Problems arising from streaming mathematics students in Australian Christian secondary schools: To stream or not to stream?

Peter Kilgour
Executive Director, Seventh-day Adventist Schools (Greater Sydney) Ltd
A mathematics teacher for many years, Peter has taught in four different countries.

Abstract

This article focuses on selected sections of a wider research study that investigated the perceptions of students in upper, lower, and mixed-ability stream mathematics classes, regarding their classroom learning environment. The study collected data from a representative sample of Year 9 and Year 10 students, employing recognised, reliable survey instruments. The most significant finding of the study, resulting from the analysis of quantitative data, was that lower stream students not only had more negative perceptions of their classroom learning environment, but wanted less change. This negative perception is seen to be worse in Year 10 than in Year 9, particularly in terms of *teacher support*, *task orientation* and *equity*.

Introduction

Streaming students into performance levels based upon academic ability is a common practice in Australia. This practice is known as 'tracking' in North America and 'setting' in the UK and generally involves "assigning students to classes based on some measure of ability" (Harlen & Malcolm, 1999).

Numerous studies have indicated that more able students achieve at a marginally higher level when placed in an 'upper stream'. However, little research has been done investigating the nature of classroom learning environments in streamed classes *vis a vis* mixed ability classes and how this might influence student learning outcomes, particularly in 'lower streams'.

Australian Christian secondary schools and colleges tend to be relatively small and usually have a maximum of three streams. Frequently there are only two streams; consequently students are placed into an upper stream or a lower stream. Streaming is further reinforced by policies. For example, the NSW Board of Studies has developed a mathematics curriculum that requires middle secondary students to choose a particular level.

Review of relevant literature

Three main reasons have been given to support schools' practice of streaming:

1. It is easier and more efficient for the teacher.
2. Students are helped to reach their learning potential and feel better about themselves.
3. Streaming limits the amount of failure slower students may experience and feel (DiMartino, 2005, p.10).

Each of these points is disputed by DiMartino. He believes the benefits of streaming are questionable when overall research evidence is considered. He points to studies that have shown that it is not possible to place students equitably or accurately into groups based on ability.

> ***"It is not possible to place students equitably or accurately into groups based on ability"***

Furthermore, DiMartino maintains that the research shows a lower self-esteem for students in lower streams. He sees no positive aspects in streaming and concludes that it polarises, creates elitism, sets low expectations for lower stream students as well as teachers, wastes time, and encourages 'segregation'.

Earlier research (Hoffer, 1992) supports the above viewpoint, showing that any academic gains from ability grouping are too small to be significant. Indeed, while placing students from a mixed ability class into an upper stream produces only a *weak positive* net result, placing a student from a mixed ability class into a lower stream class produces a *strong negative* result. This represents just one of many studies that suggest streaming minimally benefits the upper group, but disadvantages the

lower group in a pronounced way. A study by Venkatakrishnan and Wiliam (2003) reports similar findings. It found that streaming has different effects on different students. In general, upper stream students did not receive a substantial advantage by being streamed, mixed ability students kept performing at their previous level and lower performing students were disadvantaged.

Method

Data were collected to answer the main research question: What, if any, are the differences in student perceptions of classroom learning environments in upper and lower stream secondary mathematics classes?

Data came from a representative sample of Year 9 and Year 10 students (n = 581) in 36 different classes, taught by 28 different teachers, in seven Christian schools, covering four Australian states.

The students were from upper and lower streams of mathematics classes as well as from mixed-ability stream classes.

> ***Streaming has different effects on different students***

Students were surveyed using the *What is happening in the classroom* (WIHIC) instrument and a set of ten questions from the *Test of science related attitudes* (TOSRA), modified for mathematics classrooms. Participants responded to 56 items categorized into seven scales on the WIHIC. They were asked to respond to each item twice—once for their perception of their *current* (*actual*) mathematics classroom learning environment (MCLE), and again for their *preferred* learning environment. A sample of the questionnaire items can be seen in Table 1.

In the survey, student perceptions of classroom environment were measured on seven scales: *student cohesiveness*, *teacher support*, *involvement*, *task orientation*, *investigation*, *cooperation* and *equity*. One of the objectives of the study was to establish which of the scales most clearly differentiated lower stream students' perceptions of their learning environments from upper stream students' perceptions.

SPSS, version 11.5, was used for the data analysis.

Findings and discussion

Table 2 shows the difference in the mean scores given to each scale by students. It is clearly evident that while the upper stream students had a more positive perception of their learning environment for every scale, the scales of *teacher support* and *task orientation* are the two scales that most clearly differentiate lower stream and upper stream students' perceptions of their learning environments. The lower mean scores (ratings on the WIHC scales) indicate more positive perceptions.

Having established that upper stream students rate their classroom environment more positively than lower stream students, the differences between their *current* classroom rating and their *preferred* classroom rating was analysed by stream. This difference between *actual* and *preferred* MCLE scores on the WIHIC could be called 'student aspirations', because it measures the difference between what students perceive they currently have in class and what their ideal classroom would be.

Further, having shown there was a significant difference between the *actual* MCLE scores and the *preferred* MCLE scores across the whole sample, the same differences were measured after the groups were split for stream. Table 3 separates the data between upper stream and lower stream classes. It can be seen from the data that on every scale the upper stream is seeking greater changes than the lower stream.

On the scales of *equity*, *cooperation* and *teacher support*, the differences between the *actual* and *preferred* environments for the upper and lower stream were very small. For *investigation*, *task orientation*, *student cohesiveness* and *involvement*, the upper stream show a much greater difference between their *actual* and *preferred* MCLE than do the lower stream.

Given that the lower stream students perceived their MCLE to be of 'poorer' quality, it was perhaps unexpected they had fewer aspirations for change in their classroom environment than the upper stream. This may be indicative of an attitude of acceptance. Lower stream students felt this was where they belonged; this was what their stream was like; and what was the use of trying to 'climb' out of this?

There is an obvious need for educators to assess whether this is the best option for up to half of their students in a year level.

Upper stream students, on the other hand, rated their learning environment more highly than the lower stream. They appeared to be seeking greater change—excellence, than lower stream students. This could be interpreted as 'caring' more about their learning.

Further analysis of data—a comparison of scale means for upper and lower stream Year 9 and Year 10 students on the seven WIHIC scales (See Table 4), revealed an interesting phenomenon. It showed Year 9 students' perceptions of their learning environment become more favourable for upper stream students as they progress into Year 10, while becoming more negative for their lower stream counterparts. The research thus clearly indicates that the gap between students' perceptions of classroom environment in upper and lower streams widens significantly, as Year 9 students progress

Table 1: A sample of WIHIC questionaire items

	Actual					Preferred				
Student Cohesiveness	Almost Always	Often	Some-times	Seldom	Almost Never	Almost Always	Often	Some-times	Seldom	Almost Never
1. I make friendships among students in this class	1	2	3	4	5	1	2	3	4	5
Teacher Support	Almost Always	Often	Some-times	Seldom	Almost Never	Almost Always	Often	Some-times	Seldom	Almost Never
2. The teacher takes a personal interest in me	1	2	3	4	5	1	2	3	4	5
Involvement	Almost Always	Often	Some-times	Seldom	Almost Never	Almost Always	Often	Some-times	Seldom	Almost Never
3. I discuss ideas in class	1	2	3	4	5	1	2	3	4	5

Table 2: A comparison of upper and lower stream students' perceptions of their mathematics classroom learning environments

	Stream	Mean	Standard Deviation
Student Cohesiveness	Upper Stream	1.96	0.63
	Lower Stream	2.07	0.67
	Difference	0.11	0.04
Teacher Support	Upper Stream	2.40	0.96
	Lower Stream	2.67	0.99
	Difference	0.27	0.03
Involvement	Upper Stream	2.69	0.85
	Lower Stream	2.87	0.85
	Difference	0.18	0.00
Task Orientation	Upper Stream	2.00	0.70
	Lower Stream	2.27	0.76
	Difference	0.27	0.06
Investigation	Upper Stream	2.93	0.91
	Lower Stream	3.14	0.92
	Difference	0.21	0.01
Cooperation	Upper Stream	2.10	0.83
	Lower Stream	2.28	0.87
	Difference	0.18	0.04
Equity	Upper Stream	2.00	0.98
	Lower Stream	2.21	1.03
	Difference	0.21	0.05

Lower values on the WIHIC scales correspond to more positive perceptions

upper stream n = 265; lower stream n = 215

into Year 10.

This transition trend from Year 9 to Year 10, in classroom environment perception, is clearly illustrated in Figure 1 (upper stream) and Figure 2, (lower stream) on several WIHIC scales, especially *teacher support*, *task orientation* and *equity*.

Figure 1 shows that students in the upper stream in Year 10 are more positive about their learning on most scales of the WIHIC than their counterparts in Year 9. There has been an improvement in the perceptions they have of their learning environment between Year 9 and Year 10. (Keep in mind *lower scores* represent *more positive outcomes* on the version of the WIHIC used for this study.)

Table 3: A comparison of upper and lower stream students' differences of perceptions, between *actual* and *preferred* mathematics classroom learning environments

WIHIC Scales	Differences between *actual* and *preferred* scale mean scores for each stream (aspirations of each group		Comparisons of differences between aspirations of each group
	Upper	Lower	Upper - Lower
Student Cohesiveness	0.45	0.36	0.09**
Teacher Support	0.52	0.51	0.01**
Involvement	0.49	0.40	0.09*
Task Orientation	0.56	0.47	0.09**
Investigation	0.78	0.63	0.15*
Cooperation	0.39	0.38	0.01**
Equity	0.47	0.46	0.01

* p < 0.05; ** p < 0.01

upper stream n = 265; lower stream n = 215

Table 4: A comparison of differences between the *actual* and *preferred* forms of the WIHIC for each of the streams

	SCALE MEANS					
	Upper Stream			Lower Stream		
WIHIC Scales	Year 9	Year 10	Difference	Year 9	Year 10	Difference
Student Cohesiveness	0.45	0.45	0.45	0.45	0.45	0.45
Teacher Support	0.52	0.52	0.52	0.52	0.52	0.52
Involvement	0.49	0.49	0.49	0.49	0.49	0.49
Task Orientation	0.56	0.56	0.56	0.56	0.56	0.56
Investigation	0.78	0.78	0.78	0.78	0.78	0.78
Cooperation	0.39	0.39	0.39	0.39	0.39	0.39
Equity	0.47	0.47	0.47	0.47	0.47	0.47

Lower values correspond to more positive perceptions

* p < 0.05; ** p < 0.01; Year 9 upper: n = 118; Year 10 upper: n = 147; Year 9 lower: n = 97; Year 10 lower: n = 118

Figure 1: Comparison of Year 9 and Year 10 upper stream student scores on the WIHIC scales

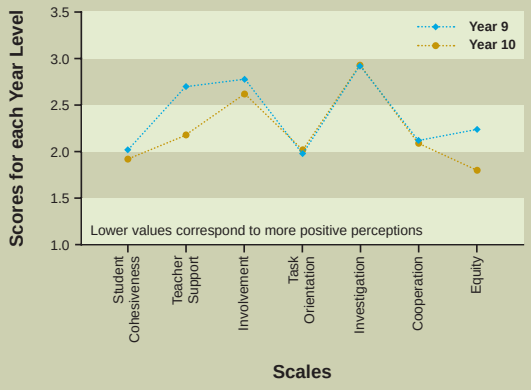
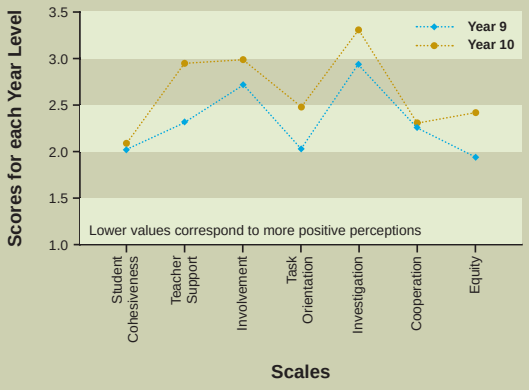


Figure 2: Comparison of Year 9 and Year 10 lower stream student scores on the WIHIC scales



Looking at Figure 2, it can be seen that the trend is in the *opposite* direction for the lower stream students. The lower stream Year 10 students have a less positive perception of their classroom learning environment on most scales of the WIHIC than do the lower stream Year 9 students.

There may be many valid reasons why Year 9 lower stream students perceive their mathematics classroom learning environments as they do. However, that they rate them even lower in Year 10, should raise alarms for educators. In contrast, upper stream students see an improvement in their learning environments as they progress from Year 9 to Year 10.

This is perhaps one of the areas where the comment "nothing succeeds like success" carries some credence (Hirsh, et al. 2002; Alden, 1987). Students who perform well at Year 9 level in the upper stream appear to become more positive in Year 10, perhaps thinking about careers requiring mathematics and looking forward to further achievement at a higher level.

Unfortunately, it appears that the converse—"nothing fails like failure"—also applies in this instance. The results indicated that lower stream students perceive their classmates as not being able to stay on task, having less enthusiastic teachers and having a poorer attitude to mathematics than those in upper stream classes. Thus, as time passes for a student, failing mathematics as a subject often becomes a learned response. Utsumi and Mendes (2000, p.241) commented on this, when they noted:

> As schooling progresses, attitudes towards mathematics become less positive, a fact that may be associated with the decrease in the understanding of the subject or of the content taught.

Conclusions and recommendations

Several major conclusions were drawn from the study.

It is clear the study of mathematics classroom learning environments can provide teachers with valuable information about the 'health' of their classroom interactions that can benefit students' learning.

The widening gap (both intra-group and inter-group) between students' perceptions of their mathematics classroom learning environment, as they progress from Year 9 to Year 10, should 'ring alarm bells' for educators. The phenomenon could help explain perceived subject irrelevance and a lack of interest in learning as exhibited by an increasing number of students in Year 10. It could also explain some challenging student behaviour management issues that occupy valuable teacher and administrator time.

The quantitative data (supported by some complementary qualitative data from small sub-groups of the study's sample population) clearly suggest a closer examination of the practice of streaming in mathematics classrooms is needed.

It is possible an educational practice that is part of the cultural fabric of Australian schools may be causing more harm than good. TEACH[R]

> ***"It is possible an educational practice that is part of the fabric of Australian schools may be causing more harm than good"***

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