STREAMING for mathematics in Victorian secondary schools

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Introduction

Streaming (or ability grouping) for mathematics learning is a contentious issue. It can also be considered an issue of equity or social justice (e.g., VanderHart, 2006) as some students may be adversely affected by the practice.

The Senate inquiry into The Education of Gifted and Talented Children (Commonwealth of Australia, 2001) attempted to differentiate the meaning of the terms, "streaming" and "ability grouping." It was noted that "ability grouping for the gifted is not the same as streaming the whole year group into A, B, C, D... classes" (p. 67), and that general streaming was "no longer fashionable because of perceived detriments to the less able" (p. 67). It was clearly pointed out that there were no submissions to the inquiry suggesting that general streaming should be resumed. The point was made that the various forms of ability grouping for the gifted could be used without streaming the whole year group. While not mentioned in the inquiry report, an unintended outcome of within subject (e.g., mathematics) streaming, due to the pragmatics of school timetabling constraints and/or teacher shortages, might be that students end up studying all other subjects in the same groupings.

Despite the differences in definitions noted in the senate inquiry report, the two terms are commonly used synonymously in Australia, and this was also evident in the teachers' responses in the study reported here. In the sense that the teachers interpreted the terms, the practice of streaming/ability grouping for mathematics at any given secondary year level could take various forms, from selecting out only high achievers or only "at risk" students, to grouping into "top/high", "medium/mixed", and "low/at risk" achieving groups, and even having subgroups within these three categories, that is, forms of streaming akin to the A, B, C, D... classes considered unfashionable in the senate inquiry (as noted above). Some schools and teachers were also found to use "ability groups" within mixed ability (or heterogeneous) classes of students.

Victorian guidelines on streaming/ability grouping

In the 1980s in Victoria, the message was clear that streaming was unacceptable. In the newsletter, AdVise, of the Victorian Institute of Secondary Education [VISE]—the curriculum authority of the time—Emmett (1983, p. 3) claimed that: "streaming and setting, if we are to believe the research, are unsound educational practices and all educators should strive to minimise, and eventually remove, their influence so that schooling recognises and promotes the gifts all young people have."

Currently, the Victorian Department of Education and Early Childhood Development [DEECD] does not appear to have clear guidelines on streaming. However, in its documentation about "gifted" students (for which definitions are provided), it is claimed that differentiating the curriculum should be part of a school's curricular strategy, that all students should have the opportunity to reach their full potential, but that the regular classroom should be the venue to provide appropriate challenge for the majority (DEECD, n.d. a). The suggested school options to cater for the gifted (DEECD, n.d. b) are consistent with the recommendations of the Senate inquiry (Commonwealth of Australia, 2001). Yet, those seeking support for a variety of forms of streaming in mathematics may selectively seize upon some of the statements made and research findings cited in the DEECD documentation, despite the clear emphasis being on provisions for the gifted.

Previous research on streaming

On reviewing classroom factors affecting learning, and not speaking of mathematics in particular, Hattie (2002), claimed that whether or not streaming is used, what happens in the classroom is more important: "Good teaching can occur independently of the class configuration or homogeneity of the students within the class" (p. 449). Findings from the research literature with respect to mathematics learning lend support to the contention that streaming is inappropriate, particularly for low achievers. Based on an extensive review of the literature, Ireson and Hallam (1999) claimed that there appeared "to be complex interactions between grouping, teaching methods, teacher attitudes, the pacing of lessons and the ethos of the school" (p. 344). They urged UK educators to find alternatives to streaming for mathematics, claiming that in the long run, as in the past, it was unlikely to succeed. Boaler, Wiliam and Brown (2000) argued that streaming "could be the single most important cause of the low levels of achievement in mathematics in the UK" (p. 646).

In another UK study, Ireson et al. (2002) found that "pupils who do well in the Key Stage 2 tests [end of grade 6] benefit more from setting [streaming] than lower attaining pupils" (p. 311). Streaming, they claimed, only had limited impact on mathematics achievement, and there were likely to be adverse longer term effects on children incorrectly placed in low ability groups who were unlikely to move out of them. In Australia, Zevenbergen (2003) also found that high achievers in Year 9 and 10 streamed settings benefitted and that those most at risk were in the lowest streams. Linchevski and Kutscher's (1998) findings were slightly different. They compared the mathematical performances of Israeli Year 7 students who were grouped by "ability" (homogeneous) and those in mixed (heterogeneous) classes. Average and less able students' achievements in the mixed

settings were significantly higher than those of their peers in the homogeneous classes, and the highest achievers' performance levels were about the same in both settings.

Clarke and Clarke (2008) listed nine reasons why streaming for mathematics should be abandoned in the middle years in Australia:

- only high achievers benefit and there is a negative impact on average and low achievers;
- streaming has negative effects on the performance of countries participating in international testing programs;
- streaming can lead to the mistaken belief that individual differences are no longer an issue;
- often the least-qualified teachers are assigned to lower ability classes;
- teachers have low expectations of what low achieving students can do mathematically;
- narrow criteria are used to group students, and the groups are considered appropriate for all tasks and topics;
- despite claims of flexibility, it is difficult to leave lower ability classes;
- various strategies exist to assist teachers in catering for children of various ability levels; and
- in the interests of social justice, streaming cannot be supported.

It should be noted that the extent of research support for each of the nine points raised by Clarke and Clarke (2008) varies.

In the initial advice about the Australian national mathematics curriculum currently being developed, there is a strongly worded statement, consistent with social justice principles, against the temptation to address the wide-range of mathematics achievement levels that might be found at particular year levels by differentiating opportunities. It was argued that there should be no barriers to progression in mathematics and that "students should have the opportunity to choose any mathematics study at the start of Year 10, and should not have their options restricted by their own previous choices or their school's structuring of subject offerings" (National Curriculum Board, n.d., p. 6). The onus was placed on systems and schools to ensure that the appropriate measures were in place to ensure that students' mathematics opportunities were not constrained. Implicitly, these statements appear in opposition to streaming, suggesting that streaming has the potential to limit students' choices of mathematics options at Year 10 and beyond. In having to meet this goal, will Victorian schools be challenged to modify their current grouping practices? Anecdotal evidence suggests that streaming for mathematics has become more prevalent than in the past; the severe shortage of qualified mathematics teachers may be a contributing factor to this situation

The aims of the present study were to explore the extent to which streaming is currently used for mathematics in Victorian post-primary schools. With respect to the social justice concern of equitable opportunity for all students, teachers' views on the streaming/non-streaming policies and practices in their schools were also examined.

The study

Sample, instrument and method

The Mathematical Association of Victoria [MAV] agreed to include information about the study in its newsletter, *Common Denominator*, and on the

MAV website. Secondary mathematics teachers across Victoria were invited to provide information about their schools. The online survey was developed using the SurveyMonkey software. The following data were gathered:

1. Background information about the schools and the teachers who responded;
2. The grade levels at which a form of streaming was used in the schools;
3. Whether the teachers agreed with the policies adopted in their schools; and
4. More specific information on the streamed groups and the criteria used to form them.

Findings

Usable responses were received from about 44 Victorian post-primary schools, that is, from approximately 8% of the schools at that level in the state (Department of Education and Early Childhood Development [DEECD], 2007). In all, data were gathered from 19 Government schools (44% of the sample), 14 Catholic schools (33%), and 10 Independent schools (23%). Government schools comprise about 60% of Victoria's schools and were therefore slightly under-represented. Of the 44 schools, 28 (65%) were Melbourne-based; this proportion is consistent with the location break-down of secondary schools in the state (DEECD, 2007).

Of the teachers who responded and provided data on their schools:

- 13 (30%) were male
- 12 (28%) were mathematics co-ordinators
- 35 (83%) were employed full-time
- 15 (24%) had taught for 0–5 years, 18 (41%) for 6–20 years, and 11 (25%) for more than 20 years
- only 5% taught less mathematics than other subjects
- there was a balanced spread of those currently teaching at each year level 7–12: Year 7: 20 (45%); Year 8: 21 (48%); Year 9: 23 (52%); Year 10: 30 (68%); Year 11: 26 (59%); Year 12: 27 (61%)

The extent of streaming

The respondents were asked whether there was a form of streaming used in any of the Years 7–10 mathematics classes in their schools and whether they agreed with the school's policy. The responses are summarised in Table 1.

Table 1. Frequencies (and percentages) of responses about streaming for mathematics and school policy

	Is there a form of streaming in Years 7–10?	Do you agree with the school's policy?	
		Agree	Disagree
Yes	35 (80%)	26 (74%)	9 (26%)
No	4 (9%)	1 (25%)	3 (75%)
No response	5 (11%)		

The data in Table 1 indicate that a form of streaming was used for mathematics in 35 (80%) of the schools at which the respondents to the survey

taught, and no form of streaming in only 4 (9%) schools; there was no response about streaming in five (11%) of the schools. Of the 35 schools with a form of streaming, most teachers (26, 74%) indicated that they agreed with the policies in their schools. The teacher from only one of the four schools without streaming agreed with the school policy; the others felt that a form of streaming for mathematics should be introduced.

Some schools did not offer all of the year levels from 7–10 (e.g., one was a Year 9–12 school). In Figure 1, the percentages of schools in which a form of streaming for mathematics was in place at each of the year levels 7–10 are shown. For each year level, the number of schools with that year level is shown in brackets.

As shown in Figure 1, the percentage of schools with a form of streaming for mathematics increases as grade level increases. The extent of streaming at Year 7 (37%) appears to be quite high, considering that this is the first year that most students are attending their schools. Two factors may partially explain these relatively high numbers. Some of the Independent schools may have been P–12 schools where teachers had prior knowledge of students before they entered Year 7. It is also plausible that teachers from schools where streaming was in place may have been more inclined to complete the online survey.

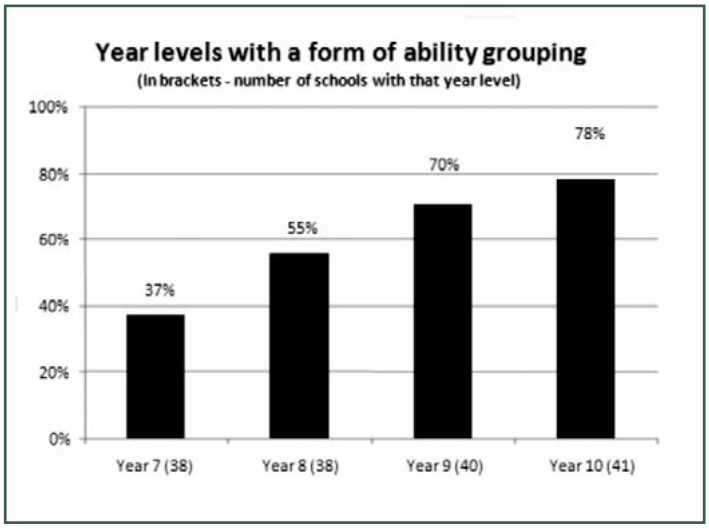

Figure 1. Percentages of schools with a form of streaming, by year level.

The teachers were also asked to explain why they agreed or disagreed with their school policies on streaming; 35 provided explanations to this open-ended question. The patterns that emerged among the responses, together with representative examples, are described in the next section.

Reasons for agreeing or disagreeing with streaming policies

The most common reason in support of streaming (or disagreement with it not being in place) was that it catered well for the needs of students of different achievement levels. Most who cited this reason focussed on high and low achievers. For example:

Teacher 1: [agreed with streaming policy] It enables advanced students to move ahead and not become bored with classroom activities. Provides healthy competition between students. Allows sensible discussion of concepts which most students follow and can participate in. Also allows students who have difficulty with

mathematical concepts to learn at a pace more suitable to their needs and they improve their confidence in maths.

Teacher 2: [agreed with streaming policy] It allows for both enrichment and extra help.

Teacher 3: [disagreed with the lack of streaming policy] …maths teachers struggle with having such a wide spread in abilities … it appears that the most common approach to dealing with this is to "drag" all the students along at the same pace, i.e. teach to the middle. This is unacceptable as we are neglecting the bottom & top in each class. We need to cater for these students as well but we aren't.

Interestingly, as shown in Figure 1, streaming was widely adopted at Year 10 and none of the respondents disagreed with this practice. However, some disadvantages were identified including classroom management issues:

> [Agreed with streaming policy] [We] only stream at Year 10. This is to better prepare students for Year 11 Maths pathways, particularly those intending to do Maths Methods. This is the first year we have done this and it has been successful as far as the Maths Methods pathway is concerned. It has caused some problems with the other Year 10 classes in that groups of lower ability students are harder to teach.

The teachers' disagreement with streaming tended to be limited, or was only related to certain forms of the practice adopted in the school, e.g., at Year 7. The reasons echoed those from the literature reviewed above including under-qualified teachers and the implication that they are allocated to low achievers, middle level achievers missing out, that flexibility of movement can be compromised, limited criteria for selection into groups, and recognition of the availability of alternatives within mixed ability classes:

Teacher 1: [disagreed with streaming policy] We are trying to meet the needs of all ability levels while having many teachers working in the area who do not have formal mathematics qualifications and we ability group the students in an attempt to meet the needs of all students with the staff that we have. We are meeting the needs of the high achievers and the very weakest students but I'm not sure that those in the middle are not missing out. The students make the selection of pathway not the staff but advice is given.

Teacher 2: [disagreed with streaming policy] In previous years I, as maths coordinator, could say when, where and if streaming could occur. The school now frowns on my "flexible grouping" approach and I have to fight to group students as I think fit. I am lucky in that the school is small and maths classes from 7 to 10 are blocked.

Teacher 3: [agreed with lack of streaming policy] I "group" in classes to allow for students to learn at their own pace and to provide added support to those that are struggling or need a challenge.

One teacher who disagreed with the school's policy on streaming commented elsewhere in the survey that while streaming could be justified at the Year 10 level, it was of major concern at Year 7:

> They have just arrived from Primary, and are still forming their knowledge, they may have unfortunately had teachers that weren't strong in maths. To pigeon-hole them too early into an ability set could effect their choices later, often there are students that don't take things seriously until Year 10 and then "knuckle down". Though I think with class sizes of 30 it's impossible to truly cater for the broad range of students' abilities well, which makes streaming at this level more appealing. With class sizes of 20–24, it makes it easier not to. Though I think it would be helpful to occasionally take out remedial groups for single sessions, but also extension groups, but not for the majority of the time. Either that or if you had a constant learning aide available…

Some teachers who agreed with the streaming policy in their schools were also aware of limitations such as its suitability at Year 7 and the selection criteria used:

> This is actually a "mostly" response. Streaming was introduced at Year 7 this year, and I don't think that it is necessary or practical at this year level… [t]he students were selected by the principal based on a single test; no member of the Maths faculty was involved in the selection. In previous years, girls were accepted for acceleration at the end of Year 7 by a process of results and discussion at a meeting of the Year 7 teachers.

Types of streaming used for mathematics in Years 7–10

Information on how ability groups were formed for mathematics was provided about five schools at Year 7, five schools at Year 8, nine at Year 9, and 13 at Year 10. The form of streaming varied greatly both within and across the year levels.

At Year 7, there was great variability in the forms of streaming used. At one extreme, the whole cohort was sorted into ability groups for mathematics based on the results of a test administered at grade 6 in the school (an Independent school); the principal, with no input from mathematics teachers, grouped the students. At the other extreme, only a small group of students with special needs was identified, with the rest of the Year 7 cohort in mixed ability mathematics classes. For the three other schools, the descriptions suggested flexible groupings. In one case, students began the year in mixed groups and later, based on test results, a "top" group for mathematics was identified and the rest remained in mixed ability groups. A second description was similar, but the groupings differed for particular mathematical topics. In the third school, ability groups and mixed groups were used for mathematics at different times with the groupings based on initial testing and pretesting for each unit of work.

At Years 8 and 9, there were comments about the ways ability groups were formed for mathematics in 14 schools. The most common forms described are summarised below.

- Advanced group/s, special needs group, the rest mixed ability (Year 8: 2; Year 9: 7)
- Advanced group/s, the rest mixed ability (Year 8: 1; Year 9: 2)

Of the remaining descriptions, one was unclear (Year 8), and the other indicated that ability groups were formed across the entire year level (Year 9), but with only a small class (10–15) for the very weakest mathematics students and a very large class (up to 30) for the highest achievers.

At Year 10, all streaming practices were described as being related to pathways into Year 11 mathematics courses. In some cases the explanations were quite explicit; in others it was obvious to those familiar with the structure of the post-compulsory two-year Victorian Certificate of

Education [VCE] program, including the Vocational Education and Training [VET] options, completed by students in Years 11 and 12 and the mathematics subjects offered (see VCAA, 2005).

Criteria for selection into ability groups for mathematics

A summary of the criteria used for selecting students into ability groups for mathematics, as indicated by the teachers who provided the information about their schools, is shown in Table 2.

Table 2. Criteria used for selecting students into ability groups at Years 7–10.

		Criteria for selection into ability groups					
Year level	Number providing data	Marks/ tests	Teacher recom-mendation	By invitation	Student choice	Parental choice	Other
7	8	5 63%	6 75%	6 75%	1 13%	2 25%	4 50%
8	6	5 83%	6 100%	1 17%	1 17%	2 33%	1 17%
9	12	12 100%	11 92%	4 33%	1 8%	2 17%	3 25%
10	17	13 76%	14 82%	5 29%	10 59%	8 47%	2 12%

As can be seen on Table 2, marks and test results (combinations of classroom testing and/or standardised tests), and teachers' recommendations were the main criteria used at all year levels. At Year 10, student and parental choices played a greater role than at other year levels.

Pedagogical considerations

It was considered important to know if teachers modified their pedagogical approaches in the streamed classes at the different year levels they taught. They were also asked to explain what they did. While not all teachers taught at each year level, the following responses were noted:

- Year 7: 4 out of 8 modified their pedagogy, 1 did not, 3 had no streaming
- Year 8: 3 out of 6 modified their pedagogy, 1 did not, 2 had no streaming
- Year 9: 10 out of 12 modified their pedagogy, 1 did not, 1 had no streaming
- Year 10: 16 out of 17 modified their pedagogy, 1 had no streaming

No explanations accompanied the responses from those not modifying their pedagogical approaches. The majority of teachers who did modify their teaching approaches clearly made efforts to meet the needs of the students in their classes.

A Year 7 teacher of a "top" stream wrote:

> I incorporate more problem solving and "real-life" activities into these classes. Less time is spent on skill development as the students often have already well developed skills in many areas. If there are exceptional students then these students are given some extra work to allow them to extend themselves even further. Technology is used to enhance the learning experience of the children…

One Year 9 teacher described what occurred in the three different streams:

> My Higher Level class receive proofs and a conceptual approach to mathematics. I encourage them to come up with their own methodology to solve problems. Students complete exploratory, open-ended assignments with relational questions using IT—Excel, GSP, Graphmatica. My Standard Level class are given explicit methodology to solve problems with simplified proof about why it works. Individual students are given challenges where required. Some students are given a modified program where necessary. The Foundation Level program is focussed on practical mathematics where instruction focuses on how to break down language of questions into relevant and irrelevant information, and how to keep track of each section of each question.

While not explicitly stated, this comment suggests that the curriculum offered was not the same in each streamed class at Year 9, thus potentially limiting movement between streams and restricting students' mathematics pathways in the years to come.

In summary, it was apparent that what took place in top streamed classes was generally consistent with the recommendations of the senate inquiry and the DEECD to cater for the needs of gifted students. The descriptions for classes of low achievers, however, appeared inconsistent with the equity thrust in the documents on the developing national mathematics curriculum.

Final words

Findings from the survey reported here suggest that streaming for mathematics was fairly widespread, even at Year 7, across the schools in Victoria represented in this study. The extent of the practice was seen to increase as year level increased. Most teachers supported the streaming policies in place in their schools. Enabling teachers to cater best for students of different achievement levels was the main reason for support.

Many teachers were only partially supportive of their school policies, and others disagreed. The limitations of streaming identified by the teachers were consistent with previously reported research and included: the effects of placement errors; inadequate selection procedures; Year 7 being too early; recognition that there are alternative ways to cater for the highest achievers within mixed ability classrooms; classroom management problems in lower streams; under-qualified teachers; and the potential for low and middle achievers to be disadvantaged. In many schools where a form of streaming was in place, care had been taken to allow flexibility, a range of criteria had been adopted to select into the streamed mathematics groups, and class sizes had been adjusted to cater for student needs. The mathematics curriculum offered and the pedagogical practices in the streamed classes of low achieving students, as described by teachers in this study, appeared inconsistent with the social justice perspective evident in the working documents for the national mathematics curriculum being developed.

Whether sanctions and/or encouragements are in place to enable schools to modify their current practices in line with the social justice imperatives of the proposed national curriculum, and/or the importance government assigns to discourage streaming when implementing the new curriculum will, in my view, be factors closely associated with any observed change. To convince teachers and school leaders of alternatives to

streaming across all year levels for mathematics, the following are needed:

- wider dissemination of prior research findings in the field;
- more research-based evidence to identify effective models for teaching across the achievement range; and
- a clearer appreciation for the difference involved in catering for the "gifted" (the very highest achievers) and meeting the needs of all students without disadvantaging them.

For the benefit of the state of Victoria and the nation in the longer term, striving to attain the socially just goal of meeting the mathematical needs of all students for the future, while not closing options, must continue.

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