Curriculum presage and technology education

The development of a National Curriculum Framework has been recently completed. Proceeded from a mapping of existing curriculum in identified areas, this has resulted in sets of statements about English, Mathematics, Languages other than English, Science, Studies of society and its environments, Health and physical education, Arts, and Technology. As noted by Hannan (1992) four of these areas are established subjects or discipline areas in the existing curriculum, the others are collections of studies or new studies. For the latter four areas, whether the collective area represents a discipline or a conceptual approach is problematic. The fact that Australia has, for the first time ever, a National Statement of curriculum intention is making a clear statement about knowledge currently valued in this society.

State education changes

State education systems are currently confronted with the task of reconciling their curriculum with the National curriculum and with the imposition of competency / outcomes based philosophy. This has impacted on both subject curriculum and organisation of credentials. In terms of subject curriculum, the National Statement for a curriculum area provides the beginning philosophy whilst the Profiles provide the key to the end product of such education throughout the student's compulsory schooling. For New South Wales curriculum developers, this represents a step backward in time.

The national progression towards common areas of curriculum was embraced by New South Wales after the election of the Greiner Liberal government in 1987. The government initiated a report, What Employers Want, reflecting the needs of business and industry at the end point of compulsory education. This document identified skills for beginning employees as those of decision making, problem solving and communicating. Employers perceptions of useful subjects in the curriculum were identified, those given high status included mathematics and science, those given low status included humanities based subjects. In 1989, a wide ranging review of education was set in process, beginning with the Committee of Review of Education in NSW (Carrick Report) who consulted across a broad range of educators and community members in order to make recommendations about curriculum K-12.

Excellence and Equity (1989), the government's agenda for curriculum revision posed reorganisation of existing subject areas into eight Key Learning Areas (KLA's) for secondary education. One such area is Technological and Applied Studies (TAS). This curriculum area was to embrace existing subjects of Agriculture, Computing, Home Economics and Industrial Arts, each of which had a previously established concern

with practical, applied, work-related skills and knowledge. Minister Terry Metherill noted that "Australia's new century will be driven by high technology, rapid communication, high levels of interaction in a dynamic international society and an intensely competitive global economy" (Preface).

Within Technological and Applied Studies, several goals are to be achieved - acquisition of knowledge about technology and design processes; acquisition of practical skills in design and making and the development of general capacity for problem solving and analysis, to be achieved through a course providing "coherent, balanced and broad coverage of modern technology and design" (p.57); which would alleviate the existing gender bias of the previous curriculum - " girls tend to

have limited access to technology and design through subjects such as Home Science, Textiles and Design and Art. Boys tend to have extensive, albeit narrowly focussed, access through Industrial Arts"(p.57). In addition, the curriculum area would embrace "Joint TAFE-Schools courses, especially in the areas of technological and vocational demand"(p.58).

Examination of this document reveals the acceptance of vocational outcomes as a legitimate change in direction for subjects now to be labelled under Technological and Applied Studies. New NSW curriculum documents begun to be developed using a model of stated outcomes in six stages across K -12. The process of curriculum (Syllabus and Support documents) by the Board of Studies had traditionally involved a committee with representatives of tertiary education, secondary government and non-government teachers, TAFE and parent groups. The task of developing a coherent course in Technological and Applied Studies was given to the Key Learning Area Coordinating Committee. This committee had much stronger representation from business and industry, was concerned with a continuum of learning from K-12, and engaged consultants in specialist fields to supplement the perceived lack of understanding of the world of work by educators on the committee.

The committee produced a course which would deliver mandatory learning in technology called Design and Technology. This course provides 200 hours of mandatory study in junior secondary school and the option for students to continue the study until year 12. In addition, several other courses have been developed which meet the demand in Excellence and Equity (1989, 56) "for a wide range of courses allowing students to specialise in....related applied and vocational studies".

At the national statement level, technology education is the umbrella for state course development in TAS. Social and environmental changes are cited in A Statement on technology for Australian schools (1994) as reasons for Australians to become "more innovative, knowledgeable, adaptable and enterprising" and this is translated into curriculum

imperatives “which will allow students maximum flexibility and adaptability in their future employment and other aspects of life”(p.4). Technology education is presented as bringing together several former areas of curriculum - agriculture, computing, home economics, media, and industrial arts, plus principles from applied science, engineering, business and commerce (pp. 5-6) and therefore linking well with the objectives of the Finn and Mayer Committee reports.

What is technology education? -

Near the end of a four-stage process where the AEC sought to map technology education curriculum materials and practices in each state and territory of Australia, review overseas practice, and develop a national statement and student profiles, the label “technology education” was changed to technology. This is perhaps indicative of the lack of clarity about what is technology education.

The National Technology statement (Curriculum Corporation 1994, 3) refers to technology as a generic term for a range of technologies that “involves the purposeful application of knowledge, experience and resources to create products and processes that meet human needs”. At no point is the term defined, rather the document refers repeatedly to technologies and technological processes. Likewise the range of technologies are not classified eg in terms of materials. Reference is made to the diverse cultural aspects of technology, technologies which use everyday materials and processes, those based on complex scientific

principles and those related to environmental needs (p.7).

Learning in technology is to be approached through a design-make-appraise process linked to materials, information and systems. Pursuing definitions and clarification in these areas finds similarly vague statements. Design-make-appraise is described as a process of development of ideas and creation of imaginative solutions about what, why and how followed by appraisal of the result (Curriculum Corporation, 1994 a, p.4). Information is defined as “ knowledge generated and used in everyday life” which can be stored, retrieved and communicated in various ways. No reference exists to the creation of new knowledge, students will work with available information as a given. Materials are described as natural and synthetic, classified in many ways. Examples given for classification systems include “polymers, fibres, alloys and composites”. Systems are “combinations of elements which work together to achieve specified outcomes”. Examples of systems highlight the connectedness of parts to make something work. Systems seen as important to technology are identified as “environmental, engineering, energy, manufacturing and organisational” systems (p.5). This immediately poses a point of disjuncture for home economics within technology. Thompson (1992) states that accepting

systems as being about relationships among events and phenomena creates a different approach from one where the system is inanimate, mechanical, designed for a specific purpose. The identified systems in the national statement are of the latter variety.

New South Wales curriculum developers created a statement to describe learning in the Technological and Applied Studies Key Learning Area (1992). Adopting the UNESCO (1985) definition of technology as "the know-how and creative processes that may assist people to utilise tools, resources and systems to solve problems and to enhance control over the natural and man made environment in an endeavour to improve the human condition"(p.2), this statement focuses the processes as being about forethought, development of ideas, responsible decision making (designing); skilful manipulation and managing of tools, resources and systems to produce; and appraisal of the outcome in terms of social, economic and environmental impacts. This learning is proposed to give understanding of technological enterprise and to develop technological capabilities. Technologies are referred to as things to use and things to understand but are not identified or classified in any way.

This lack of definition continues in the core syllabus documents in Design and Technology Years 7-10 (1991), and Preliminary and HSC (1994). Objectives of these allude to development of knowledge and understanding about a range of technologies and their uses, to identifying technologies used in historical and cultural contexts, to effects of technologies on society; to skills in using a variety of manual skills and technologies. to appreciation of the interrelationships among technologies, design, society and the environment.

Examination of reports from Britain reveal similar imprecision in definitions to those noted in the Australian documentation. Eggleston (1992, 17) appears unable to give a definition of technology although he accepts Archer's (1973) definition of design as "an area of human experience, skill and knowledge concerned with man's ability to mould his environment". Riggs and Dillon (1992) cite Black and Harrison's (1985) definition of technology as "a disciplined process using resources of materials, energy and natural phenomena to achieve human purposes". Flood (1991, 79) defines technology as "that which is concerned with the design and production of products or systems

associated with the manufacturing industries" and questions the procedural base of such education as being inappropriate to meet the bigger aims of strengthening the manufacturing base of Britain. Benson (1991) refers to technology being design and technology capability and information technology capability. Drawing on the Order for Technology, Cooper (1990, 62) explains technological capability as skills of investigation, implementation, evaluation and communication

to be engaged in a "process of bringing about change or exercising change over the environment", knowledge of materials, energy and control and aesthetic, economic, technical and moral value judgments. Technological capabilities encompass procedural qualities, communication qualities and value judgements. Capacity to adapt, modify, solve problems and make decisions is now seen as a central contribution to human life in the coming century, as knowledge and skills prized in the past are taken over by technological devices.

Medway (1992, 67), writing on the British experience, proposed that technology education is about devices - "outcomes of and means towards technological activity", about bodies of technical knowledge and expertise, and about sociotechnical practices. This has been translated into the subject Design and Technology. He questions the rationale for Design and Technology, citing educational idealism, conceptual confusion, unrealistic aspirations and ideological loading as elements in "an outcome which is bizarrely radical and conservative by turns" (1992 a, in Beynon and Mackay, p.65). He is critical of the gathering together of a series of processes which are not commonly grouped in the work world - eg. doers often design in their heads but rarely on paper, designers seldom realise their designs. He claims that design activities which are not technological are acceptable learning activities but technical activities which are not design are not which represents valuing of intellectual skills as much of the doing stages of the subject do not produce changes in the state of affairs. Medway gives the example of cooking which is allowable only if wrapped up in a design process. He claims that much technology cannot be addressed by a rationalistic means-end systematic design process - "realms of practical activity not reducible to system and logic"(p.75). Practical activity may occur in practice situations which do not involve design or technology. (is this part of a grander plan to hoodwink people into feeling they have power which is not real???)

Conversely, Todd (1990, 128) posits the plethora of definitions of technology as a problem for educators in the United States -

> ...the operational definitions of technology ... range from (a) tools and hardware, (b) production of goods and services (c) systems of construction transportation, communication and production (d) a body of knowledge of practical value (e) a philosophy of thinking and doing .. to "the use of our knowledge, tools and skills to solve practical problems and extend human capabilities"

Further development by Todd (1991) suggests that technology is product, practice, procedures and knowledge. He develops a model of elements of all technological events being tools, materials, energy, information, processes and humans.

What potential lies in the lack of definition of technology / technology education? Is this fact in itself a point of teacher

resistance to curriculum change? Mulberg (1993) writing on the National curriculum in Britain noted the links between technological education and improved industrial and economic performance in that country since 1976. He traced the historical changes in technology education from a manual arts /technical base to one concerned with

wider social and cultural elements. Mulbring noted the reluctance of a working group of technology educators to define technology because of the potential of a definition to create boundaries which "could be used for political gain, and to further particular social interests"(p. 302). He suggested that the ultimate acceptance of a design process focus towards technology as allowing the technical content to be open to interpretation is potentially flawed- " ...this interpretative flexibility could be used to further individual interests"(p. 303). Can this flexibility be used to advantage by those whose knowledge and understanding has been dispossessed by dominant discourses?

Does content or process matter? Is a curriculum predicated on process such as the new technology curriculum able to supply "workplace" skills developed in contexts of relevance to the learner? Jepson (1993) highlights the fact that technology education in Britain is a task-driven curriculum. She claims that the type of task, whether active or reflective, and the structure of the task, tightly structured or looser, alters the experiences of girls and boys. Research has shown girls are better at reflection, boys at investigating and generating ideas; girls perform better on people-related tasks, boys on industry-based tasks. This, Jepson claims bears messages for classroom pedagogy.

How can home economics serve education purposefully under a technology banner? The following studies highlight the ways in which home economics is technology education - as a channel for diffusion of technologies, by practical use of specific technologies, by mediating the effects of technological change, and by adding value to women's experiences with technology.

Thompson (1984) claims that knowledge systems guide people towards socially constructed ways of seeing. Describing this as critical reality, her position is consistent with that of Apple (1992) who argues that new technologies in education embody forms of thinking which can orient the person to the world in a desired way, eg the computer orients in a technical way, creating a logic to replace critical and ethical understanding. Hill suggests that technology is perceived and experienced differently by men and women, girls and boys, and that home economists should recognise and value such differences.

Boyd (1993) highlights the long term links between home economics education and technology - the use of technology to solve practical problems in home, family and community settings, and the managerial processes underlying technological practice. Recognising that

"technological behaviour is one of the things which make us human", she warns of the dangers of accepting the technological fix for meeting the other demands for a satisfying human life (1992, 70). Approaching technology from a human needs perspective, home economics seeks to develop critical and emancipatory attitudes towards technology. Boyd echoes the concept of technological literacy and competency as necessary for professionals to take home economics into the next century.

Petrina (1994) uses curriculum presages to identify similar mixed messages in technology education in the United States. He blames the politicisation of education policy for the creation of broad fields as curriculum organisers (easily recognised in Australia as national curriculum areas, Key Learning Areas in NSW, Frameworks in Victoria), at the expense of other models of organisation such as separate subjects or disciplines, core programs, or themes. These curriculum organisers are not neutral but reinforce certain assumptions about students, knowledge and society. Petrina claims that technology education suffers from a range of foci, including the discipline

approach, the modular approach, a systems approach, the problem solving approach, and more recently "process education using the technological method" (p.61). He uses Brown's (1978) work in home economics to support the idea that applied science leaves unanswered questions about means and ends of control.

That diversity in approaches to technology classroom practice exists is given credence in the 37th Yearbook of the Council on Technology Teacher Education (1988). Eight approaches are advanced including the systems, problem solving and conceptual learning approaches. Each of these has implications for method and classroom practice.

If technology is a new curriculum organiser subject to the problems identified by Petrina, how might its development be analysed? Lewis (1994) employs Goodson's (1987) hypothesis about the transformation of subjects into disciplines to suggest that technology will need to expand the domain of the subject and to assume a relationship with science. However, Lewis (p. 15-16) notes that, as early as 1914, Russell had set curricula boundaries for the subject in terms of materials:

> For pedagogical purposes, the materials of significance in the industries are (1) foods, (2) textiles, (3) woods, (4) metals, and (5) clays and other allied earth materials. The next step is to single out the dominant processes in the successive stages of production, manufacture and distribution, and their interrelations...1914, p.11).

The challenge of disciplinary status lies in articulating conceptual and syntactical structures. Lewis warns of the possibility of losing practical roots to abstract concepts.

Status by association may be gained by links with science and mathematics. Such a link exists within the NSW curriculum framework whereby primary school curriculum is labelled Science and Technology, the two areas splitting into separate segments in secondary schooling. Liddament, however, postulates that a social constructionist view of science implies that there is nothing 'epistemologically special' about the nature of scientific knowledge (1994). Liddament sees construction of meaning as more than accretion of facts, but also involving conceptual change and new concept acquisition. Such a position would create persons not merely functional in the various technical languages but persons active in creative processes to formulate a new perspective of techno-scientific meaning.

Excellence and Equity

Much of the tension in NSW curriculum has been about basic skills. Teachers have been reluctant to approach design projects which are open-ended and have placed high priority on the development of skills before the student attempts the project. The supposedly open-ended design brief becomes closed asthe possible outcomes then are confined to the skills the teacher has selected and the materials the teacher has chosen. Wright (1992, 9) entreated teachers to re-vision the "block of wood", to suggest that much of what has been valued knowledge is irrelevant in the context of education for life, that teachers may be teaching "selected skills that the overwhelming majority of students will never need to know".

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