CHAPTER 5

TECHNOLOGIES OF POWER: THE RECONTEXTUALISING FIELD

Curriculum and the Conditions of Teachers' Work

5.1. INTRODUCTION

The conditions of students' learning are inextricably related to the conditions of teachers' work. In this chapter I draw upon the work of Basil Bernstein for further theoretical perspectives on the Australian case study presented in chapter 4. I then relate these to broader aspects of teachers' work in the Australian VET sector in terms of the institutional constraints placed upon their professionalism.

5.2. VOCATIONAL MATHEMATICS CURRICULUM

Thomas Popkewitz (1997) argues that curriculum is a practice of social regulation, historically formed, inscribing systems of reasoning which are the effects of power, shaping and fashioning interpretation and action. Curricula not only regulate what content is selected, but also the construction of the student's 'self,' particularly in relation to labour market training (Farrell, 1999, 2000; O'Connor, 1994). Drawing on Foucault and feminist theories, he claims that the concept of an 'educated person' has shifted according to social and political conditions: teachers and students are re-visioned "as objects that are systematically classified, legislated, standardized and normalized" (Popkewitz, 1997, p. 148). Thus, curriculum and other policy documents should be read as expressions of classification of social problems and practices deployed to overcome them. How has vocational mathematics served to reproduce social relationships?

In Australia, since the late 1980s there has been a shift in control over school and VET curricula towards meeting the perceived needs of the economy (Marginson, 1997). Over a decade ago, Fitzclarence and Kemmis (1989) made the observation that there had been changes in the social relationships of education, not confined to the new communication technologies but also appearing in the technologies of social and educational administration. They argued that this might undermine the very possibility of critical thought. Although the focus of their concern was distance education for Masters students, which they asserted should be able to "offer a theoretical alternative to narrow, consensualist, bureaucratic and technicist approaches to thinking about education" (p. 174), their critique applies equally to the Australian VET sector.

5.2.1. Mathematics Curriculum in the Australian VET Sector

What do TAFE practitioners believe about current mathematics curricula?

> The curriculum is wide open now & students, especially those from industry, prefer to select non-math related subjects & not the hard-core engineering subjects. . . . It is not easy to impress on people the value of mathematics in a technical environment when other soft options are readily available in similar environments. [Male, >5 years TAFE experience]

> Mathematics is not considered important by those responsible for TAFE course design and mathematics testing is a mere formality — a pass means nothing. . . .Mathematics teaching is declining. Electronic mathematics, I-IV was 72 hours each module. Now there is a 40 hour total. [Male, >10 years TAFE experience]

> But it amazes me, here, like I used to work in the Centre for Computing and Information Technology, and there's no maths in their courses. Now they need to know about binary number systems, and so on. They need to know a little bit of Boolean algebra; when they're doing spreadsheets they need to know how to use formulas. [Female, >10 years TAFE experience]

Vocational mathematics content is apparently considered by powerful stakeholders in Australia to be of diminishing importance. Why? How is it that the teaching of vocational mathematics is virtually disappearing from even the most technological courses, such as Electronics, Engineering, and Applied Science? And that which remains becomes 'watered down' to "numeracy" — a subject intended to be taught generically (if at all) with literacy, as and when needed?

Clearly vocational courses are supposed to reflect the needs of the relevant industries as determined by their representative educational advisory bodies, so that certain branches of mathematics are more likely than others to appear in accreditation documents (e.g., calculations for trade areas, Boolean algebra for electronics technicians). Applied mathematical work in the academy and in industry appears to have had minimal effect on the actual content of the majority of Australian VET mathematics subjects which almost inevitably focus on a small subsection of teachable material from the discipline of mathematics, generally located in developments made well before the 20th century. Why did the curricula which were accredited until the last few years of the last century, free from the overwhelming influence that the universities had and continue to have on year 12 (final year), remain so dominated in form by the traditional mathematics education of earlier eras? Why does there appear to be an unquestioning acceptance of the tenet — not supported in the literature — of a fixed hierarchy of mathematical concepts and order in which they are supposed to be learned?

Why have certain generic content areas such as algebra (including concepts of rates of change, maximisation and minimisation) or statistics, even quantitative literacy, which are arguably of universal importance in industry — highlighted in chapter 2 as being of critical importance to workplaces of the future — been precluded for certain occupational groups? Does this reflect a failure to comprehend that many occupations require a broad spectrum of unrecognised — or unrecognisable to the layperson, and indeed some mathematics educators —

mathematical knowledges? Where are the visible signs of the influence of rapidly changing industrial and information technologies burgeoning in the last two or three decades?

Why are students enrolled in personal service industry and creative arts courses, for example, deemed not to need *any* mathematics? Is the diminishing mathematical content, even in technician courses, merely a pragmatic attempt at improving the completion rates? Above all, what consideration is given to the personal, social and civic development of vocational students as people who inhabit a mathematised, increasingly technological world, premised largely on economic goals and characterised by information saturation? Whose views actually inform decisions as to which mathematical content is worth knowing?

The introduction of the National Training Framework and its so-called Training Packages has seen a shift in control mechanisms from accredited curricula (as with the NVMCP framework topic packages) to assessment of outcomes according to sets of industry competency standards. In contrast to other sectors of education, curriculum no longer plays a central role in the VET sector, concomitant with a diminishing role for teachers, as all learning may now, in theory at least, take place on-the-job. With this non-endorsed model of curriculum the locus of power and control has shifted from the teacher — embodying the institution of education — to the 'user' — student or, most likely, employer — thereby making it more difficult to evaluate or to challenge. The question arises: What might be possible reasons for the elision and in whose interests are these changes? Chapter 6 will take up these questions from more theoretical perspectives.

Nerida Ellerton and Ken Clements (1994) have documented evidence of recent struggles over control of school curricula in Australia, especially mathematics. Yet over the last decade, there has been no visible evidence of any contestation by mathematics teachers in the Australian VET sector over mandated CBT curriculum and assessment regimes. One reason for this may be the widely engendered belief, accepted by TAFE teachers, that the curricula represent "what industry wants" (see, for example, Johnstone, 1993).

5.2.2. Goals for Vocational Mathematics Curricula

In the formation of curricula many goals need to be taken into account (Bishop, 1993; Niss, 1996; Stevenson, 1995a); it is not simply a matter of matching the curricula to the perceived needs of the employer which would serve neither the interests of individual students nor society at large (Ernest, 1991; FitzSimons, 1997b). Anna Sierpinska and Stephen Lerman (1996), building on Sal Restivo's case for a strong sociology of mathematics, argue that communities validate themselves, establish and retain power through their justification of socially valued knowledge. They claim that this applies to the investment that mathematicians have in the status of mathematics in society, "and it is certainly the case for mathematics educators and the status given to [school] mathematics curricula all over the world"

(p. 840). What effect might the support of mathematicians have on the public image of vocational mathematics, and with what consequences?

As noted in chapter 1, goals for school mathematics are based on the presuppositions of mathematics being able to make a contribution to the technological and socio-economic development of society at large, to its political, ideological and cultural maintenance, and to individual development (Niss, 1996). I contend that these foundational reasons should not be confined to the needs of school students if one follows the tenets of lifelong education, espoused by many governments, and assumes that adults are continuing to develop throughout their mature years. In any case, there are overlaps in age between Australian VET sector students with senior school and undergraduate students, so that there can be no justification for an abandonment of goals other than industrial ones (Stevenson, 1996, 1997).

Sue Willis (1996), developing the idea of cultural conflict identified, from a social justice perspective, four approaches to curriculum with consequent (re)solutions:

1. The curriculum is taken as more or less given. Students who are not adequately prepared are treated as *remedial*, or regarded as having *skill deficits*, and the solution is to provide assistance for that which is lacking.
2. The curriculum is also assumed as fixed, but pedagogical and assessment practices favour or relate to the experiences, interests, and cultural practices of some social groupings more than others. The proposed solution is to develop *non-discriminatory* practices so that the experiences of all students are recognised in a supportive learning environment with more valid and fair assessment practices.
3. The curriculum is viewed as a selection, neither given nor unchangeable, which reflects the values, priorities, and lifestyles of the more powerful members of the dominant culture, and which acts to produce relative advantage. The solution is to provide curricula which acknowledge, accommodate, value, and reflect the experience of the diversity of social groups, adopting an *inclusive* perspective.
4. A *socially critical* perspective considers the problem to lie with the way the curriculum positions, classifies, and selects students, in the interests of reproducing the status quo. The solution is to challenge the hegemony in a way that is recognised by all participants. This means helping students to understand and exploit the explicit uses of mathematics in their own interests and in the interests of social justice, as well as the problematic uses of mathematics curriculum.

Following Willis's analysis, the first perspective could describe TAFE vocational mathematics since the inception of the TAFE sector, at least, in its provision of remedial tuition and access programs. The second perspective could be related to the history of technical education in Australia which has traditionally favoured masculine interests, as have mathematics curricula — especially in view of their close connection to the trades and technologies. Encouraging the use of vocational applications probably renders an appearance of non-discrimination and hence gender neutrality since the curriculum is supposed to reflect the students' perceived vocational interests. However no other social interests are seriously addressed — as is the case in some other subjects such as basic computing (e.g., Australian Committee on Training Curriculum [ACTRAC], 1994) — and vocations themselves may be inherently gendered, racist, ageist, and so forth.

The third perspective could be related to the past as well as recent vocational curriculum selection which reflects the dominance of powerful industry representatives who sit on advisory bodies, and the consequent privileging of industrial values over all others. In terms of mathematics it means privileging the traditional school mathematics experienced by predominantly male industry spokespersons (Willis & Kenway, 1996). ("It was good for me, so . . ."). There has been a failure in Australia to problematise either the relevance to current industry practices or the unequal distribution of access to rewards in the form of mathematics-linked credentials. On the other hand, the proposed solution of inclusivity has long been espoused by the ACFE sector (see FitzSimons, 1997a, 2000d) and some TAFE preparatory courses with few or no externally imposed restrictions on content, assessment, and/or pedagogy. Notably, the latter, unregulated courses have all but disappeared in the current political and economic climate of accountability.

The fourth, socially critical, perspective appears antithetical to the thrust of the training reform agenda which, as illustrated in chapter 4, appears to desire a compliant, self-regulating workforce.

The question may be asked: "What are the goals and purposes of vocational mathematics instruction and whose are they?" In senior secondary school, where mathematics becomes an optional subject, the focus would appear to be on achieving a credential as a prerequisite to further study, sometimes employment, and as a general tool for other areas of study. In this environment the emphasis is on the discipline of mathematics itself, with applications usually included to provide some motivation. By contrast, mathematics in the vocational education sector, when identified as such, is usually compulsory; therefore it is essential for completion of the desired course of study and hence achievement of the credential. Its inclusion in a course of study is ostensibly on the grounds that it will be useful as a tool on the job if not in other subject areas (ACTRAC, 1993). However, Corinne Hahn's (2000) study of jewellery apprentices problematises this assumption. Similarly there appears to be a belief that learning mathematics (any mathematics) will enhance higher order thinking skills — this is not necessarily a valid assumption either. Certainly worker/students have strong opinions (often expressed in graphical language!) as to the usefulness or otherwise of the content and processes of vocational mathematics subjects in actual practice. Although the intended emphasis is on the utility of mathematical applications, it is not uncommon to find an ambiguity of purpose between mathematics as a means to an end and mathematics as an end in itself. Personal experience suggests that, contrary to popular belief, it is

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