

AN EVALUATION OF THE EFFECTS OF THE VICTORIAN CERTIFICATE OF EDUCATION ON MATHEMATICS TEACHERS¹

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Secondary mathematics teachers have historically taught centrally based, skills oriented courses at Year 11 and 12 levels. Introduction of the Victorian Certificate of Education (VCE) mathematics study design represented a significant shift in personal philosophies and practices for many mathematics teachers. This report focuses upon the effects that VCE implementation is having on mathematics teachers in the Ballarat area.

Individual teachers, and schools, were coping with implementation in different ways, and at differing rates, supporting the Northfield findings. (1992) The major concerns of mathematics teachers centred around the needs of more time, more consistent and specific advice from the Victorian Curriculum and Assessment Board (VCAB), and better in-service for country teachers.

Many have readily accepted the underlying philosophies of the VCE but are unhappy with the way in which it is being implemented. There is evidence of a growing contempt and cynicism of VCAB brought about by a perceived failure to acknowledge the importance of the feelings and attitudes of mathematics teachers. The resulting loss of faith, if unchecked, may well see little effective change in mathematics education at these levels in the long term.

THE EMPIRICAL STUDY

The impact upon teachers of mathematics of the introduction of the VCE into Victorian schools is expected to be great. This is because both the content and the teachers themselves are the product of a precisely structured, skills-oriented form of thinking. The VCE mathematics program features a commonality of elements in mathematics courses with attention focused upon problem-solving, modelling and project work, with assessment procedures involving both internal and external components. Many VCE mathematics teachers have been required to change direction drastically with regard to personal philosophies and practices.

This study, involving teachers from schools in the Ballarat region focused upon VCE mathematics teachers as they came to grips with the challenge of implementing major curriculum change. Issues of qualifications, previous experience, confidence, competence and support, were considered in an attempt to build up a characterisation befitting a typical VCE mathematics teacher.

The information was collected from two sources: (a) replies to a survey form; (b) personal interviews. The survey was completed at the end of the first term, and at the beginning of the second term 1992. The personal interviews were conducted at the end of the third term, 1992.

Seventy survey forms were sent to 13 schools, ten in Ballarat, and three schools within a 90 kilometre radius of Ballarat. Responses were received from 33 teachers (i.e. 47%) representing nine of the 13 schools. Six of the schools that were represented were State Government schools (21 respondents), while three were Private schools (12 respondents).

Each interview was approximately 40 minutes in length and was recorded on audio cassette. The five teachers interviewed were each involved in teaching VCE mathematics at Years 11 and/or 12. Interview questions revolved around three main issues: (a) personal feelings about the VCE mathematics program; (b) personal effects of VCE implementation; and (c) support services. Interviewees were chosen because their positive activity throughout implementation was considered likely to produce informed comment.

¹This paper is a summary of a study entitled *The VCE mathematics experiment: An evaluation* (Martin, P. J., 1993).

SUMMARY OF SURVEY RESULTS

Staff involved in teaching VCE mathematics programs typically had ten years of experience teaching at senior secondary levels. There were significant differences between teachers from private schools and state schools, in that private school teachers were more experienced at both Year 11 and Year 12 levels. At the Year 12 level private school teachers often had two to three times the experience of their state school colleagues.

The issue of teachers being properly qualified to teach senior level mathematics remains a cause for concern, as it was in the sixties. Thirty percent of the sample were considered to be formally unqualified to teach mathematics at this level, assuming that the major emphasis of their degree was not mathematics. More than half indicated that they were interested in studying more mathematics. There was a tendency towards a higher proportion of state school teachers being interested in further study than those in private schools, and the majority of those who expressed an interest in further study were those with less teaching experience.

The typical VCE mathematics teacher is most likely to teach Space and Number and/or Reasoning and Data. Private school teachers were far more likely to be teaching across two or three VCE mathematics units than state school teachers.

Slightly less than 25% of those surveyed were not able to express confidence in what they were doing. All taught Space and Number, and were mostly the senior experienced teachers. The difficulties of senior experienced staff adjusting to change was again evident when dealing with teachers' feelings about being prepared to teach the required units.

Generally, teachers felt that the VCE programs in their schools were successful. Practically all of the 30% who felt otherwise came from two schools only. Typically they were involved in teaching Space and Number and had had more than ten years of teaching experience at both Years 11 and 12 levels.

The major concerns of the teachers centred around the need for more time for personal adjustment, the need for consistent and specific direction in course content and assessment, and the need for better access to, and provision of, suitable in-service activities for country teachers.

While local network meetings and workshops received the highest support from the point of view of attendance, teachers rated their colleagues as the most helpful source for teaching ideas by a factor of more than two-to-one.

IMPRESSIONS FROM TEACHER INTERVIEWS

It was difficult to come away from the teacher interviews with any feelings of hope. The tiredness that Northfield (1992) found was clearly evident in most of the teachers interviewed. But there was more than just tiredness. There seemed to be a resentment towards VCAB because of its failure to provide the necessary resources and teacher-support that many mathematics teachers felt was required. The major concerns seemed to be associated with the implementation process.

Assessment: Each teacher interviewed commented upon assessment in some form or another and, if their comments are any guide, VCAB clearly needs to do a lot more work in this area. The original S/N grading was, and still is, condemned by many mathematics teachers.

T.1 The S/N system is laughable! To get an S you have to stay alive. We used to joke about it in the first couple of years, but it isn't a joke, S really stands for stayed alive.

It was often remarked that the S/N grading system provided very little incentive, particularly for the brighter students.

Critical Criteria: The guidelines introduced by VCAB to assist teachers in the grading of their students' work were not problem-free. Mathematically strong students were, in some cases, found to be receiving the same grades as students considered to be significantly weaker. Clarification from VCAB was found by some teachers to be unreliable and inconsistent.

T.2 I know of some very able mathematics students who have got the same grade as some of my very weak students and they don't deserve that. One of the problems is the way the grades are allocated.

T.3 They change the rules a little bit but we don't get informed about that though. You've got to read about it somewhere, you know, just feel, just absorb, otherwise you get caught.

Subjective Assessment: Concern was expressed by most of those interviewed regarding the subjectivity of the moderation process. This was most alarming given that uniformity across the state was one of the objectives of the moderation process.

T.1 The only thing that's surprised me more than the kids' work sometimes is the mark they have ended up getting. We've had some exceptionally good pieces of work and it's rare that any one of them has ever survived to an A in the final analysis.

It is difficult to avoid the issues of subjectivity and personal bias in instances like this. The matter cannot simply be dismissed by saying that some teachers clearly do not understand the critical criteria. If in fact this is the case, and I suspect to a large degree that it is, then why haven't these teachers been provided with more effective professional development?

Time and Money: The Essence of Implementation: There is little doubt that time and money had a major impact on how the VCE was implemented. Unfortunately, there has been an insufficient supply of both, according to many teachers. The resulting pressure was particularly felt by mathematics teachers because of their past training, the traditional content-driven courses and historical teaching practices. Several mentioned that the VCE was being "done on the cheap" and that they felt they had been used. The sad thing is that teachers feel they are the ones who are ultimately responsible for their students' performances, which naturally brings considerable pressures to bear on them.

The Underlying Philosophy: All of those interviewed believed that the underlying philosophies of the VCE were sound and that the mathematics study design had attempted to address issues that needed to be addressed. All were able to express some positive thoughts on what the VCE mathematics study design was trying to do.

T.5 As far as producing thinking people then I think VCE absolutely outdoes what HSC did.

T.2 ...for the first time how and why things are taught has been really looked at. ...I find that I've thought a lot more about how I approach topics and how I teach.

T.1 ...It has enabled some very very weak students to meet with some measure of success.

While many agreed with what the VCE was trying to do, several teachers believed that some of the original objectives were being lost. There was concern that the VCE had come to be driven by the demands of the CATS. Problems of students absenting themselves from classes as they stumbled from one CAT to the next were mentioned by several teachers. Under such conditions it is difficult to promote the idea of continuity within the courses. Others questioned the sorts of skills that are really being assessed. The following comments reflect these concerns:

T.4 ...last week was Literature and Biology and Chemistry CAT week, so no one was tuned in. If they came to class at all, well and good, but they were just taking notes. They were barely paying attention...

T.1 ... They're at school, they're working their butts off, but not in your class. The other occasions when they are there they're staring at you vacantly because they've been up all night. So the efficiency of the students has gone downhill.

T.3 The trouble here is that some of the skills it's teaching them aren't the ones that were intended. The skills now are to dig out the student who's done the work, dig out the right answer at all costs, find somebody who has the right answer, get it off them and then write it up so it looks like your own work.

Some of these problems were forecast by Northfield (1992), particularly in regard to the possibility of students becoming over-whelmed by the constant demand for CATS throughout the year. Problems associated with authentication have long been an issue, particularly with the specific nature the solutions to some of the problem-solving tasks set.

A Terribly Long Hard Grind Physically and mentally those interviewed showed signs of an unhealthy tiredness. One teacher ruefully described the situation at his school as follows:

T.1 The lunch room is empty after everybody has eaten. All they have time to do is really just go there and eat, and then they're back at their desks. Most of the staff would be at their desks for all of the lunch

break. Social activities have almost come to a grinding halt. Staff don't seem to have the time to organise them to get together.

The despair implicit in the above comment is most alarming. The tiredness that Northfield (1992) found was clearly evident in every teacher interviewed except, the one teacher who had recently returned to the classroom from a consultancy position.

T.4 When you get to the stage of being crying tired by the end of the week, or Sunday night comes and you haven't done everything you had to do...

T.3 It's still a terribly long demanding hard grind. I honestly don't know how many years I can survive working at this rate.

Listening to these comments I found myself wondering just whether or not all of this was worth it in real terms. There was an air of desperation surrounding these people, but when asked if they would teach it again next year given the choice they all said "yes."

Serious concerns and doubts have been raised with respect to the difficulties being faced by VCE mathematics teachers. If nothing constructive is done to provide assistance then many will lose faith completely in the VCE and resort to the "tried and trusted" ways of the past. You cannot continue to grind teachers into the ground. There are some similarities with what happened regarding the "new maths" of the sixties, not so much with the content, but rather, in the manner of implementation.

The VCE and Mathematics: The VCE Mathematics Study Design has stripped teachers of their traditional roles of "setting learning objectives, transmitting the necessary knowledge and skills, then assessing student performance" (Mousely, 1990, p. 53). This unfamiliar role has, as expected, created problems associated with the required adjustment. In order that teachers develop the required skills they need to be supported with ample opportunity for professional development. The two areas where support and guidance for mathematics teachers have been lacking include professional development and direction. Not enough time for professional development has been provided for mathematics teachers, and the lack of specific and consistent direction from VCAB has created confusion, undue stress, increasing contempt, and cynicism.

T.2 You know, we've been supportive, as supportive as we could have been. We've been to professional development, we're doing post graduate studies so that we can keep up with these things. We've come in over holidays and after school, on Friday nights and things like that to help students to complete these tasks. We've done everything to try and go with it, and yet VCAB still haven't come clean on some of the criteria on what people need to do to meet things like that, and in the end that's unacceptable. They have got to be honest about these things. Now we're crying out for some sort of advice in these sorts of things. They know that we don't know, and yet they have done absolutely nothing in response to that sort of thing. Absolutely nothing!

Surely, if we want the teachers to prepare students as best they can, then there has got to be time provided to enable them to do so without mentally and physically grinding them into the ground in the process. The policy-makers have to realise that they cannot radically alter schooling by simply getting teachers to change their habits. Such reforms are expensive, both in financial and human terms.

Breaking Down the Resistance: Initial resistance to innovative change is to be expected and is understandable. While they may not dispute the potential of the underlying philosophies of the VCE mathematics, many have not been able to make a full commitment to the VCE. For some there is anxiety about coping with the considerable time demands imposed by the VCE. For others, the problems associated with assessment are serving to create a barrier between themselves and successful implementation. For still others, there is scepticism and cynicism towards VCAB, and a feeling of having been used in an attempt to implement the changes as quickly and as cheaply as possible.

MAINTAINING THE MOMENTUM

The motivation and enthusiasm of mathematics teachers alone will determine the quality and the degree of change resulting from the introduction of the VCE. This study suggests that more guidance and support is

needed to enable mathematics teachers to move through the initial tentative stages and become more confident and independent in their approaches to teaching mathematics effectively at this level. The Ministry realises that to achieve improved student understanding in mathematics there needs to be changes in the following three areas: (a) teaching practices; (b) assessment procedures; (c) curricular emphasis (Leder & Forgasz, 1991). Change in teaching practice will be short-lived if it is not supported by a corresponding change in philosophy.

Smith (1985) refers to an increasing body of writing suggesting that "enduring reforms are those which change structures, create large supportive teacher constituencies, and are easily monitored" (p. 148). The VCE has achieved the first of these points only so far as the mathematics study design is concerned. But whatever stage has been reached, there has certainly been a considerable amount of unlearning and relearning for many mathematics teachers. This adjustment has impacted upon the lives of the teachers, both in and out of school.

T.2 We are now doing twice what we used to do. You didn't have course development to do. You didn't have the interpretation of the study design to worry about. You didn't have these new CAT 1 and CAT 2's to worry about. You didn't have interpretations of the criteria to worry about. All of those things, and changing your seven to ten courses, and yet we're just expected to do all of that alongside what people in the past have found quite demanding to do anyway.

Adequate time and opportunities for training should have been provided to enable this re-orientation to occur. The overall long term success of the program will depend upon continual provision of support and guidance for teachers until the changes have become part of the normal daily routine of teachers and schools. Many writers refer to this need for ongoing support and guidance through major curricular change (see for example Clements, 1990; Leigh-Lancaster, 1991; Northfield, 1989, 1991, and 1992).

The fact that the problems and the concerns identified in this study still exist surely indicates that not enough time, effort, or money was given to anticipating the problems which have arisen. Further, there has been insufficient attention given to the problems which VCE teachers are experiencing as a result of the changes. If teachers do not know precisely what they should be doing, if they are having difficulty interpreting the study design or assessment criteria, *then it is not their fault*, and they ought not be held ultimately responsible.

This study has found that many mathematics teachers are concerned with the manner in which implementation of the VCE has occurred. They are not happy with the assessment procedures, they object to the pressures which the VCE has had on their personal lives, and they deplore the role that VCAB has played throughout the implementation process. In this context, it needs to be remembered that in Victoria we have an ageing teaching force, where the average age is nearly 39, not an age noted for flexibility.

VCAB must now move quickly and decisively to calm the troubled waters. This study shows that mathematics teachers are losing faith, and evidence from the 1960's and 1970's reminds us that when this occurs worthwhile change can easily be reversed. It would be a pity if all the positive aspects from the VCE mathematics study design were to be abandoned because of a failure on the part of the policy-makers to acknowledge the importance of the feelings and attitudes of those in the front line of implementation.

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