Introduction

This paper addresses a number of key issues in relation to Technology teacher education. It commences with an analysis of current trends in program provision within Australia both for the secondary and primary/elementary levels. Discussion follows regarding the elements of exemplary Technology teacher education programs and the manner in which these differ from other disciplines. Factors that encourage student participation in Technology teacher education are then discussed in the context of market research and the resultant successful practice undertaken at Griffith University as a guide to strategies that may be employed in other institutions.

Trends in Australian Technology Teacher Education

The trend in Australian Technology teacher education over the past two decades has seen the demise of fully integrated four-year undergraduate programs in favour of alternative options. Williams (2002) points out that a number of institutions have opted for a post-graduate model where an initial degree is undertaken prior to a Bachelor of Education. In some cases a trade qualification is being accepted while design degrees or technology degrees are accepted in others. The nature of the technology degree is in some cases problematic as any degree with technology in the title is at times accepted. Williams highlighted the difficulties of identifying a “relevant” initial degree in view of the fact that “quality in teacher education is dependent on a research based, practical study of a range of industries and technologies and a critical approach to the social and environmental contexts of technology, not a study of a narrow range of specific vocations (Williams 2002, p. 6)”.

In addition to the conventional Bachelor degree programs a number of retraining programs have arisen. The existing retraining programs may be divided into two categories. Some attempts
have been made, particularly in NSW to attract existing teachers into technology education through the provision of Graduate Certificate programs whereby qualified teachers were provided with 6 months full-time training followed by a 6 month mentoring program (Gibson & Barlow, 2000). Four such programs were run between 1996 and 1999. The second type of retraining program has arisen mainly through the political imperative of retraining workers made redundant through industry closure. This lead to the federal Department of Education and Training and Youth Affairs (DETYA) negotiating with the University of Newcastle for a program to retrain BHP workers made redundant through the closure of the Newcastle steel mill. The scheme provides credit for prior learning and an 18 month teacher education program which includes a 6 month internship. Since its inception in 1997 the scheme has been expanded to encompass redundant workers from the Port Kembla Broken Hill Proprietary Ltd facility through the University of Wollongong as well as other retrainees from trade backgrounds in both Sydney and Wagga Wagga. This program has continued in four centers throughout NSW with a total of 146 students due to graduate at the end of 2002 (Thompson, 2002). The advent of short retraining programs has the potential to affect the status of Technology Education within the teaching profession and the community as few, if any, other disciplines are having teachers trained in such short programs. The Technology Educators will need to monitor this trend carefully if they are to maintain their position within the teaching profession and not regress to the lower status of the past that they fought so hard to overcome.

Primary or Elementary Technology Teacher Education

Data relating to the provision of technology education courses within primary or elementary teacher education within Australia 1999-2000 provided by Williams (2002) found that only seven universities included it as a core study. A review of current course offerings in 39 universities indicates that in the 33 Primary education degrees all but 9 offered courses in technology as a compulsory part of their program. Of those offering courses 18 offered one course and six two courses. While this appears to be a dramatic improvement the figures need to be treated with caution. Investigation of the content of the technology course offerings found that technology was interpreted quite differently across the institutions. Two courses were restricted to Information Technology, 13 were designated as Science and Technology, one Science Technology and Society, one Technology and the Arts, one Science Technology and Numeracy and 11 referred specifically to the Technology Key Learning Area (KLA). The Technology KLA was however specifically referred to in 10 of the Science and Technology course outlines. Overall it would appear therefore that 33% of primary education degrees now have at least one course devoted specifically to the Technology KLA while a further 30% have at least a part of a course devoted to the Technology KLA. This represents a major shift in this area of teacher preparation over the past two years.
Program Changes

Data relating to a surge in enrolments, an influx of funds for program improvements, modernization of instructional laboratories, and expansion of program offerings is somewhat difficult to interpret. Surges in enrolments in programs over the past four years have been evident. In the main this seems to have occurred with the introduction of new programs whereas established programs have fluctuated with, for example the Australian Catholic University almost doubling its intake, Griffith University maintaining its high intake levels while the University of Sydney has closed its program. While some new programs have arisen as a result of pressure on universities from the profession and employing bodies, particularly in Victoria, others have been the result of government imperatives to prevent unemployment as a result of industry downturn. New programs have arisen in the main utilising existing facilities either within the Technical and Further Education (TAFE) sector or through the use of school based facilities. Gibson and Barlow (2000) suggest that this is a result of budgetary constraints rather than concern for curriculum delivery and caution the use of the TAFE sector for technology teacher education due to the “potential for a clash of technology teaching philosophies. TAFE teaching strategies are largely focussed on competency based learning which to some degree might conflict with the problem solving philosophy underpinning secondary school subjects such as design and technology (p. 14). Overall it would therefore be difficult to establish that there has been a real influx of funds for either the modernisation of laboratories or the expansion of program offerings. In fact, the reduction in funding to universities over the past eight years has been in the order of 26% and has meant that very little funding has been available for anything other than academic salaries. As a direct result staff student ratios in Australian universities have risen from 12.9:1 in 1990 to 18.8:1 in 2000 a fact that has major implications for Technology Education programs where laboratory based instruction necessitates small group sizes but academic teaching loads are calculated on the basis of overall student numbers taught.

Attributes of a Technology Teacher Education Graduate

In 1998 the Australian Council of Deans of Education (ACDE) published a report of the National Standards and Guidelines for Initial Teacher Education project. They suggest that graduates should possess a range of attributes including:

- “an appreciation of entering a profession of rich complexity, which is of profound value to society, and which carries great responsibility, challenge and satisfaction.

- understanding and commitment to maintain the highest professional and ethical standards.
a coherent sense of themselves as professionals who should be able to make judgements about their competence in particular circumstances, and know when and how to seek assistance.

- be committed to, and capable of, lifelong learning.
- be able to communicate effectively and appropriately to the range of audiences (students, colleagues, school administrators, parents, and others) and in the range of circumstances expected of a beginning teacher.
- have an active sense of themselves as part of the education research community. They should be practitioner-researchers for whom research is a normal part of teaching practice. They should be explicit and analytic about their practice. They should have the capacity to access, evaluate and incorporate research findings into their work.
- should have developed their individual talents and interests as they relate to teaching - fostered their critical and reflective capacities, aesthetic sensibilities, and creative and physical skills.”

In relation to content studies ACDE maintain that graduates should have;

- “a broad general education as a framework for critically developing their understanding of their subject/learning areas, for developing understanding and capability in new areas, and for providing a basis for responding effectively to a range of issues which will arise in their professional work.
- understanding, at a level appropriate to higher education, of the areas they are prepared to teach: those areas' historical development, central concepts and language; relevant content knowledge, capabilities and appreciations; structures and characteristic modes of inquiry.
- the deep understanding of content and pedagogy which enables them to transform (organise, adapt, present) content in ways which are powerfully responsive to the particular characteristics of learners, curricula and teaching environments. They need to have such ‘pedagogical content knowledge’ thoroughly integrated with their other knowledge and capabilities.”

Few would argue that all teachers need to possess these attributes, particularly those relating to the ability to be analytical or reflective about their practice, which is a common theme in teacher education. However, do these general attributes vary in relation to technology teachers? Banks and Barlex (2001) point out that whereas teachers of other disciplines come to the task of teaching with a vision of how they were taught and are therefore able to initially model their teaching on that memory, the short curriculum history of technology means that this memory is often not available. The teacher education of technology teachers is therefore faced with the challenge of creating a framework of practice within which graduates are able to operate. This includes subject content knowledge about technology, pedagogical knowledge and school subject knowledge about how to teach specific content. Furthermore Hansen (1993) proposes...
that technology teacher education programs should include the following aims; the
development of reflective practice, the development of an understanding of the
curriculum development process, the ability to link critical thinking, independent learning
and other higher order learning outcomes to the classroom experience of undergraduates
and the development in student teachers of a ‘context’ or philosophy for technology
education. Burke (1999) supports these with the addition of abilities related to
understanding technological systems, making ethical decisions about the use of
technology, using practical based resources in teaching technology, and an understanding
of technology-based careers.

Changes in curricula are particularly relevant to the technology educator at this time
with the advent of new syllabi in the Technology key learning area. Changes in
curriculum such as those occurring in the technology education field often require
changes in the roles and relationships of teachers with the introduction of new teaching
and learning methods. The new proposals generally advocate a change in pedagogy that
will affect lesson organisation through the use of a design or problem solving approach
and may necessitate a change in the individual role of the teacher as they move from a
director to a facilitator of learning. Changes or increased role interaction with other
teachers may also result from the introduction of team teaching, teaching across
traditional subject boundaries, or increased subject integration. Familiarity with these
pedagogical shifts therefore needs to be a key component of Technology teacher
education programs. One contemporary change in technology education curriculum
delivery is the shift to an outcomes or standards base. Recent research by the
Technology Education Research Centre of Griffith University has identified this as a
major area of concern for existing teachers, even recent graduates, suggesting that this
needs to be a specific focus in future Technology teacher education programs. This will
be of major importance if teachers are to gain an understanding of the process by which
outcomes are interpreted and converted into work programs and valid student
assessment planned and undertaken.

Wash, Lovedahl and Paige (1999) highlight the necessity of technology teachers to be
receptive to change through their observation that there has been more change in the last
two decades than in the entire history of the profession. Their research into receptivity
to change among traditionally and alternatively certified technology found no significant
differences, however they maintain that alternative certification in the USA usually
involved rigorous candidature screening, a requirement for ongoing professional
development and an initial degree of teaching qualification. This is unlike the Australia
experience whereby retraining programs are often for ex-tradespersons who were found
by Chester (1994) to be significantly less innovative than their colleagues. Further
research into this area is therefore needed in order to identify the potential implications
of the current trend in technology teacher education in Australia on the future of the
profession.

Welty (1999) adds to the list of potential problems facing technology teacher
education by pointing out that “it is becoming increasingly difficult to believe that
preservice education programs can prepare a new generation of technology teachers who
have mastery of a knowledge base that is expanding at an exponential rate” (p. 1). He
goes on further to make the point that many administrators see the employment of
technology education graduates as means of upgrading the existing program within their
particular school. This is not a problem unique to America as there is a similar trend
within Australia placing additional pressure on teacher educators to not only produce
good teachers but innovative leaders as well.

It would appear therefore that while exemplary technology teacher education in
Australia has much in common with other education disciplines there are a number of
specific characteristics that need to be addressed. These include the need to understand
and make ethical decisions about technological systems, and the ability to use practical
based resources (Burke, 1999), the difficulties associated with an exponentially growing
content base (Welty, 1999), the lack of an historical framework of practice (Banks and
Barlex, 2001) and high receptivity to change (Wash et al, 1999). In addition there is the
need to generate an understanding of outcomes based curricula. These factors, when
combined, tend to point towards the need for the focus of undergraduate technology
teacher education programs be on breadth and innovative practise rather than depth of
curricular offerings.

Encouraging students into Technology Teacher Education

In trying to identify the factors that encourage students to enrol in an undergraduate
technology teacher education program it is evident that little research has been
undertaken in the Australian context. A longitudinal study currently underway at Griffith
University does, however, provide some insight. The project commenced in 1998 and
involves surveying all year one students at the commencement of their studies. It builds
upon the 1995 initiative of the Faculty of Education that undertook a market research
exercise using an external consulting company Market Facts. That report highlighted the
following factors that needed to be included in any marketing/recruitment strategy;

- Highlight program strengths and uniqueness.
- Highlight the community and professional input into the course design.
- Include employment opportunities, range and success.
- Include staff qualifications, research, and their national profile.
- Tertiary entry score must be included. A high proportion of students make
career choices on the basis of the programs they think they can get into.
- The need for a contact number for further information.
- Investigate the possibility of using the Internet as an information source.
- Include commencement and ongoing salary scales.
- Include pre-requisite subjects.

The market research also strongly suggested the use of alternative presentation
methods for information as students are now very visually oriented. For example
interactive computer programs or video might be worthwhile investigating. The Market
Facts report also included suggestions for an effective marketing program. It highlighted:

- The need for accurate information for students.
- Development a distribution process - Networking!
- Identification of the 200 key people who "needed to know".
- Investigation to find out whether these people visit Griffith?
- A plan to work out how to reach them?
- Deciding how much time academic staff were prepared to spend?

As an outcome of this research a specific marketing/recruitment strategy was developed for the Bachelor of Technology Education. The current research has helped to identify how students became aware of the Bachelor of Technology Education and the factors that lead to their choice of this degree. It supports the general findings of the Faculty-wide research indicating that the factors involved in the decision to undertake general teacher education and Technology Education are similar. Tables 1 & 2 present the data from this study in terms of both response percentages and rankings.

**Table 1**

<table>
<thead>
<tr>
<th>How did you find out about the Bachelor of Technology Education Course?</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Friends</td>
<td>%</td>
<td>R</td>
<td>%</td>
<td>R</td>
<td>%</td>
</tr>
<tr>
<td>Teachers</td>
<td>%</td>
<td>R</td>
<td>%</td>
<td>R</td>
<td>%</td>
</tr>
<tr>
<td>Parents</td>
<td>%</td>
<td>R</td>
<td>%</td>
<td>R</td>
<td>%</td>
</tr>
<tr>
<td>QTAC Guide</td>
<td>%</td>
<td>R</td>
<td>%</td>
<td>R</td>
<td>%</td>
</tr>
<tr>
<td>Tertiary Expo</td>
<td>%</td>
<td>R</td>
<td>%</td>
<td>R</td>
<td>%</td>
</tr>
<tr>
<td>University open day</td>
<td>%</td>
<td>R</td>
<td>%</td>
<td>R</td>
<td>%</td>
</tr>
<tr>
<td>Promotional video</td>
<td>%</td>
<td>R</td>
<td>%</td>
<td>R</td>
<td>%</td>
</tr>
<tr>
<td>Course brochure</td>
<td>%</td>
<td>R</td>
<td>%</td>
<td>R</td>
<td>%</td>
</tr>
<tr>
<td>School guidance officer</td>
<td>%</td>
<td>R</td>
<td>%</td>
<td>R</td>
<td>%</td>
</tr>
<tr>
<td>Direct Contact</td>
<td>%</td>
<td>R</td>
<td>%</td>
<td>R</td>
<td>%</td>
</tr>
<tr>
<td>Previous Student</td>
<td>%</td>
<td>R</td>
<td>%</td>
<td>R</td>
<td>%</td>
</tr>
<tr>
<td>Web</td>
<td>%</td>
<td>R</td>
<td>%</td>
<td>R</td>
<td>%</td>
</tr>
<tr>
<td>Other relatives</td>
<td>%</td>
<td>R</td>
<td>%</td>
<td>R</td>
<td>%</td>
</tr>
</tbody>
</table>

Of particular interest from Table 1 is the fact that teachers are consistently one of the major sources of information for students. It is for this reason that all correspondence has been directed to the technology teachers within the schools and not the guidance
officers. The other major source of information is the tertiary entrance guide booklet (QTAC Guide). It appears that in many cases students make choices on the basis of the entrance score they achieve and therefore use the guide to find out what programs they can get into. The other factor of interest is the increase in the use of the internet as an information source. This supports the 1995 recommendation to investigate this as a potential information source.

### Table 2

<table>
<thead>
<tr>
<th>Factor</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Had the necessary entry score</td>
<td>23</td>
<td>8</td>
<td>17</td>
<td>7</td>
<td>21</td>
</tr>
<tr>
<td>Good job prospects</td>
<td>82</td>
<td>1</td>
<td>74</td>
<td>1</td>
<td>75</td>
</tr>
<tr>
<td>Secure future</td>
<td>84</td>
<td>6</td>
<td>57</td>
<td>3</td>
<td>66</td>
</tr>
<tr>
<td>Opportunity to work with students</td>
<td>36</td>
<td>6</td>
<td>68</td>
<td>6</td>
<td>48</td>
</tr>
<tr>
<td>I liked this subject at school</td>
<td>64</td>
<td>2</td>
<td>72</td>
<td>2</td>
<td>61</td>
</tr>
<tr>
<td>Good working conditions</td>
<td>44</td>
<td>32</td>
<td>48</td>
<td>8</td>
<td>55</td>
</tr>
<tr>
<td>Looking for a change of career</td>
<td>46</td>
<td>4</td>
<td>29</td>
<td>6</td>
<td>42</td>
</tr>
<tr>
<td>Didn't know what else to do</td>
<td>6</td>
<td>9</td>
<td>6</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Good salary</td>
<td>28</td>
<td>7</td>
<td>33</td>
<td>5</td>
<td>13</td>
</tr>
</tbody>
</table>

The factors leading to the choice of Technology teaching as a career strongly support the need to highlight job prospects and future security in any marketing/recruitment program. In addition it supports the strategy of directing marketing materials towards the teachers of technology who have a significant role in the student decision to follow this particular career path.

The research undertaken at Griffith University has enabled both the initial development and later refinement of the marketing of the Bachelor of Technology Education over a period of seven years which has resulted in higher student numbers, increased student quotas and the attraction of higher quality candidates to the program. This process has proceeded through a number of stages. The first stage was the development of a new program brochure. This included all of the information suggested by the initial Faculty market research. Academic staff then undertook personal visits to over 80 school guidance officers throughout the state, addressed teachers at professional development courses, attended school careers night, and addressed groups of students during which time the new program brochures were distributed. Following this process a mail out of brochures was undertaken to guidance officers in every Queensland school.
How effective was the strategy?

Figure 1 displays a number of interesting trends. Firstly there was an increase in student intake progressively to a peak in 1999 after which there has been a slight decline. The decline however has been as a result of political factors within the university. As may be seen from the graph the difference between allocated places and intake increase dramatically up until 1999 after which there has been a closer match. The university is funded on allocated places and not actual enrolments thus numbers in addition to quota remain unfunded. Following 1999 the ratio of placement offers to allocated places has been reduced by the university in order to reduce the number of unfunded positions within the degree. However, it needs also to be noted that the quota has been steadily increasing over the whole period in recognition of the demand for places. Of interest also is the fact that while numbers have increased the entry score has changed also with students needing progressively better school results and/or prior qualifications in order to gain entry.

As a part of the ongoing marketing/recruitment strategy the Technology Education faculty now have a policy to accept all invites to talk about Technology Education at Griffith regardless of the location or the size of the audience. In addition a professional upgrade program was developed for existing teachers to gain degree status. This had the effect of meeting a market niche and also providing a forum for teachers to learn about the new degree. Of equal significance is the development of an alternative entry pathway for students who do not, for a variety of reasons, meet the normal entry requirements. These students may now undertake a one year Certificate in Technology Education. This program runs on a fee for service basis but uses four of the eight first year courses from within the degree. In this way the small numbers involved join existing classes thus only marginally increasing staff workload. At the end of the program success at the
tertiary level elevates the student entry score to a point well above that required for entry the following year at which time students are given full credit for the four courses they have already completed. A number of very able students have entered the program via this process.

In line with the initial need a number of other marketing related strategies have been developed. The development of CDs of student work and the Presentation Night represent attempts to provide information visually and have proved particularly successful. These two activities relate to the Design and Technology Project students complete in the final semester of their program. During this time they work directly with a client to produce a product for which there is a particular need. These range from teaching aids for schools to aids for the handicapped and industry related products to improve production capacity. The CD was used to highlight the research testing and planning undertaken in the process of meeting the need and has now been replaced by similar Web-based materials. The Presentation Night, hosted by the Dean of Education, provides a public forum where key members of the university, state and private education and the community are invited to see presentations and static displays of the student work. The Presentation Night provides the opportunity to not only showcase the students’ work but educate the invited guests regarding the nature of Technology Education. Since its inception there has been a noticeable increase in support for the program from within the university. In addition Griffith University has an ongoing process of Web site development that helps to inform our potential clientele of all of those pieces of information originally identified by the market research. New hard copy marketing materials are now directly related to the Web site.

Conclusion

Technology teacher education continues to face a number of significant issues for the future. The expansion of primary/elementary technology education course offerings provides a unique opportunity to increase the status and influence of the discipline and should be seen as a positive development. Teacher shortages and in particular the manner in which they are addressed provides a major challenge. Equally challenging is the nature of technology teacher education programs. The specific needs of the discipline outlined in this paper may provide a guide for future program developments and existing program evaluation. Having an exemplary program however means little if student recruitment is ineffective. The outcomes of the research outlined in this paper may provide a guide to future practice in this area.

References

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