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STUDENT PERCEPTIONS OF CLASSROOM ENVIRONMENTS IN STREAMED MIDDLE SECONDARY MATHEMATICS CLASSES IN AUSTRALIAN CHRISTIAN SCHOOLS

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ABSTRACT

This paper reports on a study into the perceptions students have of the learning environment in Year 9 and 10 mathematics classrooms when the classes are streamed. The sample consisted of 581 students in Years 9 and 10 in 7 different Christian independent schools across Australia. The *What is Happening in the Classroom* (WIHIC) inventory was used along with a qualitative analysis of interviews with a subset of participants. Results included: students in lower stream mathematics classes report significantly less positive perceptions of their classroom learning environments than students in upper stream mathematics classes, the areas rated most negatively by the lower stream students were in teacher support and task orientation, the areas rated most negatively by the upper stream students were in involvement and investigation, students in the upper stream often feel overworked and left behind whereas students in the lower stream are in some cases not encouraged to excel and fall into a fatalistic attitude of underachievement, even though the learning environment in upper streams was perceived by students to be more positive than lower streams, the desire for positive changes in the upper stream learning environment was more pronounced than in the lower stream. Another result of particular interest and concern was that lower stream perceptions of learning environment deteriorates from Year 9 to Year 10 whereas upper stream perceptions become more positive from Year 9 to Year 10.

INTRODUCTION

The question of whether it is a sound practice to stream students for academic ability in mathematics classes in the middle years of secondary school has been a matter of debate for many years. While there have been numerous studies which indicate that more able students achieve at a marginally higher level when placed in an 'upper stream' (e.g., Brewer, Rees & Argys, 1996; Hoffer, 1992; Venkatakrishnan & Wiliam, 2003), there has been little research done which shows the nature of the classroom learning environments in streamed classes as opposed to mixed ability classes and how this may influence the learning outcomes of the students, especially those placed in lower streams. What aspects of their learning environments do students see as causing them to feel the way they do about their mathematics classrooms?

This question is even more pertinent when one considers that in many cases Christian secondary colleges are small enough to have only two streams which means students will be placed into an upper stream or a lower stream.

The question may be asked as to why anybody would even question the practice of ability grouping, particularly when in NSW the mathematics curriculum is itself streamed, requiring middle secondary students to choose a particular level which in many cases leads logically on to specific mathematics options in the senior school. This study revealed enough data to encourage educators to reassess the practice of academic streaming in general.

If the question is asked of teachers as to why they support academic streaming in middle secondary mathematics, their standard answers are usually 'it is easier and more efficient for the teacher', 'it helps students learn to their level and feel better about themselves', it limits the amount of failure slower students may experience and feel', it has 'worked for years'.

DiMartino (2005) disputes each of these points. He believes that when the evidence of research is taken together, streaming doesn't really help anybody. He points to studies that have shown that it is not possible to place students into groups based on ability and do it equitably or accurately. The history of research in this area also shows that students do not necessarily do better when put in classes of students with like ability. He also believes that the research shows a lower self-esteem for students in lower streams. In fact he can see no positive aspects of streaming. The logical conclusion to what he is saying is that streaming is polarising, creates elitism, sets low expectations for both lower stream students and teachers, wastes time, and encourages segregation.

Hoffer's (1992) research showed that any academic gains from ability grouping are too small to be significant. Indeed placing students from a mixed ability class into an upper stream produces a weak positive net result while placing a student from a mixed ability class into a lower stream class produces a strong negative result. A study by Venkatakrishnan and Wiliam (2003) reports similar findings. While it was stated that streaming has different effects on different students, in general it was found that upper stream students did not receive a large advantage by being streamed, mixed ability students kept performing at their previous level and lower performing students were disadvantaged.

THE STUDY

This study reports on 581 Year 9 and 10 students in 36 different classes taught by 28 different teachers in 7 schools covering 4 states of Australia. All of these schools were Christian independent schools. The students were from upper and lower streams of mathematics classes as well as from mixed ability classes.

The students were surveyed using an instrument called the ‘What is Happening in this Classroom’ inventory (WIHIC). The participants were asked to respond to the 56 items categorized into 7 scales. They were asked to respond to each item twice – once for their perception of their current actual mathematics classroom learning environment, and again for their preferred classroom learning environment. A sample of questionnaire items can be seen in Table 1.

Around 5% of the students surveyed with the questionnaire were also interviewed by email and asked questions on issues that arose from the questionnaire. This was a new way to interview students, but proved to be successful perhaps because email is one of the most common ways students currently communicate. It was found that email communication eliminated some of the common roadblocks to interviewing students. These include: establishing trust, overcoming reticence, maintaining informality, avoiding assuming that children ‘know the answer’, overcoming the problems of inarticulate children, pitching the question at appropriate level, inadvertently giving non-verbal cues, avoiding children giving answers they think the interviewer wants to hear, avoiding the interviewer being seen as an authority spy or plant, keeping to the point, having students be open and honest despite peer-group pressure, or having students feel equal in importance to adults.

The seven scales of classroom environment perception that were measured in the survey were: *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.

Because of the relatively small sample size used in this study it was important to calculate Cronbach’s Alpha Reliability Coefficient for scales of the WIHIC to check for internal consistency or reliability.

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Table 1

Sample Items from the What is Happening in this Classroom Inventory Used in this Study.

Table 2 provides information for the WIHIC when used specifically with the present sample of mathematics classes. Statistics are reported for two units of the analysis, namely, the individual student’s score and the class mean score. It can be seen in the table that, as expected, the reliabilities for the class means for each scale were higher than the reliabilities for the individual student on each scale. Table 4.4 also shows that the range of Alpha Reliability figures for each of the different WIHIC scales ranged from 0.79 to 0.93 when the individual student was used as the unit of analysis and from 0.89 to 0.97 when the class mean was used as the unit of analysis. These are high reliabilities for all scales of the WIHIC when used with the present sample.

Table 3 shows the difference in the mean scores allocated to each scale by students. It can be seen clearly that while the upper stream 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 scores indicate the 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 were analysed by stream.

ACTUAL

PREFERRED

Student Cohesiveness

Almost Always

Often Some Seldom Almost times Never

Almost Always

Often Some- Seldom Almost times Never

1. I make friendships

among students in this class.

Teacher Support

9. The teacher takes a

personal interest in me.

Involvement

1

2345

1

2345

Almost

Always

Often

Some

Seldom

times Never

Almost

Almost

Always

Often

Some-

Seldom

times Never

Almost

1

2345

1

2345

Almost Always

Often Some Seldom Almost times Never

Almost Always

Often Some- Seldom Almost times Never

17. I discuss ideas in class.

1

2345

1

2345

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Table 2

Internal Consistency (Cronbach Alpha Coefficient) and Ability to Differentiate Between Classrooms for the WIHIC

Scale

Student Cohesiveness Teacher Support Involvement Task Orientation Investigation Cooperation Equity

n = 581 in 36 classes

Table 3

Unit of Analysis

Individual
Class Mean 0.92

Individual
Class Mean 0.97

Individual
Class Mean 0.89

Individual
Class Mean 0.91

Individual
Class Mean 0.93

Individual
Class Mean 0.93

Individual
Class Mean 0.97

Summary Table Showing Statistics Which Compare Streams with Actual Scales of the WHIC

0.79 0.14*

0.91 0.31*

0.84 0.13*

0.84 0.18*

0.89 0.14*

0.89 0.11*

0.93 0.25*

*p<0.001

Student Cohesiveness

Upper or Lower Upper Stream Lower Stream Difference

Upper Stream Lower Stream Difference

Upper Stream Lower Stream Difference

Upper Stream Lower Stream Difference

Upper Stream Lower Stream Difference

Upper Stream Lower Stream Difference

Upper Stream Lower Stream Difference

Mixed ability=101

Mean Std. Deviation 1.96 0.63 2.07 0.67 0.11 0.04

2.40 0.96 2.67 0.99 0.27 0.03

2.69 0.85 2.87 0.85 0.18 0

2.00 0.70 2.27 0.76 0.27 0.06

2.93 0.91 3.14 0.92 0.21 0.01

2.10 0.83 2.28 0.87 0.18 0.04

2.00 0.98 2.21 1.03 0.21 0.05

Teacher Support

Involvement

Task Orientation

Investigation

Cooperation

Equity

Upper stream n=265;

Lower steam=215;

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This difference between *actual* and *preferred* scores on the *WIHIC* can be called ‘student aspirations’ because it measures the difference between their current perceived classroom environment and their ideal classroom environment. Having established that there was a significant difference between the *actual* scores and the *preferred* scores across the whole sample, the same differences were measured after the groups were split for stream. Table 4 separates the data between upper stream and lower stream classes. It can be seen from the data that in every scale the upper stream is seeking greater changes than the lower stream. In the scales of *equity*, *cooperation* and *teacher support* the differences between the *actual* and *preferred* environments for the upper and lower stream are very small. For *investigation*, *task orientation*, *student cohesiveness* and *involvement*, the upper stream show a much greater difference between their *actual* and *preferred* classroom learning environments than do the lower stream.

Table 4
Comparison of the Differences Between the Actual and Preferred Forms of the WIHIC for Each of the Streams

WIHIC Scales	Differences between actual and preferred scale mean scores for each stream (aspirations of each group)		Comparison 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

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* $p < 0.05$, ** $p < 0.01$ Upper stream n=265 Lower steam n=215 Mixed ability n=101

It can therefore be seen that the lower stream had the least aspirations for change in their classroom environment even though they rated their environment the lowest. This is indicative of an attitude of acceptance. It appears that the students feel that this is where they belong and this is what the lower stream is like and “what is the use of trying to climb out of this?” Educators need to assess whether this is what we want for up to half of our students in a year level.

Even though upper stream students rated their learning environment more highly than the lower stream, they were in fact seeking greater change than the lower stream students. It could be said that they ‘cared’ more about their learning.

The situation became a little more concerning when analysis showed that the perceptions Year 9 students have of their learning environment becomes more favourable for upper stream students as they progress into Year 10 while becoming more negative for lower stream students. The research therefore indicates that the gap between the perceived classroom environment in upper and lower streams in Year 9 widens significantly for students as they progress into Year 10. Whatever the perceived damage being done to student perceptions of their learning environments by streaming, the gap widens over time.

To more clearly illustrate the trend of more negative perceptions of classroom environment as the students make the transition from Year 9 to Year 10, Figure 1 (upper stream) and Figure 2 (lower stream) show a widening gap between the perceptions of students in Year 9 and Year 10 for several scales of the *WIHIC*.

Remembering that lower scores represent more positive outcomes on the version of the *WIHIC* used for this study, in Figure 1 it can be seen that the upper stream in Year 10 is more positive about their learning environment on most scales of the *WIHIC* than the upper stream in Year 9. There has been an improvement in the perceptions they have of their learning environment between Year 9 and Year 10

Figure 2 demonstrates 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.

It is therefore of great concern that while for many significant reasons students in Year 9 lower stream mathematics classes rate their classroom learning environments the way they do, they rate them even lower in Year 10. To contrast this however, upper stream students see an improvement in their learning environment going from Year 9 to Year 10.

Table 5

Compares Scale Means for Upper and Lower Stream Year 9 and Year 10 Students on the Seven Scales of the WIHIC

Scale Means

Upper Stream
Year 10 Difference

1.91 0.11 2.17 0.53** 2.61 0.18 2.01 -0.02 2.93 -0.01 2.08 0.04 1.79 0.46**

Lower Stream

Student Cohesiveness Teacher Support Involvement
Task Orientation Investigation Cooperation

Equity

Year 9 2.02 2.70 2.79 1.99 2.92 2.12 2.25

Year 9 2.05 2.33 2.73 2.04 2.94 2.26 1.94

Year 10 2.09 2.95 2.98 2.47 3.30 2.30 2.44

Difference -0.04

-0.62** -0.25* -0.43** -0.36** -0.04 -0.5**

*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

3.5 3 2.5 2 1.5 1

Scales

Year 9 Year 10

Figure 1. Comparing Year 9 and Year 10 upper stream student scores on each scale of the WIHIC. Lower values correspond to more positive perceptions.

The difference in perception is perhaps one of the areas where the comment ‘nothing succeeds like success’ carries some credence (Hirsh, Kett, & Trefil, J. (eds), 2002; Alden, 1987). Students who have success at Year 9 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 is also true that ‘nothing fails like failure’. Lower stream students see lower streams as not having the same motivation or positive behaviour, are not able to stay on task, having less enthusiastic teachers and having a poorer attitude to class. These findings could point to the possibility that as the years go by for a student, failing mathematics as a subject can become a learned response. Utsumi and Mendes (2000) commented on this when they said: “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.” p. 241

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Scores for each Year Level

Student Cohesiveness Teacher Support

Involvement Task Orientation

Investigation Cooperation

Equity

3.5 3 2.5 2 1.5 1

Scales

Year 9 Year 10

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Figure 2. Comparing Year 9 and Year 10 lower stream student scores on each scale of the WIHIC. Lower values correspond to more positive perceptions.

If it were to happen that schools with traditions of streaming their mathematics classes in Year 9 and 10 decided that they wanted to revert to mixed ability classes, they would no doubt have plenty of resistance from stakeholders. The qualitative data gleaned from this research indicated that streaming in many cases is so much part of our culture, that each interested party tended to accept it as a practice – even students in lower streams.

An example of this is that a lower stream student disliked the streaming because she was afraid of feeling ‘dumb’ when in the presence of the others:

Ali: I think it would be good to have all the kids doing the same level of maths in the same class so the teacher is working with them all at the same time and can help them all on a closer level. It would also be better because everyone is doing the same work and can work through it together and this way no one has to feel stupid or dumber if they're doing a less challenging maths. (lower stream)

Trainee teachers were also asked their opinion on the benefits of streaming. The responses were interesting and reflected the fact that these people had come from upper streams themselves and feared being placed as a teacher in lower streams. There is a real risk that stereotyping of streamed mathematics classes is self-perpetuating. An example of a comment from a trainee teacher was:

Higher stream kids want to ‘give it a go’ while lower stream kids want to ‘muck around’

Practising teachers also spoke in favour of streaming for various reasons. Some were thinking of their own workload and classroom management while others were thinking about how they would get through the prescribed content. They were all practical issues:

Teacher 1: We have often wondered about what damage we may be doing with streaming but the parents want it and it is a way we can get the kids ready for Year 11 and 12 where they would stream themselves anyway by choice of subjects.

Teacher 2: I just can't see any other way around it. There is content to cover and this is the most efficient way of doing it.

Even parents couldn't see the real issues with streaming – even if their child was in a lower stream:

Scores for each Year Level

Student Cohesiveness Teacher Support

Involvement Task Orientation

Investigation Cooperation

Equity

Students that are brighter can go ahead while the others stay behind. They need the open space to be able to develop at their own speed without being slowed down by other children. The slower children in maths need extra help and care which they can be given at their own speed. It's frustrating for a teacher to do both ends of the scale at once, and tiring. All round it's better for everybody, behaviour in the class would be a great deal better.

CONCLUSIONS

The study of learning environments is a very interesting field and can provide practising teachers with valuable information about the health of their classroom interactions. The research discussed in this paper shows that the quantitative data (information collected by a survey instrument) was validated by the qualitative (information collected by interviews) data. Collecting this information left no doubt in the mind of the researcher that in the large majority of cases academic streaming in mathematics is part of the academic and social fabric of private school life in Australia. Perhaps it is ingrained into students, trainee teachers, teachers and parents. Each of these stakeholders rarely sees the issues involved with streaming, but if they do they accept it as 'just what happens'.

Apart from the significant findings already discussed, differentiation was also able to be made between the classroom environment perceptions of girls as opposed to boys. It was also valuable to be able to track the connection between the students' attitude to mathematics as a subject and their perception of their learning environment.

Should schools consider de-streaming their mathematics classes? Certainly this should not happen without plenty of consideration. Should skilled, qualified and motivated teachers be on hand to teach mixed ability classes where peer support for students and parallel programs need to be used in a setting of group work and investigations. It is possible that mixed ability classes could put students in a worse position than streaming if it is not thought out carefully.

How does a school make the best out of a streaming situation? It is about changing the culture of the mathematics department. A good place to start is by putting those teachers recognized as the more motivating practitioners with the lower stream classes

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