Strategy To Attract Students Into ICT Programs

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ABSTRACT

In recent times, there have been well-founded concerns worldwide about the decline in interest on the part of school leavers to enter into academic programs in science and technology in general, and in ICT in particular. Concerns stem from the observation that our "knowledge society" sorely needs informed and skilled perpetrators of innovation if it is to sustain its forward march.

This paper reflects on possible reasons for this decline, discussing some philosophical and pedagogical aspects of the problem as observed in Australia. It then reports on strategic initiatives taken in Australia with particular emphasis on South Australia to attract students into ICT programs.

I. LANDSCAPE

There has been a worldwide concern about the shrinking pool of suitably qualified candidates to enter the science and technology based professional programs, especially in Information and Communications Technologies (ICT). This may be partly attributable to the so-called "burst of the dotcom bubble", as the demise of highly visible high-tech ICT companies has been broadcast globally. These perceptions have been reinforced by the current global economic crisis, especially in the IT sector. However there is hardly any doubt that the society is ever more dependent on technology and its advancement. This being so, the alarming downward trend in enrolments in science and technology courses in schools and programs at tertiary level in many countries threatens the future of science and technology based wealth creation needed to enhance living standards for society at large. Thus, the widespread concerns about the current inadequate supply of ICT graduates are more than justified.

1.1. Industry & economy

Information communications technology and bioscience industries have been two of the fastest growing sectors, with a huge impact on the global economy. In South Australia, the estimates are that at least AUD660 million will flow into the State's economy with 2400 new jobs over the next decade in bioscience alone. On the other hand, the role of ICT industry is seen to be critical in the new economy, since it massively

contributes to wealth creation and impacts on virtually every other industry from telemedicine to e-commerce. Currently, South Australian ICT sector employs some 17000 people, already lamenting about the shortage of skilled human resources. Of particular concern is the shortfall of suitably qualified graduate engineers, which is perceived as particularly threatening to the further advancement of the industry. Unfortunately, the decline in enrolments in ICT science and technology programs, especially those in the area of ICT, puts in jeopardy the adequate supply of much needed graduates in a rapidly advancing and expanding industry, with implications for the economy.

1.2. Universities

Funding cuts pose a threat to the viability of engineering and science programs. Even traditionally well-endowed universities in wealthy countries have apparently suffered stringent cuts in recent times, causing widespread outcries. Institutions in USA, such as Virginia Tech, Iowa State University and others are subjected to painful cost cutting measures. It is reported that in the case of Virginia Tech, nearly ten percent of the entire engineering faculty is to be laid off. It is lamented that this will lead to a major loss in teaching experience and teaching capabilities, as well as impairing research capacity [1].

The situation is not much better elsewhere. Australian universities have been experiencing a sustained funding squeeze over the past decade with no prospect of improvement in the near future. This has been forcing universities to rethink their position, reassess their teaching methods and get accustomed to the reality that more needs to be done with less funding. Improving quality whilst reducing cost seems to be the order of the day. In this context, although it is observed that "IT has not yet begun to have a significant impact on the ways in which higher education is structured", it is conceded that there is much scope in embracing IT for improving the quality of teaching and learning in a cost effective way [2].

1.3. Societal attitudes

There seems to be a range of further factors, which stem from societal lack of awareness of the key role of science and technology in today's knowledge society as well as a mismatched approach to secondary education hampering the preparedness for entering science and technology programs. In many ways, this lack of awareness of the importance of science and technology is ironical, since almost every member of modern society enjoys the benefits provided by, and is increasingly dependent on, the products and processes of technology [3].

1.4. Schools

The decline in ICT enrolments parallels the decline in enrolments in science and mathematics courses in secondary schools. The situation is exacerbated by an observed lack of contemporary context and relevance (perceived or otherwise) of science subjects in school. Teaching and learning approaches in current practice are not *contructivist*, but

rely on *transmission*. Balance between expertise and engagement (constructivism) in teaching seems to be lacking. In addition to a looming shortage of professionals capable of effective science teaching, many existing teachers are ill prepared and lack confidence in teaching science and technology. There are arguments alleging that secondary schooling is failing in preparing students for tertiary study, especially in ICT. Some see the fact that increasingly universities no longer insist on pre-requisites such as mathematics, physics and chemistry as an entry requirement into engineering programs as an indictment of schools. Liberals see removing the barriers as a triumph for open participation. Unfortunately removing the requirement for appropriate prerequisite knowledge has not increased entry numbers; only diluted the quality. There does not seem to be enough incentive, or interest, for teachers to improve their skills and qualifications in mathematics/science/technology areas. Ill-informed guidance by career counsellors at school also contributes to students' not choosing science subjects [3,4].

II. STRATEGIES

Figure 1 illustrates the 'flora' of the ICT knowledge society, identifying the strategically important stakeholders as the key players. The connotation is that it is in the interest of the entire knowledge society for its stakeholders to assume the responsibility for contributing to its sustenance and advancement for the common good. The following is a discussion on strategies developed and implemented by some stakeholders. Even though the examples given are from Australia, the authors believe that the principles involved are equally valid elsewhere.

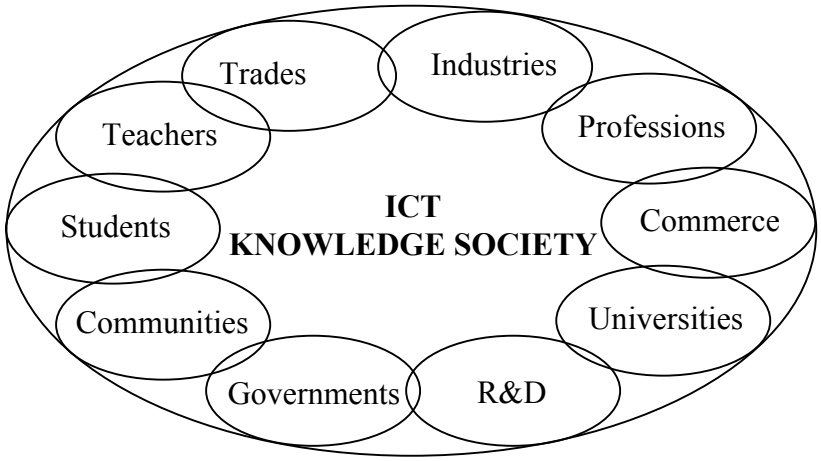

Figure 1 "Flora" of the ICT Knowledge Society

2.1. Government

2.1.1. Science and Technology Awareness Program

The Science and Technology Awareness Program, administered by the Department of Industry, Science and Resources, contributes to raising community

awareness of the central role which Science and Technology play in the pursuit of national economic and social goals. The program also administers the Australia Prize, together with Science and Technology awareness raising project grants and funding for activities held during National Science Week.

2.1.2. Backing Australia's Ability

Backing Australia's Ability: An Innovation Action Plan for the Future is a recently launched Commonwealth Government initiative. The Innovation Statement declares that a key aim of the initiative "is to strengthen Australia's research capability, to ensure the flow of new ideas which underpin innovation, to create critical mass in leading research fields, and to build competitive advantage in ICT and biotechnology." The plan provides additional funds to government schools for the purpose of fostering scientific, mathematical and technological skills, developing school-based innovation and build supportive school environment. Funds are also being made available to help develop online curriculum content in schools with the aim of enhancing student access to quality learning opportunities and provide experience of ICT as a learning tool [5].

2.1.3. Review of teacher education

Strategies for the longer term include "to ensure that talented young people are attracted to teaching as a career especially in the fields of science and technology education". To this end, teaching and teacher education is under review, in consultation with State and Territory Governments [5,6].

2.2. Profession and industry

2.2.1. Outreach programs

The Institution of Engineers, Australia, (IEAust), is the professional body representing all disciplines of engineering in Australia. IEAust is entrusted with the accreditation of engineering programs. As the custodian of the profession, IEAust is disturbed about the decline in the number of pupils studying science and mathematics in high school, and consequently the decrease in the number adequately qualified candidates to enter into engineering programs. Thus, the Institution has taken the initiative to mount a number of projects ranging from organising public events such as the Engineering Week, to producing resources within the framework of IEAust's *Schools Outreach Program* promoting a deeper appreciation of science and engineering. *Engineering Our Future* is one such teaching resource on CD-ROM; it has been designed to assist teachers to gain an understanding of relevant science, engineering and technology concepts. It provides exercises and materials suitable for the classroom with the aim of presenting science, engineering and technology to students as 'fun' in a stimulating way. Technical ideas and relevant background information are presented in simple, clear language and

supported by classroom demonstrations and exercises that are easy to carry out. Student worksheets and additional references are provided. Each unit ultimately leads to a hands-on design project, allowing the pupils 'to put theory into practice'. The aim is to demonstrate how exciting and challenging science, engineering and technology can be!
Engineers Make It Happen is another multimedia resource on CD-ROM designed to promote awareness of the importance of engineering and technology in the modern role, and the indispensable part played by engineers and information technologists.

The *Neighbourhood Engineering Scheme* links a member of the engineering workforce with a local secondary school to provide information on careers in engineering and advise on scientific and technological input into curriculum. The scheme is beneficial to both the school students and participating members of the profession. The students learn to relate technical knowledge to everyday situations and gain a better appreciation of the skills in engineering and the effect members of the engineering team have on modern day living. It places students in an informed position to consider a career in engineering [7].

2.3. University

The institutions of higher learning, the cardinal providers of education in ICT, themselves must be adequately prepared to provide the lead in the onerous task of attracting students into ICT programs for all the reasons advanced previously. Despite the funding pressures and the changing landscape they must find innovative ways of doing so whilst improving the quality and effectiveness of their teaching programs whilst reducing the cost of doing so. UniSA has actively pursued initiatives to enhance awareness of engineering and science to attract students into engineering education [8].

2.3.1. Mentoring schemes

The University of South Australia (UniSA) through its School of Electrical and Information Engineering (EIE) has instituted a number of mentoring schemes aimed at increasing awareness for the importance of science and engineering on the part of high school students. One such scheme is conducted with the active support of **e**Labtronics, an Adelaide company. **e**Labtronics has won international acclaim with accolades including a recent award at the WCIT2202,World Congress on Information Technology 2002, "Secrets of IT Innovation" in the Smart Card category. The company's innovative products are used to train University students who volunteer to take part in the scheme. These in turn train others: their fellow students in the first instance, then – more importantly – teachers and pupils in selected high schools.

2.3.2. Industry-University cooperation

There has been a growing number of initiatives developed jointly by the University in close cooperation with industry to attract students into information engineering programs. These range across the spectrum of external curriculum advice, industry-based lecturers, sponsored final year projects, scholarships and prizes, and internal publicity.

One of the distinctive features of UniSA's academic programs is the heavy reliance on committees dominated by industry figures for the formulation of curriculum proposals. This is especially important in the constantly evolving ICT area, where there is a real danger of academics falling behind current practice because of work pressures, isolation, and funding deficiencies. The School of EIE within UniSA particularly values the contribution made by industry practitioners to the teaching of undergraduates and post graduate students in its ICT programs, which instils a strong sense of contemporary relevance and assists students in building useful networks. Over 80% of the School's final year projects are sponsored by industry partners. These working links are heavily publicised in publications and by other means. Perhaps one of the most noteworthy avenues is the invitation of high school students to attend the final year seminars and demonstrations by final year ICT students. This enables potential entrants to hear and see at first hand the achievements of students, and drives home the message that potential employers play an active part in the formulation of graduate engineers and information technologists. Against a background of high structural youth unemployment, this is a strong attraction.

The ICT industry provides many prizes and scholarships for students entering and currently studying programs within the School. Some scholarships involve paid work placements, others require students to engage on project work to meet immediate needs of the sponsoring organisation. The availability of both formal programs and intensive courses is publicised internally as part of the drive by industry to upgrade its skill base. UniSA has established a nested Graduate Certificate / Graduate Diploma / Masters structure which enables the accumulation of credit for professional short courses towards formal qualifications on an incremental basis. This is probably less of a reason for industry-based graduate practitioners to study ICT courses than immediate task needs and IEAust continuing professional development (CPD) requirements.

2.3.3. Other initiatives

A number of other initiatives has been taken to make ICT programs attractive to prospective students. The scope of these initiatives is broad and consists of activities complementing each other in a holistic way. They include organising workshops, seminars, and summer schools for pupils and teachers at school. Practical placements and internships are offered to pupils to aid them in career choices. There is particular emphasis on segments of the community, which are socio-economically disadvantaged. Staff and students of EIE regularly participate in high school and UniSA events to promote engineering and science. All these activities are undertaken in close cooperation with relevant community sectors including industry, professional bodies and interest groups.

Community-based initiatives extend the University's core activities in teaching by fostering graduate qualities related to body of knowledge, working in teams and alone, and communicating effectively. Students develop confidence in public speaking, human relations and dealing with organisational issues. They are also made aware of the importance of professional service to the community and the associated responsibilities.
Currently some 13 schools have been scheduled for participation in the mentoring part of the scheme, involving altogether some 100 people to date, with a similar number of

schools to be added in 2003. Industry partners include eLabtronics, ITEK and a large sector of SA industry represented by Electronics Industry Association (EIA).

The *Science and Technology Awareness Program* is a formal expression of this community outreach to attract students into ICT programs, involving schools, teachers, education authorities, university staff and students, industry sponsors and community organisations.

III. CONCLUSION

The decline in interest in science and engineering programs at university is paradoxical in view of the dependence of the *knowledge society* on the successful endeavours in science and technology, especially in ICT. Stakeholders everywhere seem to be acutely aware of this, as evidenced by their concerted efforts. The examples from Australia presented here reflect the determination of stakeholders within society at large to reverse the trend, and inspire optimism for the future. There are encouraging signs that such strategic initiatives may be succeeding in attracting students into ICT programs.

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