right through to accredited ICT professional status for students who choose the VET career path.
 10. The Government should halve HECS fees for ICT courses, as has been done for mathematics and science courses, to help attract students to study higher education ICT programs and reverse the significant and ongoing decline in enrolments.
 11. Industry and government should be actively encouraged to develop rolling 3 to 5 year skills forecasting plans as part of their annual reporting processes. This information would be invaluable for governments, industry and higher education providers to ensure we are training people with the skills that are going to be needed by industry.
 12. Government and industry should to provide greater support for work integrated learning scholarship programs, such as those provided by the ACS Foundation for women and those provided for indigenous students and students from lower socio economic backgrounds to improve participation in higher education.
 13. ICT courses are akin to experimental laboratory courses such as the sciences and engineering and should be funded to similar levels. They are currently funded to the same level as mathematics courses.
 14. The Government should continue to guarantee the autonomy and support of independent research undertaken by universities so they continue to foster free inquiry, play a leading role in new discovery and enhance social and scientific debate.