

# **The Impact of External Assessment on Teaching Practice: Constraints on Change in the Classroom**

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The Victorian "Ripple Effect" study documented the impact of changes in mandated assessment in the final years of schooling on the teaching and assessment of mathematics throughout the secondary school, and showed that assessment can be a powerful catalyst for curriculum reform. This paper reports the final stage of a study which sought to examine the different set of influences on teaching and assessment found in NSW. Interviews with teachers from a broad range of schools explored the constraints which they experience as a consequence of the assessment system, and the extent to which they value, and implement, teaching and assessment practices such as problem solving, investigations, journal writing and self-assessment.

## **Introduction**

It is widely believed that there is a close link between assessment and instruction. Irrespective of whether this link is seen to be desirable or not, the assumption that it exists has motivated attempts internationally to redefine curricula by changing high-stakes assessment. It is not satisfactory, however, to *assume* that a link between assessment and instruction exists; its existence needs to be established by research, and the mechanisms by which assessment is translated into classroom practice identified.

Clarke and Stephens (1996) set out to investigate the purported link between assessment and instruction. During 1993 and 1994, a study was undertaken in Victoria to determine whether the form taken by a "high-stakes" assessment, the Victorian Certificate of Education (VCE), significantly affected classroom instruction at earlier year levels (Clarke & Stephens, 1996; Stephens, Clarke & Pavlou, 1994). The causal link hypothesised between changes to high-stakes mandated assessment and subsequent changes to instruction in earlier year levels has been called the Ripple Effect.

The Victorian study substantiated the Ripple Effect in Years 7 to 10 arising from changed assessment practices in Years 11 and 12. In addition, it provided a more sophisticated characterisation of this Ripple Effect and of the mechanisms by which it occurs. In particular, specific terminology and practices associated with the VCE were found consistently in mathematics instruction at every level of the secondary school. Other practices, such as student self-assessment and the use of student journals, while endorsed by the informed community, did not have the explicit sanction of inclusion in VCE assessment. The uneven occurrence (and widely different interpretations and implementation) of these non-VCE practices in the sample schools was taken as confirmation of the research hypothesis. This study found that teachers are reluctant to embrace new assessment and instructional practices unless these have the endorsement of inclusion in high-stakes assessment. It appears that, where a high-stakes assessment scheme is in place, school policies and practice adapt to accommodate the performances valued in the assessment and to prepare students to engage in such performances.

During 1995, a comparative study was undertaken in New South Wales, where the conjunction of high-stakes assessment in Years 11 and 12 and curriculum advice in Years 7 to 10 is quite different from that in Victoria. Notable differences include: well established (and separate) syllabuses for Years 7–8 and Years 9–10 in NSW; and the presence of a state-wide examination in Year 10. In Victoria, where no comparable syllabus documents were in place, the Ripple Effect study clearly demonstrated a top-down assessment-driven effect on Years 7 to 10. The NSW study examined a different set of influences on teaching and assessment in Years 7 to 10 in the absence of comparable dramatic changes in assessment practices.

The preliminary results of the NSW study (Barnes, Clarke, & Stephens, 1995) were consistent with the hypothesis that mandated external assessment sends strong messages to schools and that the style of assessment and the types of activities assessed play a powerful role in determining which aspects of the mathematics curriculum are valued by teachers. The 1995 questionnaire data established significant differences in the value accorded to "problem solving" and "investigations" by mathematics teachers in Victoria and NSW. While these key terms were employed in the questionnaires for both Victorian and NSW studies, we cannot be sure to what extent they have similar connotations for teachers across the two States. Interviews conducted in the latter half of 1995 sought to determine whether the issue was one of a difference in the valuing of similarly conceived activities or whether these mathematical activities assumed different meanings as a consequence of their different embodiment in high-stakes assessment. This paper reports the consequences of that analysis.

## Method

### *Design of Interview Questions*

In both studies, the aim was to determine how external assessment influenced teaching practice at junior secondary level. Because there are two external examinations in NSW, one in Year 10 (the School Certificate Reference Test) and one in Year 12 (the Higher School Certificate (HSC)) both of these were discussed in the interview. Teachers were asked to what extent they saw these examinations as influencing their teaching and assessment practice and how they thought their practice might change if there were no external assessment. In addition, they were asked about a number of specific teaching practices, including some, like problem solving and investigations, which form part of the VCE assessment, and others, such as journal writing and student self-assessment, which are endorsed by the mathematics education community, but do not form part of the mandated assessment in either NSW or Victoria. We sought in the interviews to ascertain the meanings and values which teachers attached to these various practices, and the extent to which they thought these practices might be helpful or otherwise to students preparing for external examinations.

### *Sample selection*

The priority in identifying interviewees was the desirability of obtaining a balance across the school sample and across teacher demographic variables such as gender and length of teaching experience. When completing the questionnaire for Stage 2 of the study, teachers had been asked to indicate their willingness to take part in a short interview, and thirty three had responded positively. From among these, between one and three teachers were selected from each of the twelve schools. As a result, 26 teachers were interviewed during September 1995, either in person or by telephone.

In quoting teacher responses in the results section, each teacher is identified according to length of teaching experience: new (less than 6 years), established (from 6 to 15 years) or veteran (over 15 years) and location and type of school.

## Results

### *Perceived Influence of the Higher School Certificate*

The teachers differed in the extent to which they thought the HSC influenced their teaching and assessment practice in Years 7 to 10. As Table 1 shows, the influence of the HSC was stronger for teachers in non-government schools than for their colleagues in government schools.

Teachers who thought that the HSC had only a slight influence on their teaching explained that awareness of the examination made them more content oriented. They mentioned the choice of options in the Year 10 syllabus—for those students likely to

undertake the more demanding HSC courses, they selected options which would be good preparation for work in Years 11 and 12. In general, they felt that the HSC influenced their depth of treatment of various topics, because they saw it as important to build a sound foundation for work in Years 11 and 12. This meant emphasising the basics, and perhaps adopting a more theoretical approach than they might otherwise choose. Apart from content issues, they felt that the need to prepare for the HSC made them more examination oriented. Some teachers found it difficult to distinguish between preparation for the HSC and good mathematics teaching. A typical remark was

Well, what I try and do is basically teach the syllabus, and give them a good grounding in everything, which I consider necessary to do well in the HSC. ... so I suppose ultimately, I'm trying to give them a good grounding in mathematics. (new teacher, metropolitan government school)

*Table 1: Perceived influence of the HSC on teaching and assessment in Years 7–10*

School type	Strong influence	Slight influence	No influence at all
Government	3	9	3
Non-government	8	3	0

Those teachers who felt that the HSC had a strong influence on their teaching and assessment expressed ideas similar to those above, but indicated a much greater awareness of the importance of the HSC, in many cases right from the beginning of Year 7. In some independent schools, this was very much part of the culture of the school. There was a strong emphasis on training students to perform well in written examinations, but there was also emphasis on developing a deep understanding of mathematics, the ability to reason mathematically, and to express mathematical ideas in written form clearly and correctly. Typical comments from this group included

The school community, the parents and the students, are so focused on the HSC that everything is focused on it, it's a cultural thing ... right from Year 7. ... Our approach seems to be that this is very real and earnest, that it's important, and the parents are very concerned that the students are moving forward in what they see as traditional maths, so we tend to stay with traditional approaches (veteran teacher metropolitan non-government school)

You're very much aware of you're training them, you're training the students, and I always compare it to a sports event, for the students, you're training and training, you put years of training into it. So, yes, especially the Advanced students ... it's preparing for a one-event that is a big event in their lives. ... The way I teach the middle-to-lower ability differs greatly to the way I teach the higher ability students. With the middle-to-lower ability, I'm much more prepared to experiment. ... whereas I'm not prepared to experiment with the higher ability, I think time is too important. (established teacher, rural government school)

I think we have an idea, right from the beginning of Year 7 ... of what it is that we're trying to do in the senior school ... we don't want them to do things by rote, we want them to do things by understanding, and we want them to understand at the highest level that they can. (veteran teacher, metropolitan non-government school)

### ***Perceived Influence of the School Certificate Reference Test***

Teachers were next asked about the influence of the Reference Test on their teaching and assessment in Years 7 to 10. The Reference Test is taken by all students in August of Year 10, and is used to moderate school assessments, to determine grades for the award of the Certificate. It consists mainly of multiple-choice items, with a small number of answer-only questions and an even smaller number of free-response questions at the end. Again, opinions about its influence varied, as shown in Table 2.

The four teachers who claimed that the Reference Test had hardly any influence all came from two independent schools, and all had already indicated that they saw the

HSC as the major goal for their students. In these schools -all, or nearly all, students continue at school after Year 10, and so the School Certificate has negligible importance as a leaving credential. One teacher said, "The exam itself doesn't suit what we're trying to do. It is a "pick-a-box" exam, and we're trying to train the boys to write coherent answers." (veteran teacher, metropolitan non-government school)

*Table 2: Influence of the Reference Test on teaching and assessment in Years 7 to 10*

School type	Affects Years 7-10	Affects Years 9-10	No influence
Government	4	12	0
Non-government	2	4	4

For teachers from the other independent schools, and all those from government schools, the Reference Test exerted a strong influence on both teaching and assessment in Years 9 and 10. The main effect on teaching mentioned was the need to complete the syllabus in time for the test. A majority mentioned feeling rushed, being under pressure to complete the course in time. In some cases, this meant teaching a topic in a less-than-optimal way, in order to get through it before the test, and then, perhaps, returning to it, and teaching it "properly" afterwards. Typical comments from these teachers included

I suppose it cuts out a lot of the activities that we could do, and that would possibly be more interesting for the kids to do, but due to time constraints we can't do because we're forced to condense it down or just teach it in another way so it's done quicker. (new teacher, rural government school)

I'm teaching for an exam for the first half of the year, and I find there's a lot of stress trying to get topics completed. ... And then I've come back after the exams and done them properly. (veteran teacher, metropolitan non-government school)

As these comments indicate, many teachers felt constrained by the School Certificate. A few, however, found it helpful: "It's more like a guide and very helpful" (veteran teacher, metropolitan government school) and "[the external examinations] provide a goal for the students." (veteran teacher, metropolitan non-government school)

As for the effect on assessment, all teachers felt it was essential to give students practice in doing multiple-choice questions. In a few schools, this simply meant giving out copies of past Reference Test papers a few weeks before the actual test. Students were encouraged to use these for practice, but were not assessed on them. In all the other schools, the major assessments in Years 9 and 10, and sometimes in Years 7 and 8 also, took the form of examinations modelled on the Reference Test. Teachers felt that, in order to be fair to their students, they had to emphasise preparation for the Reference Test in this way. Several claimed that other schools did it, and their students would be disadvantaged if they did not do so too. Typical comments included

We make sure that our students always have, in exams, multiple-choice questions to practice, to work on, so that they are accustomed to them and they're not thrown by them and don't treat them as multiple guess! ... And what's more, I'm going to set the Year 7 exam at the end of the year, and I will use some multiple-choice questions from the General School Certificate exam [the "Reference Test" for the lowest level course]. (veteran teacher, metropolitan non-government school)

The two major assessments that we have are modelled on the School Certificate in Years 7 to 10, and we have two each year, a mid-year and an end-of-year. (veteran teacher, rural non-government school)

I suppose to a certain extent that you tend to "coach"... I think, to be fair to the students, you have to do that, because I'm quite sure that ... the majority of schools, will be doing the same thing. So we don't want to put them at a disadvantage. (established teacher, rural government school)

Many teachers were not very happy about the situation, but felt forced to go along with it. As one said, "I don't think it's a good teaching method at all, it's just something you have to do."

### *What If There Were No External Assessment?*

As a way of gauging the extent of the influence of the HSC and the Reference Test, teachers were asked "Thinking more about process and teaching style than about content, would you teach differently in Years 7 to 10 if you did not have to bear in mind the requirements of external examinations?"

Six teachers, from both government and non-government schools, said that it would make little difference to what they did. They were satisfied that their current program was effective and met the goals they had established for their students: "you'd still follow some of those procedures, because you know students learn under that system" (established teacher, metropolitan government school). Two other teachers thought that teachers might become slack without the imposed discipline of external examinations, or that the students would lack motivation to work.

It's good, to keep you honest, and perhaps, I think, stop you taking the easy way out, where ... if a kid's having trouble with it, well, maybe it is beyond them. (veteran teacher, metropolitan government school)

The external examinations keep you honest. I like external examinations. I think they're the only things that are keeping any form of self-discipline within our students. (veteran teacher, metropolitan government school)

The rest of the teachers expressed, in a variety of ways, the idea that removing the constraints of external examinations would free them to be more experimental. It would give them the chance to try more exciting things, to undertake more extension or enrichment work, more "hands-on" practical activities, more investigative activities or group work, or to relate mathematics more to the students' interests. For example

If we weren't tied to a formal exam, I would hope to do a lot more practical work, a lot more work on estimation, have the sort of ideal maths lab situation, ... and to assess the students on what they did in that practical situation, you know, their ability to do practical things, to actually draw a circle with a — good grief! (veteran teacher, metropolitan non-government school)

You would probably tend to do more interest type activities, more outdoor type activities, that you wouldn't worry about in an exam, and the children might enjoy it more, find it more interesting. (established teacher, rural government school)

I would like to do more of a thematic approach I suppose ... not only in maths, but in other curriculum, other subjects as well. (established teacher, metropolitan non-government school)

### *The Importance of the Reference Test*

To gain some understanding of why so many teachers felt constrained by the requirements of the Reference Test, we asked them how important they thought the test was, and how important the students and their parents perceived it to be.

Answers to this question revealed an interesting contradiction. Most teachers saw the School Certificate as of little relevance nowadays, because the great majority of their students stay on at school and complete the HSC, which then outweighs their School Certificate results. Typical of this attitude was a new teacher in a metropolitan non-government school who said "I don't see it as having any purpose beyond a bit of feedback to the students and their families." Only a few disagreed with this point of view. Some saw the Reference Test results as a guide to standards "an indication as to whether we are being too soft or too hard in the marking of our own assessments" (new teacher, rural government school) or "the only thing that monitors just how we're performing in relation to other schools" (veteran teacher, metropolitan government school). Another thought it was important because "it gives the students the chance to do an external exam" (established teacher, metropolitan government school). In that sense, presumably it helps prepare them for a more important external exam, the HSC.

In spite of the widespread belief that it was not important, however, nearly all the

teachers felt it necessary to emphasise the importance of the Reference Test to their students and to put a great deal of effort into preparing them for it. In part, this was simply because of its external status “because it’s an external examination, ... you can’t help but have it influence your teaching” (veteran teacher, metropolitan government school). Other reasons varied from school to school. In some schools, a significant minority of students were likely to enter the workforce without completing the HSC. For such students, the School Certificate results are an important credential. The role of the Reference Test as a moderator means that the grades which can be awarded to these students are determined by the performance of the school as a whole on the test, and therefore it is important for all students to make an effort. Many teachers felt that parents and the local community judged their school’s performance by the students’ School Certificate results. While this was the case for a government school in a country town, similar views were also expressed by teachers in city schools, and independent schools. “if we didn’t get our usual good results ... the parents in this school would be, not up in arms, but ... I think their concern would become greater” (veteran teacher, metropolitan government school).

One teacher articulated very clearly her awareness of the contradiction in attitudes towards the School Certificate: “Yes, it’s strange, isn’t it? What’s it like? I suppose it’s like, maybe, 21st birthday parties. You know, they’re not important any more, but we still make a big deal of them. I suppose it’s something like that, they used to be important ...” (established teacher, rural government school).

### *Problem Solving and Investigative Activities*

Problem solving and extended investigations play an important role in the VCE assessment, so teachers in the parallel Victorian study were asked to articulate their understanding of the terms “problem solving” and “investigations” and the value which they attached to these activities for students in Years 7 to 10 (Clarke & Stephens, 1996; Stephens, Clarke & Pavlou, 1994). To enable comparison with the Victorian sample, the NSW teachers were asked similar questions. They were first asked to describe a problem-solving activity they had used recently with students in Years 7 to 10. If their understanding of “problem solving” had not become clear from the reply, they were then asked to describe the kinds of activities which, in their view, came under the heading of problem solving.

We found great variation in teachers’ understanding of what constituted problem solving. At one end of the scale, some thought that any textbook word problem, or any minor change in the statement of a routine question could be called a problem:

Every question can manage to raise problem solving ... just by changing the words you can change the problem for the kids. ... Instead of the rote three times two is six, when you say three lots of two, and if you had some aids, say some old cuisenaires or whatever, then it becomes a problem for them, doesn’t it?” (veteran teacher, metropolitan government school)

Others saw problem solving as “using their skills from what they’ve learnt in an unfamiliar situation” (veteran teacher, metropolitan government school). A few teachers mentioned Fermi problems and open-ended questions. Some schools had problem solving task centres for Years 7 and 8. Several teachers spoke of teaching problem-solving strategies, while others doubted the value of this, “when you’re solving a problem you’re on your own and you’re basically bringing out all the things you have in your kit-bag or whatever it is. I think teaching problem solving is a rather dubious idea” (veteran teacher, metropolitan non-government school). It was common for teachers to look for real world applications when selecting problems for less-able students, but to choose more abstract, logical reasoning, or puzzle-type problems for students whom they regarded as having higher ability.

Assessment of problem solving varied greatly, too. In some schools students kept a brief record of their solutions and strategies; in others, solutions were reported orally, either to the teacher or in class. A few teachers regularly placed one or two “problems” on the end of tests, and a number said that they did not formally assess problem solving.

Teachers were less clear about the meanings which they attached to investigative activities. When asked to describe an investigative activity they had used, or planned to use, with students in Years 7 to 10, many hesitated for a long time, and several mentioned the same activity as they had described in relation to problem solving. One teacher said that she found it hard to differentiate, but simply classed problem solving and several other activities together under the heading of “doing something different” (established teacher, rural government school). Others were stumped, “It’s hard to think what to put in that category” (veteran teacher, metropolitan government school).

Several teachers mentioned practical work in geometry (ruler-and-compass constructions, measuring and paper folding to find properties of figures, the area and perimeter of a circle, measuring volumes, using trigonometry to measure heights of objects, outdoor activities to measure areas), statistical investigations involving data collection and graphical representation, and probability experiments. With only a couple of exceptions, teachers appeared to have the idea that investigations involve practical “hands-on” activities. Investigations were commonly seen as a way of introducing a new topic, and only rarely was more than one period devoted to such an activity. Time constraints were the main barrier mentioned. One of the few teachers who saw investigations as requiring a longer period of time, said that he hardly ever used them because of exams and the restricted time available for mathematics.

Teachers seldom asked students to produce written reports of investigations, preferring to obtain feedback from class discussions. They were not explicitly asked about the use of investigations as an assessment tool, but no-one mentioned doing this. Most teachers thought that investigations were important, although few made extensive use of them. Typical comments were “in a way they start to take control of their learning” (veteran teacher, metropolitan government school) “if they’re finding things out themselves they tend to remember it better” (new teacher, rural government school) and “a very good motivational thing” (established teacher, metropolitan government school). A few expressed doubts: “Theoretically it sounds great, but I think in practice they don’t actually remember much of it. They just remember that ... the day we did this, they spilled the water” (veteran teacher, metropolitan non-government school).

### ***Written Reports***

Teachers were asked what sort of activities they might ask students to produce written reports on. Again, there was great divergence of responses. Only one teacher, from a rural government school, mentioned using a draft-redraft process for students’ report writing. Seven mentioned projects—either writing a report on a topic in the history of mathematics, or collecting information for a project on personal finance. Eight said that students were asked to write *short* reports of problem solving activities. Four had asked students to write reports of statistical investigations, one asked them to summarise chapters, and six said they did not ask students to produce written reports.

Written comment provided by teachers on such reports was usually brief. Most teachers indicated that they prefer to provide feedback by talking to the student. One commented, “I don’t really do it often enough to have much of a set pattern.”

### ***Mathematical Journals and Self-assessment***

Several teachers had thought about using student mathematical journals, and thought that it would be a good idea, if they had time, but only one had actually done so regularly. This same teacher also used student self-assessment. Apart from this one teacher, none of those interviewed had made regular use of student self-assessment.

## **Conclusion**

The picture in NSW is one of skilled and professional teachers, working hard within the rules prescribed by the education system, to achieve the best outcomes they can for their students. The present form of the HSC examination encourages teachers to emphasise deep understanding of important mathematical concepts, and to encourage

correct expression of mathematical ideas. The School Certificate Reference Test creates an interruption to this process, putting pressure on teachers to rush through sections of the syllabus, and to spend time and effort in training students to tackle multiple-choice and short-answer questions. It appears, however, that the NSW system tends to inhibit educational innovation. Teachers are less prepared to experiment with alternative approaches to teaching or alternative forms of assessment, mainly because of pressure of time, but probably also because they do not see a clear pay-off for their students in terms of improved marks in the HSC.

The School Certificate Reference Test is not "high-stakes" assessment in the sense of the Higher School Certificate, but there are still important matters at stake for schools and teachers, which lead them to accord it greater importance than many would wish: their own sense of professionalism, the reputation of the school, and the need for a credential for students who leave school before the HSC. Thus the Reference Test has the effect of shaping the priorities for teaching in Years 9 and 10, except in a few independent schools which can stand back and say to parents, "Our goal is the HSC. We regard the School Certificate as largely irrelevant for our students."

It appears that "problem solving", which has taken on a specific definition for Victorian teachers, is not employed with such consistency of meaning by mathematics teachers in NSW. "Investigation" is not at the moment part of the lexicon of most NSW teachers, and in some cases was assumed to be synonymous with problem solving.

This study suggests that such assessment as the NSW Reference Test may wield curricular power through its mandated, external character, even though it is no longer a truly high-stakes event within the NSW school system. Most teachers acknowledged its lack of significance, whilst simultaneously reporting that they stressed its importance to their students. The importance of the Reference Test was variously associated with its implications for the reputation of the school and with the maintenance of "standards."

The significance of the HSC lies in its character as a timed written examination. The high-stakes nature of the HSC leads teachers and schools to value this form of assessment. Both the Reference Test and the HSC act to inhibit experimentation and innovation in the mathematics curriculum in NSW secondary schools. It was asserted, however, that the HSC examination demanded a depth of understanding that went beyond the replication of procedures learned by rote. In this, the HSC can be taken to represent a vision of "high-quality traditional mathematics." In comparing the Victorian and NSW studies, we see a conflict of paradigms, most clearly evident in relation to the significance accorded to problem solving and investigations. It is the conclusion of this study that these differences in the value systems which govern the professional activity of teachers can be attributed to the form taken by mandated, external assessment.

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