Information Technology in Education

AN OVERVIEW OF INFORMATION TECHNOLOGY CURRICULA IN AUSTRALIA AND THE IMPLICATIONS OF THE NATIONAL STATEMENT ON TECHNOLOGY EDUCATION

by

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Introduction

In this issue you will read detailed contributions from the majority of states outlining the Information Technology (IT) related courses offered in their education systems. This article overviews these contributions in an effort to highlight the general thrust of IT courses in Australia and then discusses the implications of the National Statement on Technology Education for the content and pedagogy of such courses in the future. As such, it should be noted that the comments made with regard to the various states are on the basis of the information contained in the more detailed articles only and may not give a complete or accurate picture of affairs in that state overall. Information from some states was not available at the time of writing and so no comment has been made in their regard.

An Overview

Policies

From the information available, the policy area is one which varies considerably from state to state. Though all states would probably agree on the general directions and outcomes desirable from IT in schools, states education bodies appear to be at varying points down the path to clearly articulating these views in policy documents.

New South Wales appears to be furthest along, particularly with respect to the directions which have been set nationally, while Victoria and Western Australia have clearly articulated policies on schools' computer use in general. It appears that the ACT, though it has no system-wide policy in the area of Technology Education at present, one is likely to result after the release of the National Statement.

It seems that the release of the National Statements in each of the eight Curriculum Areas may result in a flurry of policy activity as states move to align their thinking with these national frameworks. This has already been evident in changes to the Mathematics curriculums in most states over the past two years.

Curriculum Frameworks

With respect to the lower secondary education sector, the frameworks governing the development of curriculum in the various states have been in the melting pot for the past five years. During this time there has been the trend towards encouraging school-based curriculum development, the "unitisation" of the curriculum into shorter, more discrete chunks and the general acceptance that "student choice" and "educational pathways" should be encouraged.

The adoption of the Hobart Declaration on Schooling and the "Curriculum Areas" resulting on the national scene, has created a need in the states for some modification to these curriculum frameworks. The emphasis on Student Learning Outcomes (SLOs) means that students may be able to reach the required outcomes for schooling without studying a set of particular "subjects" as has been a requirement in the past. As a result, the pathways which students choose in order to reach the required outcomes may be quite different. This realisation needs to be grasped by those involved in shaping and delivering IT related curriculum, since it is paramount to ensuring the continued relevance of such courses through their provision of a mechanism for the attainment of broader student outcomes.

At the time of writing, both Victoria and WA have clearly adopted a framework for "Technology" as a curriculum area in its own right, whilst NSW has aligned Technology and Science together as evidenced by their release of the recent K-6 Science and Technology curriculum

Primary Experiences

As mentioned above, the NSW Science and Technology syllabus provides a specific framework for the use of computers in their primary schools and states like WA have a generic computer use policy for primary schools which specifies their use across the curriculum. It is clear that primary schools in all states are using computers as an aid in many aspects of curriculum delivery.

Some states have a continuing emphasis on specific keyboard instruction and the author has recently become aware of an area in Queensland where this is compulsory, beginning in year one. This appears to be an exception, though keyboard intensive word processing applications appear to be the those in most frequent use in primary schools nationwide. At present, teachers in primary classrooms generally seek specific software to meet their needs rather
than utilise the greater power that generic applications software offers in some situations. For example, teachers often seek a specialist graphing package, when a spreadsheet like "Grasshopper" (BBC) or "Works" (PC/Mac) already offers this functionality and a lot more besides. There is widespread use of specific packages for simulations, adventuring etc., particularly in the lower primary grades and in support of general language activities.

Generic databases and spreadsheets in particular, receive considerably less attention, perhaps due to the unfamiliarity of many teachers with their operation and application in the general curriculum. There is a general feeling that such software must be complicated and is irrelevant to the general curriculum. This is an unfortunate perception since a multitude of simple curriculum applications can be found which require only the elementary functions of such software to be used, but still result in powerful new representations of information which students can more easily interpret. Evidence from the UK supports this and hopefully the current changes to our curriculum which stress analytical skills over mere content, will reinforce a similar shift in this direction.

**Lower Secondary Courses**

Both NSW and WA have centrally prescribed and clearly articulated courses specifically related to IT. The ACT has similar courses but these appear to have resulted from school-based curriculum development initiatives. In Queensland and Victoria various subjects across the range of curriculum areas contain optional material related to IT and the use of specialised software packages. This author supports cross-curricular IT initiatives, but at this time the general lack of coherent, whole school IT policies, access to equipment and teachers (from a broad range of curriculum areas) with sufficient IT awareness, usually results in such optional material or specialised software packages often not being introduced to students as part of the general curriculum. This is changing over time and the growing prominence of Technology Education should provide a new context for IT courses in their own right.

Presently, IT courses across the states range from "Computer Awareness" (emphasising broad issues related to IT use in society) to "Computer Studies" (involving the investigation of specific applications packages and programming). Across this range such applications generally include: word processing, spreadsheets, database management systems, graphics, communications, sound, computer control etc. In almost all cases, investigation of these applications occurs in the context of their use as tools in the solving of more general information problems.

**Post-Compulsory Courses**

Currently, almost all education systems have a "computer related" course of study which leads to tertiary entrance. This has resulted in a choice between two courses in each state, that for tertiary entrance and the previously available "non-tertiary" course.

In general, the non-tertiary courses repeat to some degree and then extend on material presented in lower school IT units. The emphasis continues to be on practical experience with "applications" software, where it is used in the context of a personal productivity tool and some attention is given to social and current issues related to IT. In most cases the study is undertaken as part of an overall theme or as part of a project which integrates a number of aspects of IT. Course content is fairly consistent across the states, most covering word processing, DTP, spreadsheets, database management systems, graphics, communications, sound, and control systems. In some cases robotics, programming, AI and expert systems are also included. In most cases, the range of activities available is dependant on local resources and expertise.

Typically, assessment of these courses is entirely school-based with some form of external moderation of standards either by common assessment tasks, consensus meetings or school visits by an external "moderator".

The courses leading to tertiary entrance generally have a "Computer/Information Science" flavour. All include a significant amount of programming/algorithms, hardware architecture, systems analysis/design and societal implications. The areas of greatest difference between the states are the inclusion/exclusion/depth of such areas as: expert systems, AI, robotics, assembler programming and personal productivity tools. The studying of information systems as the unifying element between hardware and software is a common thread between the courses in different states and provides the context for the studying of other underlying aspects.

With respect to computer programming, most courses emphasise the use of procedural languages like Pascal, however Queensland's ITP course does appear to give relatively greater emphasis to non-procedural languages and their applications.

All involve a significant amount of academic rigour and the content of most are influenced by undergraduate computing courses. Despite this, few if any school IT courses are required pre-requisites for undergraduate computing/information courses, with most tertiary institutions preferring higher mathematics learning instead. This apparent conundrum bears further investigation as it has a detrimental effect on the status and acceptance of such courses at the secondary level in all states. It also retards the forward movement of undergraduate courses which could otherwise introduce new and higher level material to their first year students.

**The Impact of the National Statement on Technology Education**

**Context for Change**

It is arguable that the Hobart Declaration on Schooling, the resulting national goals and the ensuing national statements in each of the eight key curriculum areas are the most significant events in the shaping of school curriculum this century. In general they mark a significant shift with regard to the improved status of education and the changing locus of control for curriculum change in this country – away from educators with local interests to national groups representative of education, government and business/industry; groups focussed on the national
imperative of making Australia a competitive, clever country on a global scale.

There is no doubt that such a realisation may send a shiver down the spine of many educators – What? Have non-educators tell us what to teach? What do they know? What they know about is the real world! The world outside the protective walls of the classroom. The world which our students will live in and create, in the future. It is a world many educators, because of their own individual roles, may not know as well as they think!

As a career educator who has taught in classrooms for several years and worked in curriculum development at a state level more recently, it is an admission this author too, has had to make. Our past curriculum has been founded on well meaning ideals, focussed on benefitting the individual. However, to paraphrase a well known quote: Now is a time to "Ask not what the education system can do for our youth, but what can educated youth do for our country"!

Unless this country's slide toward third world status is halted now, the happy, well adjusted products that our current education system aims to produce will be neither happy nor well adjusted in the third-world Australia of the future. Education is not just for the benefit of the individual. Education benefits our country and produces a higher standard of living from which individuals benefit in return. For those who believe this is alarmist rhetoric, it is a similar, complacent apathy and fear of change that has seen Australia arrive at its current economic crossroads.

She won't be right mate! – not unless sectional interests are left behind and educators and others alike, act together for the national good.

The National Statement on Technology Education

It is not within the scope of this article to explore the statement itself in depth. Instead a brief overview is provided.

The statement provides a context for providing students with Technology related experiences. It involves one process and three knowledge strands:

- process – design, make, appraise (investigate, devise, communicate, produce, reflect)
- materials technology
- information technology
- systems technology

The "process" of design, make and appraise is the framework for all activities related to technology and is the iterative method by which new technologies are created.

The draft statement makes several observations about each of the three knowledge strands:

Materials
- materials are natural and synthetic
- physical, chemical and aesthetic properties of materials should be utilised
- consider materials' advantages and limitations
- use different types and combinations of materials
- process, preserve and recycle materials
- explore materials' origin, development and production

Information
- use hardware & software for managing information
- gather, store and retrieve information
- synthesise visual, sound, symbolic and electronic information
- interpret and predict patterns and trends in data
- generate models and simulations
- edit, format and publish information
- assess the reliability of information
- explore the effects of information technologies

Systems
- investigate performance of structures and mechanisms
- examine energy use, conversion and trans ferral
- devise interactions between components
- control systems to achieve specific outcomes
- make, assemble, organise and modify systems
- ethical implications and consequences
- examine the inputs and outputs of whole/sub-system

At first glance the future of IT courses seems assured – all of the points listed which relate to the information knowledge strand are currently outlined in all states' IT syllabuses at the secondary level and most have the capacity to be incidental in the course of IT use in primary schools. However, a closer inspection shows that all these outcomes can and probably be reached through the use of IT in the context of the design, make and appraise cycle involved in whatever the target technology is. In other words, IT becomes a service or tool in the investigation/development of technologies in other subject areas. There is certainly nothing wrong with that and it has been and should continue to be encouraged. However, if the content currently taught in IT courses is covered in the context of other subject areas, then is there a place for IT courses per se?

In the short term, the practitioners among you will realise that the issues of equipment access and availability of suitably trained staff in other curriculum areas mean that many schools will continue with IT courses as they are, because practicalities dictate that students will otherwise not be exposed to this content. There is an element of "Catch-22" here for as long as that responsibility is assumed by one specialist teaching group, it is generally shirked by the others, meaning that the necessary equipment and skills are not more broadly acquired thus facilitating effective cross-curricular use.

The statement alludes to students creating new technologies using various materials, arranged to form a system, according to a communicated design which is based on a firm foundation of information. However, when one looks at what the statement views as materials (only natural and synthetic) and that systems are simply described as structures and mechanisms involving energy use, trans ferral and conversion, a cynic could be forgiven for thinking that the statement's creators had a far better grounding in the Industrial Arts than Information Science. One has to draw a very long bow to accept, as it was once explained to the author, that information systems "fit in" simply because the electronic circuits in a computer use energy (electricity),
transfer it from place to place in circuits and convert it to represent information! Wow, talk about being able to sell refrigerators to eskimos!

In the context of the National Statement, IT fits nicely as a service to aid in the creation of other technologies. But what of the development of information technologies? Perhaps it is that those not involved more directly with IT often overlook the fact that unless the information technology is developed in the first place, then the information tools wouldn't exist to help create the winged keel, orbital engine or biotechnical mutant.

The author's greatest concern is not with what the statement says, but what it doesn't say! Fundamental is the statement's oversight that data is a material, the raw material of the information technologist and that information systems, while enacted through items of hardware are logical arrangements of data and the processes which act on it. As such the development of information systems/technology routinely deals with abstract materials and systems, not only the physical/concrete ones alluded to by the statement.

Students have every right (and the development of a viable Australian IT industry demands it) to develop skills and interests related to the creation/development of original information technology, not just the consumption/use of existing IT imported (as most of Australia's is) from overseas. At a recent ACCE meeting held to discuss the implementation of the statement, the author raised the place of IT as a technology in its own right in the above context. This resulted in ACCE forwarding a submission to the national working party outlining its concerns. The outcome remains to be seen.

These issues are raised as it is the author's opinion that the long term place of IT courses in schools in this country lies in the direction of the creation and investigation of IT itself; the "awareness" and "applications" focus that currently exists will eventually disappear and occur instead, in the context of IT's use in other subject areas. This could be seen as somewhat of an about-face considering that the late 'seventies and early nineteen eighties also saw a concentration on the technology itself which was subsequently seen as inappropriate. However, at the time the concentration on the technology was for the wrong reasons – a programming language may have been the only software available, and if the teacher had any computing skill at all, it was probably in elementary programming.

All this has changed. Computer Education as it has developed and all its benefits, should continue to occur throughout the general curriculum. Learning to use existing IT should occur in the context for which it is being used, not in isolation. Students are taught to hold a pencil when its time to learn to write and later they are taught other pencil techniques when they are needed in art or drawing. So it should be with any other tool – learn what is needed, when it is needed: there is too much else to learn to carry extraneous baggage. Teaching students all about word-processing using exercises designed just to illustrate all its functions is becoming an outdated concept. In completing a given brief, students will learn/be taught enough about the tool to accomplish what they need and many students will pick up a lot more incidentally.

Those teachers with a more in-depth knowledge of information technology will be freed to enthuse students about IT and provide an environment where IT is the focus of the problems students solve, not just a tool. Australia needs information technologists just as much as it needs those who craft other technologies. The future of specialist IT courses in our schools lies in skilling students to use existing IT to create the new applications and information tools needed for tomorrow.

As a result, there is a diminishing need for specialist courses in how to use computers and associated software. This country's economic imperative means that the development of a viable, home grown IT industry is not just desirable, it is essential. Therefore, specialist courses which enthuse and skill young people to the point where they become designers/developers of IT, instead of simply being consumers/users of IT, must begin to replace the current crop of "service" courses.

Information technology is the fastest growing industry in the world at present. The software and systems aspects require little physical or manufacturing infrastructure to support them. A country such as Australia with a currently retarded manufacturing capability must recognise that "brain-based" industries such as IT are a foundation upon which we can build a more secure national future. The National Statement, while making IT's role clear as a mechanism for the creation of other technologies, fails to clearly address the needs of the IT industry itself.

Despite this shortcoming, the National Statement on Technology Education provides a catalyst for change and it is change in the right direction. The emphasis on design is essential to developing a creative atmosphere where students learn to develop their own solutions and not import the "correct" one, ready-made by the teacher or someone else. Educators most closely involved with IT in schools, particularly those involved in the specialist IT curriculum, must see this writing on the wall and prepare for this change. It is for the better and it provides the opportunity for doing and creating so much more with IT in the future. Technology Education is all about being creative and IT is the most creative tool available to humankind. The only thing left for IT educators is to live up to the potential the field offers – embrace the change and be creative, for change is the only constant in the future!

Editors Note:

The comments by the author about the National Statement on Technology Education are based on a draft of the Statement. Since then the Statement has undergone some revisions which may allay some of the concerns raised by the author. Readers will be able to make their own appraisal of the Statement when it is published around the middle of 1992.