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Teacher Education Futures: Implications of Teaching and Learning in an Online World

Abstract

In this paper, we argue that Information and Communication Technologies (ICTs) in education are linked to the need for an urgent reconceptualisation of the skills and learning experiences of students in current teacher education courses. We suggest that future teachers will require skills not currently emphasised in many teacher education programs, and that some skills which have been traditionally considered as important will become less central. Professional development programs for teachers must acknowledge the notions of reskilling and deskilling, which arise from the improved provision and connectivity afforded by ICTs. Pedagogical practices, curriculum and even the nature of schooling are being influenced by ICTs, and in recent years there has been a blurring of the traditional boundaries of geographical territory, home and school, and reality and cyberspace. An increasing proportion of the wider community is connecting to the Internet. It is no longer remarkable for parents and their children to access school web sites, or even virtual schools, where students complete much of their work at home, using online computers. Those teaching methods, which in the early twentieth century would have concentrated on paper-based literacies, are increasingly being complemented or subsumed. We discuss the implications for teacher education of these developments, and argue that changes must be introduced if teacher education courses are to continue to be relevant in the twenty-first century.

The Imperatives of ICTs for Teacher Education

For the purposes of this paper, we acknowledge that information and communication has become “increasingly interlinked and mediated by technology” (QSA, 2003, p. 3) through the use of technological devices which enable individuals to

access, construct and publish information for particular purposes and audiences. [They]...allow communication and collaboration with others in real and virtual spaces...as a medium to express ideas and be creative. Interaction takes place at the interface between humans and machines and can be controlled to meet the needs of clients. (QSA, 2003, p. 3)

Thus, the term Information and Communications Technologies (ICTs) is used to refer to computers and computer related devices used for information and communication purposes.

Growing concerns about preservice teacher education in Australia have focussed on issues such as teacher shortages, funding, and teacher education quality provided by universities. These are undoubtedly real concerns, and they are reflected in the observation by the Australian Council of Deans of Education (Oct. 2001) that “teacher supply is projected to reach critical levels over the next five years” and that “the need to provide and train more teachers is an urgent one” (p.114). We argue in this paper that there are additional urgent issues relating to what student teachers should learn, and that teaching and learning in the 21st century needs to be linked to the imperatives of technological change and globalisation. Specifically, as indicated in the recent Department of Education, Training and Science (DEST) report, Raising the Standards: A Proposal for the Development of an ICT Competency Framework for Teachers (DEST, 2002a), there is now evidence of widespread acceptance and support that we need to “better exploit the potential of ICT” (p. 3). The DEST report notes that

to date, this potential has not been realised in any significant way, particularly the potential to transform how, what, where and why students learn what they do. While there are only limited examples of the transformative power in the educational sector, experience from industry and other sectors clearly demonstrates that new times need new approaches, and that the nature and application of ICT enable that transformation.(DEST, 2002a, p.3)

Recognition of the importance of ICT curriculum integration has already occurred, and most teacher education programs have introduced courses in ICTs for future teachers. International examples include the USA (see Preparing Tomorrow’s Teachers to Use Technology. US Department of Education, 1999), New Zealand (see Interactive Education: Information and Communication Technology (ICT) Strategy for Schools. Ministry of Education, New Zealand, 1998), and Hong Kong (see Information Technology Learning Targets - Information Technology Learning Targets Working Group, 1999). In Australia, evidence of ICT adoption can be found in the report entitled Making Better Connections: Models of Teacher Professional Development for the integration of Information and communication technology into classroom practice. (DEST, 2002b).
A concern with early implementation of ICTs, according to DETYA (2001), was a tendency in early approaches to focus on the acquisition of ICT skills as an end in themselves. A subsequent trend attempted to change the orientation from teaching about computers to teaching with computers, with the emphasis being on enhancing teaching and learning through integrating ICTs within the existing curriculum. The teacher education response to this orientation has meant that student teachers are increasingly taught how to integrate ICTs into their teaching and learning. While this is commendable development, it is based on the assumption that teaching and learning will continue to take place in traditional classrooms and other bricks-and-mortar buildings where students and teachers meet regularly in face-to-face teaching and learning situations. Further, it is assumed that when computers are used that they will be seen as an interesting way to present much of the same content that schools have taught for many years. That is, this approach implies that little changes in what students learn.

A useful framework for conceptualising the dimensions of ICT use is provided by DETYA (2001) which identified four interrelated and overlapping dimensions of ICT use in schools:

- a tool for use across the curriculum or in separate subjects where the emphasis is on the development of ICT-related skills, knowledge, processes and attitudes;
- a tool for enhancing students’ learning outcomes within the existing curriculum and using existing learning processes;
- an integral component of broader curricular reforms, which will change not only how students learn but what they learn; and
- an integral component of the reforms, which will alter the organisation and structure of schooling itself. (Our italics)

Drawing on the implications of the fourth dimension of ICT use, which suggests that ICTs will “alter the organisation and structure of schooling itself”, we question the assumptions which tend to suggest that it is sufficient to focus on learning about and learning with computers, and suggest that much of this work in teacher education has not gone far enough. The DEST report (2002b) reviewed preservice teacher education programs in Australia and reported that “while pre-service teachers receive considerable exposure to, and experience with, ICTs in their training, they receive limited experience in actual classroom use” (p. 2).

Little or no evidence is provided of programs in which ICT use is an “integral component of the reforms” to schooling. We argue that schools and student needs are likely to be very different in the next decade. Among the diversity of school types will be virtual schools, where students spend part or all of their time working ‘off-campus’, for example, from home using an online computer. In preparing for the future, we need to ask - what will schools look like in 5-10 years time? The traditional model of one teacher with a class of students which meets in a physical space for timetabled lessons is already being challenged. More than thirty years ago, Alvin Toffler (1970) predicted in Future Shock that computer-assisted education would play a part in changes to school education. He predicted that parents would educate their children from home, and students might "continue going to school for social and athletic activities or for subjects they cannot learn on their own..." (p. 367).

Toffler's prescient writings anticipated the current developments of virtual schools. There are now over one hundred virtual schools in the U.S.A. alone (Clark, 2001). These schools are characterised by a separation between teacher and learner, and the use of online computers. There is evidence that the numbers of these virtual schools are continuing to expand. Clark (2001) also noted that more virtual schools began operations in 2000 or 2001 (43%) than in the previous four years combined. There are virtual schools in Canada, Australia, Israel and the United Kingdom, in addition to examples such as the Islamic Virtual School, the Virtual School for the Gifted, and the International House Net Languages School (Russell, 2002). In addition to virtual schools, ICTs are affecting many aspects of school education, and it is timely to consider what the implications of these changes might be.

**ICTs and the Colonisation of School Education**

School education is being colonised by online computers. Pedagogical practices, curriculum and even the nature of schooling are influenced by them. This process is reminiscent of the ways in which the imperial expansion of Europe and the U.S.A. in the nineteenth century affected traditional life in areas including Africa, Oceania, and South America. Sometimes, the colonisers would be faced with passive or even active resistance, but it was clear that changes to the customary way of life were inevitable. For the colonisers, there were overseas markets, raw materials, cheap labour and profitable land, as Said (1993) points out. However, Nemo (1900) writing at the beginning of the twentieth century, has also described the ways in which the natives were "despoiled of their possessions" (p. 3)
Similarly, the spread of online computers has sometimes been resisted on grounds such as familiarity with existing practices, expense, or a perception that there is a threat to family life. There have also been concerns that computers may hinder learning, and be harmful to physical development or creativity (Armstrong and Casement, 2001). However, despite these concerns, it is increasingly common to find internet-capable computers in primary and secondary schools. For example, the NCES report (2003) indicates that 99% of a sample of public schools in the U.S.A. had access to the Internet in 2001, as did 87% of instructional rooms. Of those schools with an Internet connection (all but 1%), 85% used a broadband connection. This would greatly increase the chances of students using online multimedia in their classes.

An increasing proportion of the wider community is connecting to the Internet, and it is no longer remarkable for parents and their children to access school web sites. Parents can read school newsletters online and communicate with teachers, and students can complete on-line units of work, and submit their work electronically. In this sense, parents and other members of school communities are able to participate more fully in the educational process. In the nineteenth and early twentieth centuries, learning was constrained by a schoolhouse paradigm of four walls, blackboard and teacher, but, as indicated earlier in this paper, this view of school education is being subsumed by online alternatives. Education systems not only now expect ICTs to be integrated in all curriculum areas, but are examining the implications of ICTs for reforming curriculum, pedagogy and assessment. In the DEST (2002a) conceptualisation of ICT use described in this paper, the third dimension of ICT use implies changes in how and what students learn. Hence, teachers of more traditional subjects are now being expected to vary what they teach to enable students to use web sites and online databases. Teaching methods, which in the early twentieth century would have concentrated on paper-based literacies, are increasingly being supplemented by multi-modal screen-based literacies. Students will find that their daily lives require them to operate in multimedia environments where they are required to read and author words, images, and sounds.

As the use of online computers in school education becomes more prevalent, student and teacher perceptions of the world are likely to be affected. Resnick (1993) explains the situation in terms of a metaphor:

If a person has only a hammer, the whole world looks like a nail. Indeed, a person's perceptions and models of the world are strongly shaped by the objects that exist in the world. This is true for computational systems. The way people interact with (and think about) a computational system depends on the objects that compose the system. (p. 208).

Students are immersed in digital environments, and their understandings of the world are mediated by them. As McLuhan (1994) has observed, technology can change people without their realising it. Hence, the range of technologies reported in the DETYA (1999) study of the information technology skills of Australian school students is likely to be important more for the ways that the technology itself affects students than for its content.

The challenge posed by students' use of ICTs has already lead to widespread responses. In an overview of ICT initiatives in educational systems across Australia, Finger and Trinidad (2002) have recently concluded that there is an "emergence of initiatives aimed at taking advantage of the potential of connectivity and students' learning in an online world" (p.4). Evidence of the Australian Commonwealth Government's support for such initiatives is also found in the DETYA (2000) report, entitled Learning in an Online World – School Education Plan for the Information Economy. As displayed in Table 1 below, major online initiatives are occurring at the national level within Australia.

<table>
<thead>
<tr>
<th>Initiatives and Projects</th>
<th>Summary</th>
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- Progress Report: Learning in an online world
- The Le@ming Federation – Schools Online Curriculum Initiative
- Innovation and Best Practice Project
- Quality Teacher Programme (QTP)
- Models of teacher professional development for the integration of ICT into classroom practice
- ICT Competency Standards for Teachers
- Innovative Bandwidth Arrangements for the Australian Education and Training Sector
- Computer Technologies for Schools
- Technical Standards for the Education and Training Sector
- Performance Measures for ICT
- National ICT Research Database
- International Comparison of ICT policies
- Effective use of ICT to enhance learning outcomes of disadvantaged students
- EdNA Online

- The Commonwealth Government promotes and supports national collaboration across school systems to achieve the goals set down in Learning in an Online World.
- A component of Backing Australia’s Ability: An Action Plan for the Future, the Le@ming Federation aims to generate online curriculum content for system delivery to schools.
- Information technology is one of the QTP’s six priority areas.
- High speed online communications is a very high priority for the education and training sector. The project report is available at http://www.dest.gov.au/schools/publications/2001/bandwidth/index.htm
- This project provides surplus Commonwealth Government computers and equipment to schools throughout Australia.
- The AICTEC established a Standards Sub-Committee to deal with standards issues relating to ICTs for education and training.
- MCEETYA, in 2001, endorsed a framework for national assessment and reporting of students’ ICT skills and knowledge. MCEETYA also authorised the development of assessment instruments and key performance measures, and endorsed the national monitoring of ICT skills and knowledge of Year 5/6 and Year 9/10 students through two- or three-yearly sample assessment.
- An online database of State, National and Commonwealth research on the use of ICT in school education has been developed.
- This project describes and analyses what governments in Australia and overseas, private education and training providers in Australia are doing in terms of ICTs and supporting transition to the information economy. This will provide a searchable, online database available through EdNA Online.
- Due for completion in mid 2002, this project seeks to identify effective ICT practices and how they can be used with disadvantaged students to enhance learning outcomes.
- EdNA Online website is available at http://www.edna.edu.au, is managed by education.au.limited which is a non-profit company owned by the State, Territory and Commonwealth Ministers for Education and Training. This website provides a portal for an extensive range of quality services and resources to facilitate a network of Australian educators.

As well as the obvious implications for schools from the national initiatives and projects, each of the Australian States and territories are engaged in a wide variety of online initiatives. For example, Table 2 below displays examples systemic online initiatives in the State of Queensland in Australia. Those initiatives include examples such as emailed lessons, shared web space, Internet lessons, telephone lessons, HF radio lessons, and hands-on lesson materials. Another example from Queensland is an innovative approach called The Virtual Schooling Service. This initiative commenced in 2000 and introduces new patterns of distance learning using flexible delivery strategies and a range of learning technologies (Education Queensland, 2003b). Delivery modes can be synchronous whereby students are linked using audio and data conferencing technology. In addition, asynchronous teaching and learning is available whereby the students can access digital media including documents, digital video, audio and graphics.

<table>
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<th>Table 2: Education Queensland – Systemic ICT Initiatives and Projects</th>
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<td>4</td>
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Summary of Education Queensland's Systemic Projects to Support ICTs for Learning

Hardware, Infrastructure and Connectivity

The systemic student to computer ratio improved from 6.6:1 to 6:1 over 12 months from 2000 to 2001. In Secondary Schools, the systemic student to computer ratio was 4:6:1. Schools report that, in 2001, 66.2% of curriculum computers had access to the managed Internet service. Education Queensland has set a target of 1 computer for every 5 students by 2005.

- All Education Queensland schools are part of the Wide Area Network, each with either full cabling or a network starter kit installed.

- **Staff Professional Learning Programs**
- **Learning and Development Foundation** facilitates learning programs. ICT related professional development initiatives included:
- **Quality Teacher Program**
- **Learning and Development Centres (Technology)** were established to provide professional development for teachers.
- Other initiatives include:
  - The establishment of 8 Technology, Maths and Science Centres of Excellence.
  - The Minimum Standards Learning Technology requires all teachers to have attained these standards.
  - The Information and Communications Technology Continua (draft form) provide scaffolds for personal learning and development plans that incorporate ICT

- **Education Queensland’s Website** (http://education.qld.gov.au)
  Redesigned to improve teacher and student access to online resources. The Curriculum Exchange, for example, has ICT resources - http://education.qld.gov.au/tal/curriculum_exchange/ict/

- **ICTs for Learning Strategy** (http://education.qld.gov.au/etsforlearning/)
  Aims to assist Queensland state schools to integrate information and communication technologies (ICTs) into teaching, learning and the curriculum. It is part of the Queensland government's Education and Training Reforms for the Future (ETRF) package.

**Key Features:**
Benchmarking, Core Schools Program, Priority Schools program, Innovation, Excellence and Improvement program

**Systemic Projects to Support ICTs for Learning:**
School ICT Profile Project, Performance Measures Project, Systemic Procurement and Service Delivery Project, ICT Support, Online Examples of ICT Curriculum Integration, Community Access to ICTs in Schools, Learning and Development Centres (Technology), and The Learning Place.

- **Education Queensland's Information Technology Board**
  Established as a high-level strategic action group

- **Digital Content Initiatives**
  AccessED produces digital content. Edulist is a collection of reviewed Internet sites. The Digital Resource Centre service is a key element and manages the Curriculum Exchange and Professional Exchange. Virtual Schooling Service has developed a range of digital content for some Year 11 and 12 subjects. Education Queensland actively promotes EdNA Online and Education Queensland schools are participants in EdNA sponsored online collaborative projects such as Netdays and OZProjects.

- **BYTE Awards**
  Established to recognise excellent student achievement in ICTs and developing partnerships with industry leaders and universities.

- **Blackboard5**
  Adopted as the Standard e-learning Platform.

- **Managed Internet Service Steering Committee**
  Established to enhance communications between schools and the Internet Service Provider.

Implications of Online Learning for Teacher Education Futures
An extrapolation of these trends into the future shows that teachers will need skills that are not currently emphasised in many teacher education courses, and that other skills will become less important when compared with current needs. Palloff and Pratt (2001) refer to the concept of the art of online teaching, and indicate that teaching in the cyberspace classroom requires that we move beyond traditional models of pedagogy into new and more facilitative practices. However, the transfer of traditional pedagogy to new and different media has not been matched by adequate training and professional development. This has resulted in less effective learning environments for students. Evidence for these assertions is derived from Palloff and Pratt (2001), who have found numerous examples such as
- teachers within academic institutions ill-prepared to teach in an online environment;
- poor student and faculty participation in courses,
- difficulties with course construction; and
- poor course evaluations by students.

Thus, we argue that new skills are needed to enable the potential benefits afforded by ICTs to be realised. In order to conceptualise these new skills we have drawn on lists of skill sets in the U.S.A. and Australia. These include the enGauge 21st-century skills list (NCREL, 2003), which in turn has been derived from a number of nationally recognised skill sets in the U.S.A. In addition, we considered the teacher learning technology competencies developed by the Australian Council for Computer Education (ACCE 2000). We have also drawn on the conceptual map of ICT skills provided by Russell, Finger and Russell (2000). These writers, drawing on the earlier work of Sandholtz et. al (1997), argue for a transformative stage in teaching and learning using ICTs, in which technology is a catalyst for significant changes in learning practice.

We argue for a conceptualisation of these ideas. Table 3 focuses on two of the essential conditions for effective technology use; that is, the notions of educator proficiency and effective teaching and learning practice. These are defined by NCREL (2003) as follows:

a) **Educator proficiency** (with Effective Teaching and Learning Practices) refers to educators who are proficient in implementing, assessing and supporting a variety of effective practices for teaching and learning. Proficiency requires the cultivation of digital-age skills and processes, planning and design, implementing technology-supported learning, assessment literacy, professional practice and productivity, and able to guide students as they deal with social, ethical and legal issues related to life in a technological world; and

b) **Effective teaching and learning practice** requires the vision to be translated into practice through learning environments characterized by powerful, research-based strategies that effectively use technologies.

Those two considerations do not comprehensively cover all dimensions proposed in the NCREL framework. However, our focus on these represents an attempt to suggest a starting point for identifying implications for pre-service teacher education, and for the reskilling and deskilling of existing teachers through professional development. In each case, a future skill is identified, together with corresponding implications for teacher education. We believe that these require further conceptualisation to align with the third and fourth dimensions of ICT use (presented by DEST 2002a, pp. 20-21 and described earlier in this paper). In our view, this is necessary to enable effective changes in what students learn, how students learn, and reforms to the organisation and structure of schooling.

**Table 3: Implications of ICT and Connectivity for Teacher Education**

<table>
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<tr>
<th>Essential Conditions</th>
<th>Implications for Teacher Education</th>
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<tr>
<td><strong>Teacher Skill</strong></td>
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<td><strong>Educator Proficiency</strong></td>
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| Behaviour Management | Still required in conventional schools. Reduced need in virtual schools where there is no face-to-face contact. New environments require  
  • Establishment of protocols for online communications  
  • Development of acceptable use policies; e.g. for Internet use  
  • Confidentiality, copyright, intellectual property. |
| Multi-modal Screen-based Literacy | Increased need for this skill in most traditional and virtual schools. Includes  
• Reading, authoring and correcting screen-based material  
• Advising students on appropriate use of elements such as graphics and sound  
• Teaching web-authoring and multimedia production  
• Evaluation of online materials |
| Assessment | Multimedia and online environments enable  
• Creation of digital/electronic portfolios  
• Online testing  
• Online surveys, data collection, storage and analysis |
| Authenticity determination | Students will submit materials electronically. Verification will be difficult. Issues include  
• Cybercheating and plagiarism.  
• Intellectual property. |
| Context knowledge | Teachers should not learn ICT skills in isolation. They will need to know  
Social practices, beliefs and values that embed ICT in students' lives |

### Effective Practice

| Hypertext Pedagogy | In addition to a basic knowledge of how to follow or create hyperlinks, teachers will need to be able to:  
• Teach students how to avoid the "lost-in-space" syndrome  
• Advise students on how to achieve deep learning using the Internet  
• Incorporate web-delivered, web enhanced and web-supported modes of delivery  
• Incorporate "Learning objects" in teaching |
| Interpreting Cues in Mediated Communication | In the absence of face-to-face cues such as facial expressions and body language, teachers will need to develop skills in reading nuances in email and other materials sent by students. If text-based email continues, this may include use of emoticons |
| Socialisation and the Teaching of Values |  
• Where traditional school-based socialisation is reduced by agencies such as virtual schools, teachers will need to be able to offer alternative programs  
• Explicit provision must be made for the teaching of values required in a civilized community |
| Incorporating ICTs into Discrete Subject Areas | It will not be sufficient for teachers to be able to use a computer, or understand common applications such as a word processor, spreadsheet or database.  
• All teachers will need to be able to use online computers for learning in specific subject areas, in rich tasks which involve a transdisciplinary approach, and in integrated themes across subjects involving an interdisciplinary approach |

To understand the implications of this table for teacher education, we relate our earlier comments on the colonisation of education through ICTs to the arguments of the New London Group (1996). The closing decades of the twentieth century and the beginning of the twenty-first century have been characterised by change in almost every aspect of people's working, public and private lives. The spread of ICTs in schools through improved provision of computer hardware, infrastructure and connectivity should not be seen as an important but isolated example of change affecting traditional educational structures. It is, rather, a sign of the global, social and technological changes that have contributed to the 'new times' that we live in. We live in a time of global economy and globalised society, where daily life is mediated by complex and changing multimedia and technologies. In education, this situation causes unavoidable dissonance as teachers who were trained in earlier times try to forecast and prepare others and themselves for future. It is likely that this problem is compounded by the concerns relating to resistance raised by Hodas (1993). In this understanding of the organisational culture of schools, a conservative conception of what schools should be like can lead to technology refusal, or at least to change customary practices.

An example cited by Russell (2000) illustrates this point. Russell describes a secondary school English class where the students were using computers to write hypertexts with pictures and words. The teacher was well respected by peers, students and the administration, and she was also familiar with computers. While she was able to provide valuable assistance to students on word-related tasks, questions such as how pictures and words could work together, and whether the positioning, size and colour of pictures was important, proved more challenging.
We contend that teacher education in the twenty-first century should ensure that newly qualified teachers are able not only to cope with such challenges but to capitalise upon the potential of the new ICTs to create new learning and teaching environments. In the example given above, it would have been insufficient if the teacher had been recently trained in the operation of computers. In addition, studies that explore future literacies and are guided by a pedagogy underpinned by theory incorporating ICTs could contribute to future teachers' abilities to teach in "new times".

Conclusion

In this paper, we have argued that Information and Communication Technologies (ICTs) in education are linked to the need for an urgent reconceptualisation of the skills and learning experiences of students in current teacher education courses. We suggest that future teachers will require skills not currently emphasised in many teacher education programs, and that some skills which have been traditionally considered as important will become less central. More sophisticated understandings of the implications of ICTs for reforms in curriculum, pedagogy and assessment are required. Teacher education programs must move beyond the tendency to focus on students' improvement of ICT skills, knowledge and learning to the integration of ICTs into existing curriculum using current practices.

References


