What Information and Communication Technologies Courses Should Be Taught at a New Senior College?

Tony Fetherston

Edith Cowan University
2 Bradford Street, Perth
Western Australia, Australia 6154

t.fetherston@cowan.edu.au

Abstract

This paper answers the challenge posed in the title. The author was asked to propose what innovative courses in Information Technology should be taught at a new Senior College catering for students in their final two years of schooling (aged 16 and 17). After examining existing curriculum design approaches, the author decided upon a simple approach based on scope, sequence, articulation, and balance to the design of the curriculum. This allowed some initial decisions to be made.

A strong vocational stance was adopted and a search was made for courses which would provide good vocational opportunity but that would also articulate well with university and Technical and Further Education courses. The paper concludes with the description of the courses finally chosen and how these will advantage the students.

Background

In early 2000, the author was approached by a group representing a senior college that was in the process of being established. The brief given was of describing and recommending leading edge Information and Communication Technology education and training for Years 11 and 12 students (16 and 17 year olds in their last two years of formal schooling) at the college. This was to occur within the broad framework of examining opportunities for applying technology to enhance the education and training opportunities for all students at the college.

The college opened its doors in January 2001. From that day, this education facility will have the largest aggregate enrolment of Years 11 and 12 students (800 full time students) in Western Australia, and within four years this enrolment is expected to grow to 1,200 students. The College will be unusual in that it will be co-located with a Technical and Further Education (TAFE) facility to jointly from the campus. In time this campus will also cater for university student enrolments.

The use of ICT was seen as a key strategy in establishing the joint facility as a ‘smart’ campus. It was envisaged that the demand for specialised courses in this learning area would increase rapidly and that the whole campus would provide enhanced vocational education and training opportunities for young adults. The structures of the educational programs to be provided for secondary and TAFE students were to be complementary and facilitate transition from secondary education to tertiary education studies.

The campus is located in an area that, in the last 10 years, has carried high levels of both general and youth unemployment. The population of the area is growing at a rate of 4% per annum with a significant proportion of that population growth being from lower socio-economic families with a high welfare dependency. A significant proportion of students graduating from secondary schools in the area do not aspire to undertake any form of further education or training at either a TAFE or university level.

Forty percent of the working population commutes daily to employment outside of the region as the region itself is not able to supply the number of jobs required by its working population. A major metropolitan area is located within commuting distance and will continue to have particular relevance in supplying work opportunities for local residents. With all these factors in mind, any ICT training opportunities to be delivered at the senior secondary school level were regarded as having to be very relevant to the future employment prospects of young people.

The task presented was seen essentially as one of curriculum design. In the rest of the paper this design process is described together with the recommendations made, as I believe that this may be useful information to schools world wide who maybe facing a similar task: providing relevant ICT studies for this age group.

Curriculum Design

The task of curriculum design can be approached in many ways. For example it can be located in larger movements concerned with the restructuring of Western education systems, as Carlgren (1995) might view it, or as part of the general movement towards outcome based curriculum in the same systems. Unfortunately this way of designing curriculum is not often accompanied by any new or innovative approaches to content or learning approach.

Grundy (1987) talks of constructing or designing a curriculum as a technical enterprise. She describes Tyler (1949) as being credited with providing a blueprint for the curriculum design process and stating that a technological consciousness was pervading the actions of those engaged in curriculum work at that time. This technological approach results in the outcomes of learning being judged against pre-determined objectives.

Other more general approaches, like that outlined by Gunter, Estes and Schwab (1991) for example, have steps broadly similar to the following: describe the educational goals; determine the learning outcomes and evaluation strategies; organise the content; and select the instr-uctional tools. This is essentially an instructional design

approach and is usually followed by a selection of some kind of model that matches objectives to instruction.

Most curriculum approaches these days are dynamic and interactive. They usually start from the premises that planning involves making decisions about the learning experiences of students (content and process), it will involve many groups, it will take place at many levels and it is a continuous process (Beane, Toepfer and Alessi, 1991).

None of these above broad approaches were judged to be useful in the present context of validating the choice of subjects that would suit the brief above. Eventually a simple, useful approach of attending to concepts of scope, sequence, articulation and continuity (Armstrong, 1989) proved to be an excellent way of beginning to make decisions about offerings and these concepts are considered below.

Scope

This term refers to the extent and depth of content coverage. Scope can include decisions about year level, the amount of instructional time available and also can involve value decisions about the relative worth of subjects. In Western Australia, to qualify for tertiary admittance students must have an exit 'Certificate of Education.' To qualify for graduation a student must complete ten full year subjects, in two years, of which up to four subjects can be vocationally oriented and delivered by the school or TAFE. Thus the scope of the proposed curriculum can be a maximum of four subjects.

The college had made the value decision that innovative IT subjects should promote high levels of computer literacy and high levels of technological skills. There were already IT subjects available in the curriculum and these were not innovative. It was most likely that the kinds of subjects required were not to be found amongst the traditional disciplines, but more likely to be found amongst vocationally oriented subjects not normally offered in schools. Ideally a ready-made course could be found, able to be delivered when the college opened.

Sequence

This refers to the order in which students complete subjects. In this case the sequence was clear because decisions had been made about the scope of the course. Two subjects had to be made available at Year 11 level and two more related subjects had to be available at Year 12 level. Students needed to be able to leave at Year 11 level and take up TAFE studies or work, or continue studying the same subjects at Year 12 level.

Articulation

In this context, this term refers to the relationship of any proposed subjects and their content to the other subjects that students may wish to study. While mindful of the need to make horizontal connection between content studied in any proposed IT subjects and other subjects in the curriculum, it became apparent that the proposed subjects would not necessarily articulate well and that little could be done about it. This was because subjects would be chosen on the basis of other compelling reasons and that articulation may be a lesser priority.

Continuity

Any proposed subjects had to be accessible to students leaving Year 10 and the students needed to have the requisite skills to succeed in the subject. In other words vertical articulation had to allow smooth succession between Year 10 and Year 11.

Balance

This important concept forces examination of all the different components in the total offerings available to students. Being able to offer only two new, innovative IT subjects at each of the Year 11 or 12 levels meant that students still had much choice available in remaining subject offerings at each level, thus were well able to achieve a balanced curriculum.

Using the simple constructs above allowed many preliminary decisions to be made. The task then became a problem solving activity, deciding what is best practice in using technology to enhance opportunity—that is the task became one of choosing two subjects with an IT emphasis that could be offered at Year 11 and 12 and would offer students most opportunity.

The Focus

The Australian labour market is facing international pressures and these global market pressures will affect students graduating from any potential program developed at the college. Any curriculum implemented should equip graduates with the ability to compete on a world scale and students should have knowledge of world's best practice in the particular subject chosen. This is essentially a vocational focus.

Youth unemployment also bears out the need for this strong vocational emphasis. Western Australia's youth unemployment rate increased to 22.1% in April, 2000. A month before this the rate was 19.3% and a year before the rate was 18.4%. Nationally, the youth unemployment rate was 21.3% in April, 2000. For employment reasons, it was felt that any subjects offered should bestow some vocational advantage.

In Australia in 1995/96, IT industries generated $47 billion revenue and employed 209,000 people. The sector is currently growing at 12% per annum, with higher projected growth to 2001 than most other sectors. These figures further support the decision to take a vocational stance.

In Western Australia, while not all specialisations of computing professionals are reported to be in shortage, overall the level of demand for computing professionals is relatively high and supply from tertiary institutions does not appear to be increasing significantly. Western Australia is losing some of its more experienced computing professionals to other states and overseas (Department of Communications *et al*. 1998).

For all the above reasons, it was decided that any subjects offered should offer immediate vocational opportunity, but should also articulate well with tertiary institutions offering IT courses, thus creating educational opportunity.

Options

Many existing programs at a range of institutions both inside and outside Australia in the general areas of information technology, information processing and information management courses were examined. Some examples are given below.

The Community Colleges for Innovative Technology Transfer (CCITT) is an American national coalition of 12 community colleges. Government and industry partners include the National Aeronautics and Space Administration (NASA) and NASA contractors, Environmental Systems Research Institute, Inc. (ESRI), the Universities Space Research Association (USRA), the National Center for Advanced Technologies (NCAT), and National Science Foundation (NSF). CCITT provides a number of educational resources, including curriculum development integrating remote sensing, image processing, and geographic information systems into earth systems science. It has produced a series of modules intended for a 1–2 week time period within an earth systems science or specific disciplinary course for undergraduates and/or advanced high school students. Technology is infused within each module through use of the Internet, image processing and Geographic Infor-mation Systems (GIS). While GIS courses do provide vocational advantage, the short nature of these courses made this general approach not suitable for the college.

A TAFE centre in Claremont, Tasmania provides a Vocational Education and Training (VET) course for students interested in a career in the ICT industry. Students who study this course gain qualifications in Information Technology (Client Support). Students complete year-long classes at the College, which include six weeks of work placement during the year. As a part of the course, students staff a help desk in the school library on a roster basis. It is aimed to produce graduates who can work in help desk, operation, software support, hardware support, or client support.

Although this course does not involve any students who are at high school, it contains real work and user oriented elements. It also provides some articulation to Computer Science and Applied Computing courses at university level. This approach, or something similar, seemed well suited to the college, but needed to involve high school not TAFE students.

A Western Australian metropolitan high school and a nearby TAFE combined to develop a course that would integrate school, TAFE college and structured work placement. The established course involved substantial negotiations between schools, TAFE colleges, employers, students and parents. Utilising the Year 11 and 12 secondary course and a national broad-based TAFE module, the delivery was balanced by the work experience component. Following the first year of the program, a large proportion of the students obtained apprenticeships in the metal industry. This approach served as a model of how different institutions could cooperate to produce good outcomes at Year 11 and 12. Unfortunately its program did not articulate well to tertiary study.

One key to gaining nationally recognised qualifications, pathways for the unemployed to gain training and jobs, and access to the publicly funded training system in Australia is the 'Industry Training Packages,' usually delivered by TAFE colleges. An Industry Training Package consists of three components: a set of competency standards established by the industry and covering the skill requirements of jobs in the industry; competency assessment guidelines; and the packaging of the competency standards to Australian Qualifications Framework (AQF) qualifications.

One example of such a package is the Telecommunications (Technical) Training Package which covers installation and maintenance activities in telecommunications cabling, customer premises equipment, customer access networks and telecommunications networks. Another example is the ICT Client (User) Support Training Package which includes competencies grouped into five streams: enterprises working with information technology; using information technology; installation of information technology; support of information technology; and management and maintenance information technology. These packages map well with high vocational demand areas and would bestow some advantage. However articulation with tertiary courses would again be problematic, and other courses could be even more advantageous to students.

As the final example, courses at the Bendigo Senior Secondary College in Victoria were examined. The Victorian State Government established this college as a Science and Technology School, one of six Science and Technology Centres with a charter to pilot learning technologies. It caters for Years 11 and 12 and has enrolments of about 1,500 students. The Victorian Government funded the College with $1.3 million, provided in 1995. Its stated learning approach is constructivist and experiential, integrated with the use of technology and aimed at restructuring teaching in the associated school. The College is extensively wired with all classrooms having access to networks, video and satellite feed, and having ISDN connections to the Internet.

The Bendigo college recognised early that student instruction and student learning will change as telecommunications and other new technologies alter the ways in which information may be accessed, communicated and transferred through access to online services. The college offered Aries (Aries Technology 2000), Cisco (Cisco Systems, 2000) and Microsoft (Microsoft 2000) courses to its Year 11 and 12 students. After further investigation it was decided that these courses were also suitable for the new college.

Aries A+ is a 'hands on' course in computer construction and maintenance supported by multimedia curriculum materials. The course is aligned with the International

Society for Technology in Education (ISTE) and provides for a complete range of basic and advanced computer construction and maintenance theory and techniques. Aries Technology has a close relationship with the Cisco Academy program and has designed its courses to be complementary and aligned with the Cisco Academy's curriculum.

The Cisco Networking Academy Certificate course provides theory and practical instruction in network design, construction, and implementation. Through this program students learn the information needed to prepare them for the Cisco Certified Network Associate examination. This certification positions them for either job openings or engineering and science-focussed studies. CISCO is the world's leading computer networking company.

The four-unit curriculum is based on the principles and practices of designing, building, and maintaining computer networks. It provides course work for a complete range of basic through to advanced networking concepts—from pulling cable, through to concepts such as sub-net masking, router configuration, TCP/IP, routed and switched networks and standard local area network technologies. Most class materials, across the entire curriculum, are accessible over Internet.

Microsoft Certified Professional (MCP) courses offer certification in Network and Software management. The beginning course offers students training towards becoming a Microsoft Certified Professional which is the first step towards achieving Microsoft Certified Systems Engineer (MCSE) status. This highly valued certification is in demand in the industry. This course can be challenging but seems to be an ideal companion course to the Cisco Certified Networking Academy. Together these qualifications support the complete design, building, testing and management of a LAN that operates on Microsoft server and client products.

Final Choices

After much debate and presentation of alternatives, some of which have been outlined above, it was decided that the new senior college should initially offer the Aries and CISCO courses. These were deemed to provide the most vocational advantage, fulfill the criteria of allowing students to choose up to two subjects in this area in each year, and also to articulate well with other TAFE and university courses in the IT field. Completion of these courses would be recognised in existing courses and possibly by a local university likely to be part of the college in the near future. It was felt that students could leave at the end of Year 12 and be immediately employable and capable of earning good salaries. Anecdotal evidence from the Bendigo College supported this view. Given that the area contained many multi-generation welfare recipients, this was a telling factor in the final choice of courses.

Conclusion

This quest for suitable courses to offer at a new senior college began from a theoretical perspective and it was found that only some traditional constructs regarding curriculum development were useful in generating or developing choices. Simple ideas of scope, sequence, articulation, continuity and balance were found to form a useful starting point for decision making regarding courses. However as useful as they were, these constructs were judged relatively unimportant compared to the imperative to provided vocational opportunity to students from a low socio economic area. To this end the courses proposed seem a wise choice providing entry to a well paid and high demand industry.

References

ARIES TECHNOLOGY. (2000): *Aries A+ Certified Computer Technician* (Version 3.0). http://www.aries.net/.

ARMSTRONG, D. G. (1989): *Developing and Implementing the Curriculum*. Allyn and Bacon, Boston.

BEANE, J. A., TOEPFER, C. F. and ALESSI S. J. (1991): *Curriculum Planning and Development*. Allyn and Bacon, Boston.

CARLGREN, I. (1995): National curriculum as social compromise or discursive politics? Some reflections on a curriculum making process. *Journal of Curriculum Studie*. **27**(4): 411–430.

CISCO SYSTEMS. (2000): *Cisco Certified Internet work Expert course*. http://cisco.com/warp/public/10/wwtraining/.

DEPARTMENT OF COMMUNICATIONS, INFORMATION TECHNOLOGY AND THE ARTS; Department of Education, Training and Youth Affairs; Department of Employment, Workplace Relations and Small Business; Department of Immigration and Multicultural Affairs. (1998) *Skill shortages in Australia's IT&T Industries: Discussion Paper*. Available at: http://www.dewrsb.gov.au/group_lmp/files/skillshort/it&t.pdf

GRUNDY, S. (1987): *Curriculum: Product or Praxis*. Falmer Press, London.

GUNTER, M.A., ESTES T. H. and SCHWAB, J. H. (1991): *Instruction a Models Approach*. Boston, Allyn and Bacon.

MICROSOFT. (2000): *Microsoft Certified Professional*. http://www.microsoft.com/trainingandservices/default.asp?PageID=mcp

TYLER, R (1949): *Basic Principles of Curriculum and Construction.* Chicago, University of Chicago Press.