

Issues Associated with the Professional Development of Mathematics Teachers in the Vocational and Educational Training Sector

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Abstract

The issues associated with the teaching and learning of mathematics in the Vocational and Education Training (VET) sector have been largely ignored by the mathematics education community in Australia. Recent changes to curriculum and assessment the VET sector, including the introduction of competency-based training, will impinge upon the roles of mathematics practitioners. This paper reports on possible constraints on the practice and professional development of mathematics teachers, particularly in the VET sector.

Introduction

The Vocational Education and Training Sector

Since 1990 "vocational education and training" (VET) has slowly but surely come to replace "technical and further education" (TAFE) as the official designation of Australia's largest, most complex and most diffuse sector of post-compulsory education" (Kinsman, 1993). Since the 1974 Kangan Report, the definition of the sector has been a "by default" concept, including all government funded education and training not included in other education sectors. The 1992 National Training Board definition continued along this line.

Vocational Education and Training (VET) refers to post-compulsory education or training which is directed to the development of

competencies, or is preparatory to, or is directed to the enhancement of opportunities for such education and training up to and including para-professional education and training. (National Training Board, 1992, p. 61)

The diversity of the sector is reflected in the academic backgrounds of the mathematics practitioners, which vary widely, as do the academic levels of the subjects they deliver. VET sector teachers, tutors, and lecturers hold mathematical qualifications ranging from the level of the trade calculations they are teaching, to higher degrees in mathematics. Their involvement with research or professional development relating to mathematics education ranges from nil to post-graduate study, but is predominantly at the lower end of the scale.

The definition quoted above signalled important changes and new directions for the sector. There has been a policy shift towards harnessing the resources of the TAFE system to support the micro-economic reform agenda, and away from TAFE's traditional focus on its social utilitarian function of providing for all individuals regardless of needs and capacities (Kinsman, 1993). The shift is also affecting the day-to-day practice of traditional TAFE teachers, in vocational and academic areas. To classroom teachers, policy changes appear to be occurring very rapidly, and they find it difficult to keep abreast. Changes to practice are likely to occur with the implementation of new or reaccredited curricula, especially if it involves CBT,

or with a new teaching environment, such as workplace education.

Competency-Based Training

Throughout Australia, as a direct result of the Federal Government's national training reform agenda, the VET sector is in the process of introducing competency-based training (CBT) in courses as they fall due for re-accreditation and in newly accredited courses. It is possible that inadequate attention will be given to a range of professional development issues which should be associated with the development and implementation of new mathematics curricula (Burkhardt, Fraser, & Ridgway, 1989). In the VET sector the focus of staff development will be on developing competencies in staff, as teachers and trainers learn to implement a CBT system, through a modular approach (Broadmeadows College of TAFE, 1994). There is no evidence that the professional concerns of teachers of mathematics, statistics, and trade calculations will be addressed in a manner consistent with recent research in the field of mathematics education, despite the critical importance of success in mathematics for many of the students involved.

Professional Development of TAFE Teachers of Mathematics/Statistics Subjects in Victoria

In Victoria there is no statewide requirement or provision for professional development specific to TAFE teachers of mathematics/statistics subjects (other than in Adult Basic Education). The TAFE Mathematics Common Interest Group, a voluntary association of TAFE mathematics teachers ran three annual one-day conferences between 1987 and 1989. In 1993 the author organised a two-day seminar: "Research-based Approaches to the Teaching of Mathematics in TAFE and Higher Education," which was attended by about 50 TAFE and higher education teachers, tutors and lecturers. There are an estimated 300 effective full-time teachers

of mathematics subjects in the sector, delivering at a range of levels, from basic numeracy to first year tertiary mathematics. Professional development in mathematics education seems not to be regarded by many, either teachers or their managers, as a priority. In addition, there is little or no incentive, in terms of promotion or study leave, for TAFE teachers to undertake post-graduate study in mathematics or mathematics education.

Although it is recommended that suitably qualified mathematics educators provide the teaching for mathematics service courses (Owen & McKnight, 1988), the reality is that many heads of department decide to give these classes to departmental members who are underloaded (and whose area of teaching expertise does not include mathematics). One of the most pressing issues confronting those responsible for the provision of courses in mathematics and statistics at this level is the diversity of student abilities, resulting from a lack of control over entry levels (Surman, 1993).

Constraints on Teachers

Social Contexts and Philosophies

Stephens (1984) asserted that the "planning and practice of mathematics teaching takes place in an institutional context shaped by educational and political traditions; embedded in social interests; and influenced by philosophical ... and political beliefs about the purposes of schooling" (p.14). Grossman (1992) argued that the methods by which teachers manage their classes enable or constrain the possibilities of teaching, classroom discourse, and student learning, and they depend on teachers' ultimate goals for students, within implicit theories of instruction and social control.

Political constraints. Peoples (1994), referring to the VET sector, commented that the values of corporatism, managerialism and economic rationalism

have informed changes in this sector. According to Peoples,

... the agenda has run top down with little or no input from educationalists. The result has been less than satisfactory. The rush to reform with no sound base of helpful educational research has recently led the Australian National Training Authority (ANTA) to review the training reform agenda with the purpose of untangling the extraordinary proliferation of bureaucratic structures. (p. 2)

From a different perspective, Sweet (1994) argued that educational scholars have largely ignored vocational education in Australia. Traditions of not expecting workers to think or solve problems or as having need for a broad education have resulted in vocational education having a relatively low status, being comparatively poorly resourced, and distinctly isolated from the mainstream. According to Sweet, the Australian Council of Trade Unions has consistently argued that training must belong to the industry parties and not the providers. It is probably not an exaggeration to say that the perceived needs of industry dominate the current curricula of the VET sector.

Classroom constraints on mathematics teachers. According to Stephens (1984) constraints which affect teachers and relate to their classroom management styles include their attitudes and perceptions towards the mathematical content in the classroom, and their perceptions and expectations of pupils. This view is supported by Nickson (1992), who maintained that there are a variety of classroom cultures — which arise not only in relation to the subject being taught, but also because each class is unique in its own way. Education mediates between the individual and their culture, and research has shown that differing views of mathematics

held by the teacher will influence the presentation of content (Thompson, 1992). Nickson (1992) stated:

Where mathematics as a discipline has been perceived in formalist terms, it has on the whole remained inaccessible to teachers and hence to students. The traditional detachment of mathematical content from shared activity and experience, so that it remains at an abstract and formal level, erects a barrier around the subject that removes it from other spheres of social behaviour. (p.104)

The perception of mathematics by teachers who have not undertaken research, formally or informally, or attended any post-initial mathematics education courses, is likely to be formalist. Personal experience would suggest that this is true for the majority of people teaching mathematics subjects in TAFE.

FitzSimons (1994a, 1994b) found that in some TAFE students, including adults returning to study, general self-concept was tied to their own perceptions of their mathematical ability, and that this could be confirmed or changed depending on the attitude conveyed to them by their teachers. The second study also supported Nickson's (1992) assertion that decisions to implement a more open type of curriculum depend on the teacher's confidence in the appropriateness of doing so, as well as the support given by their immediate manager.

Explicit curricular constraints relate in part to administrative decisions made by the institution. These include the grouping of students into particular classes, even to the point of combining two different vocational groups, enrolled for different numbers of hours per week and weeks per year, into one mathematics class to reduce costs. The timetable is imposed by the institution, and operates under a variety of constraints, such as teacher, student and room availability.

Time constraints on the number of hours delivered are imposed by funding of accredited curricula, although this may change with the introduction of CBT, where the concepts of nominal hours and flexible delivery are being promoted. Within each class the teacher then needs to make compromises between the needs of individual students and the group as a whole.

Implicit curricular constraints include messages transmitted by physical settings for learning (determined in part by the institution and in part by the teachers), social and inter-personal relationships, and the teachers' epistemological assumptions which under *Mathematics curriculum constraints*. According to Stephens (1984), assumptions about the professional role of teachers are reflected in the ways that mathematics curriculum is developed and communicated to teachers. In the VET sector there is now a national mathematics curriculum, comprised of an extensive network of six- and twelve-hour topic packages, which may be combined to form modules. It has been recommended that all new national curricula containing mathematics incorporate relevant topics from the network, and that existing curricula do so at the time of revision. TAFE teachers were involved as curriculum writers for topic packages, but only after the competency-based learning outcomes for each had been determined by the project team in consultation with industry.

Teachers' professional judgement is more important using outcomes based education, according to Willis (1993), and many practising teachers will need to develop new skills in curriculum and assessment. "Many will feel empowered, but others will no doubt feel deskilled. Either way, professional development — formal or informal — will be essential" (Willis, 1993, pp. 151, 152). Willis's last statement underlines the tensions felt

among educators, in schools and in the VET sector.

Constraints on attending professional development. Apart from availability, two major constraints affecting the extent of involvement in professional development programs are funding and time release. Each TAFE college has responsibility for the professional development of its staff. While there are restrictions for national budget allocations imposed by the Federal Government, individual decisions are made at the departmental level, and allocations made to mathematics teachers must be balanced against competing needs. Enthusiastic teachers frequently have to fund part or all of the costs associated with their attendance at professional development seminars, conferences, etc. Time release is a further constraint, as it is difficult for classes to be adequately covered during teaching weeks (generally 36 weeks a year). Unlike school teachers, many TAFE teachers are on duty until late evening, and sometimes at weekends. The optimal time for attendance is during non-teaching weeks (usually four weeks), however even in these weeks there are further scheduled duties, such as interviewing and enrolments, new course development and practical placement. Committed teachers will forego vacation time.

Given the recent introduction of private providers offering TAFE accredited courses (Nankervis, 1994), a further concern is that their teachers of mathematics subjects will be even less aware than is the case at present of the findings of recent research or of the availability of relevant professional development. The same concerns apply to the increasing numbers of TAFE teaching staff employed on a casual basis, who spend just a few hours in the college per week.

Conclusion

In Australia few mathematics education researchers have addressed the issues confronting practitioners in the VET sector. This paper has described some of the recent changes in the sector, and explored some of the constraints placed on teachers of mathematics subjects which may impede change, irrespective of the quality of professional development offered. There are social, philosophical, and political forces influencing the curriculum offered by the teacher within the institutional setting of each particular classroom. Finally, should a teacher wish to attend a professional development program, there are financial and time release constraints. Research could be undertaken into the various professional development requirements of the needs of these practitioners, and into developing a range of research-based models to adequately address them.

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