

## Working Group on Social Research in Mathematics Education

(Convenors: Peter Gates and Tony Cotton, Nottingham University)

This was the third meeting of the group and it had been decided at the previous meeting in London to focus part of the discussion on the paper presented to BERA ~ Jo Boaler titled "Setting, Social Class and the Survival of the Quickest"<sup>1</sup>. In fact this paper provided the stimulus for a discussion that took all of the session. Attention focussed particularly on several extracts from the paper. These are collected in an appendix to this report.

As might be expected, the discussion was wide-ranging, but the following brief notes indicate some of the major points raised:

- The paper exploded the myth that pupils do better by setting and that pupils prefer setted situation.
- There seems to be a claim that setting makes it 'easier to teach'. However this is a problematic argument. If we accept that it does make it easier, then this is at the expense of other more significant losses.
- What the setting argument overlooks is the adoption of varied classroom strategies.
- There is considerable disaffection from employers about the current state of affairs in education - the current state of affairs in mathematics education is one in which setting is the norm.
- There are a range of ideologies around which support or reject some of the assumptions underpinning setting and it is likely to be these ideologies which affect classroom organisation rather than any objective examination or investigation.
- In many schools maths is the only (or at least one of the few) subjects which set. This raises questions about the nature - or perceived - nature and the status of mathematics in the institution and the society at large.
- What is different about mathematics is its use in bringing about social differentiation and it defining the class of intelligent individuals.
- Setting is nothing to do with ability, but is about conformity and surveillance. It is also about encouraging and legitimising a divisive competition in society.
- There are a number of 'naturalising ideas' which need to be challenged, such as 'ability exists', 'pupils can be easily discriminated by ability'.
- A question for us is 'how can research in mathematics education serve to challenge some of the current 'common sense' ideas.

<sup>1</sup> We are particularly grateful to Jo for allowing us to circulate and use her paper for this session. All members of the Working Group either had access to the paper and the choice of the above extracts was entirely that of the convenors.

## Focus for the future

We took cognisance of one of Marx and Engels' Thesis on Feuerbach, that hitherto philosophers have merely interpreted the world, but that the point however is to change it. Hence we considered what we could do to influence matters.

In the short term we agreed to the following:

- Providing a forum for discussion was useful and encouraging to us.
- The name of the Working Group would change to "Mathematics Education and Society".
- We would look to putting together an occasional paper / journal of short articles and at the next meeting we could look at some data and/ or begin a collaborative editing of articles for the publication.

## Coda

There is a mailing list for those interested in being kept informed of the group, and articles are invited to form the informal publication. For either of these contacts the convenors: peter .gates@nottingham.ac. uk or tony .cotton@nottingham.ac.uk. Discussion on relevant issues can be carried out on the mathematics education email discussion list. (subscribe by sending the message <subscribe> to maths-education-request@nottingham.ac.uk) There will be a dedicated email discussion list set up under the title meas@nottingham.ac.uk. Details of this can be obtained from Peter Gates or Tony Cotton.

Since this meeting, the circulation list has increased to 30 and is growing.

## References

Boaler, Jo (1997) "Setting, Social Class and the Survival of the Quickest" to appear in *British Educational Research Journal*

Appendix - Extracts from:

Setting, Social Class and Survival of the Quickest

Jo Boaler, King's College London

to appear in *British Educational Research Journal* (1997)

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Abstract

This paper reports upon a study that examined the ways in which setting and mixed ability teaching affected the motivation and achievement of students over a three year period. A variety of qualitative and quantitative methods were used to investigate the experiences of students learning mathematics in two schools, one of which taught to setted groups the other to mixed ability groups. This showed that setting diminished achievement for many students. This was partly because students of a similar 'ability', assessed via some test of performance, did not work at the same pace, respond in the same way to pressure or have similar preferences for ways of working and students who deviated from the expected model for their set were disadvantaged. This disadvantage particularly affected students who were female or working class.

I: Introduction

The question of whether students should be grouped and taught in classes according to their perceived 'ability' during their school careers is one of the most controversial issues in education. This is partly because the issues that surround setting, streaming and mixed ability teaching are relative, both to ideology and personal values. Decisions about student grouping are also of immense importance to the education of students and this importance extends beyond the development of subject understanding. In the UK moves from streaming to setting to mixed ability teaching and back again to setting can be related directly to developments in research, educational theory and the political agenda of the time. In this paper I will present a brief overview of the theoretical and historical developments which surround student grouping, I will then aim to extend theoretical positions further by examining the way in which setting and mixed ability teaching influenced the motivations, perceptions and eventual attainment of students in two schools.

[ ... ]

II: The Research Study

(i) Research Methods

The issues reported in this paper emerged as part of wider, ethnographic (Eisenhart, 1988) case studies of two schools. The aim of the studies was to monitor the learning of students who experienced 'traditional' and 'progressive' approaches to the teaching of mathematics. Particular attention was paid to the influence of the students' teaching approach upon the degree to which students could use mathematics in new, unusual or out-of-school situations (see Boaler, 1996, 1997a & 1997b). The research

involved a longitudinal study of a year group of students in each of two schools as they moved from year 9 to year 11. In one of the schools there were approximately 200 students in the year group, in the other school there were approximately 110. A variety of qualitative and quantitative methods were employed in the study. In order to learn about the students' day-to-day experiences of mathematics I observed approximately one-hundred lessons in each school, interviewed approximately forty students in each school, and gave questionnaires to all of the case study students each year. I also performed a number of secondary analyses such as recording time-on-task and eliciting constructs (Fransella, 1978) from teachers. To learn about the students' developing understanding of mathematics I performed a wide range of assessments of the students and analysed their school-based assessments and their GCSE performance. All of the qualitative and quantitative methods were used to inform each other in a continual process of comparison and re-analysis. Interviews and fieldnotes were analysed using open coding (Strauss, 1987) and observation data were collected and analysed using a grounded theory approach (Glaser & Strauss, 1967). Extensive use of triangulated data was made in the formation of emergent theories. As the study developed I used progressive focusing to form and shape new research ideas, in response to events occurring in the field. Setting was not an initial focus of the research study but it quickly emerged as a major and significant factor for the students; one that influenced their ideas, their responses to mathematics and their eventual achievement.

In year 11 twenty-four students from each school were interviewed about mathematics lessons and the qualitative analysis that forms the first part of this paper draws heavily upon the students' perceptions about setting which were reported in these interviews. The students were not specifically interviewed about setting and the twenty-four students were chosen because they held a range of positive and negative views about mathematics lessons.

#### (i) The Students Responses to setting

At an early stage of my case study at Amber Hill I became aware that certain features of the students' mathematical experiences were causing some students to become disaffected about mathematics and, subsequently, underachieve. A number of these features were intrinsically linked to the setted nature of their learning environments. I have grouped the complaints of the students which relate to setting, into 4 main areas which, inevitably, overlap in places. I will now discuss each of these areas in turn, starting with the one that seemed to have the most impact upon the largest number of students.

[ ... ]

#### ill Research Results

##### *Working at a fixed pace*

Probably the main reason that teachers place students into sets in mathematics is so that they can reduce the spread of 'ability' within the class, enabling them to teach mathematical methods and procedures to the entire group, as a unit. Mathematics departments that use class teaching tend therefore to put students into setted groups, whilst mathematics departments that use individualised schemes generally teach to mixed ability groups. This link between classroom pedagogy and classroom grouping is not inevitable, but it is the prevalent model in the UK. Hence OFSTED reports that

show that 94% of secondary schools use setting for mathematics in the upper years, fit with their reports that the majority of these lessons involve students listening to the teacher and then working through exercises. In this analysis I have therefore linked working at a fixed pace with setting, because these two features tend to go hand-in-hand in the majority of UK mathematics classrooms:

[ ... ]

Tomlinson (1987) provides evidence that the behaviour of students can influence the examination groups which they are put into and some of the Amber Hill students were convinced that their behaviour, rather than their ability, had determined their mathematics set, which in turn, had partly determined their examination grade.

[...]

#### IV Discussion and Conclusion

At Phoenix Park school the students experienced a great deal of freedom to work when they wanted to work and talk or wander about when they did not. The students were grouped in mixed ability classes, the high ability students were not placed in high sets that would "push" them, the low ability students were not placed in sets in which teachers could "concentrate upon their individual needs". At the end of three years of this relaxed and open approach the students who did well were those of a high ability. Students who did exceptionally well, compared to their entry scores were mainly working class students, those who did exceptionally badly were both working class and middle class students.

In all of these respects Amber Hill differed from Phoenix Park and although ability grouping was not the main focus of my research study, there were a number of clear indications from various forms of data, that at Amber Hill:

- social class had influenced setting decisions resulting in disproportionate numbers of working class students to be allocated to low sets
- significant numbers of students experienced difficulties working at the pace of the class resulting in disaffection and reported under achievement
- students became disillusioned and demotivated by the limits placed upon their achievement within their sets
- some students responded badly to the pressure and competition of setted lessons, particularly girls and students in top sets (Boaler, 1997a).

For a student, being able and hard working at Amber Hill was not a guarantee of success within their setted classrooms. Indeed the students indicated that success depended more upon working quickly, adapting to the norms for the class and thriving upon competition than anything else. A number of different results from this study cast doubt upon some wide-spread beliefs about setted teaching. For example, there was no qualitative or quantitative evidence that setting raised achievement, but there was evidence that setting diminished achievement for some students. A comparison of the most able students at the two schools showed that the students achieved more in the mixed ability classes of Phoenix Park than the high sets of Amber Hill (at Phoenix Park 3% of the year group attained A \* / A grades, compared with 0.5% of the Amber Hill year group). This may be related to a number of features

of the two schools' approaches, but there were many indications from the top set students at Amber Hill that features of their top set learning had diminished their achievement (reported in Boaler, 1997a). The various forms of data also seem to expose an important fallacy upon which many setting decisions are based. Students of a similar 'ability', assessed via some test of performance, will not necessarily work at the same pace, respond in the same way to pressure or have similar preferences for ways of working. Grouping students according to ability and then teaching towards an imaginary model student who works in a certain way at a certain pace, will almost certainly disadvantage students who deviate from the ideal model. The stress and anxiety reported by the students in interviews at Amber Hill is probably an indication of this phenomenon. There was much evidence that the students who were disadvantaged by this system were predominantly working class, female or very able. The class polarisation that existed within the setted system of Amber Hill and that was completely absent at Phoenix Park is consistent with the results of other research studies that have considered the links between setting and class bias (Abraham, 1995; Tomlinson, 1987; Ball, 1981; Lacey, 1970; Hargreaves, 1967). A common feature that links all of the findings of this study concerns the individual nature of students' responses to setting. Students at Amber Hill responded to setting in a variety of different ways indicating that it is too simplistic to regard the effects of setting as universally good or bad for all students, even students in the same set. The various quantitative studies that have compared the group scores of setted and mixed ability classes overlook this fact and, in doing so, overlook the complexity of the learning process for different individuals.

The results reported in this paper are based upon a case study of two schools and the reports given in the first part of the paper come from a sample of only 24 students in one of the schools. It would not be sensible therefore to make hard and fast claims about the generalisability of this data. However, the students interviewed at Amber Hill were clear that their achievement had been diminished because of factors that related to setting and class teaching and it would seem unwise to dismiss the students' reported experiences or to assume that they were unique to Amber Hill school. If future research studies are to investigate the prevalence of negative responses to setted teaching it seems likely that conversations with students will be the most informative means of communication, particularly as these have been lacking in existing research studies that have considered the effectiveness of different student groupings.

To conclude, 'survival of the quickest' is probably not the most accurate way to describe the experiences of setted students, for this research has indicated that it was the students who were most able to adapt to the demands of their set who were most advantaged, or least disadvantaged by setting. In predicting who those students may be, it seems fair to assume that if a student is middle class, confident, thrives on competition and pressure and is motivated, regardless of limits on achievement, they will do well in a setted system. For the rest of the students success will probably depend upon their ability to adapt to a model of learning and a pace of working which is not the most appropriate for their development of understanding.

The consequences of setting and streaming decisions are great. Indeed, the set or stream that students are placed into, at a very young age, will almost certainly dictate the opportunities they receive for the rest of their lives. It is now widely acknowledged in educational and psychological research that students do not have a fixed 'ability' that it is determinable at an early age. However the placing of students in academic groups often results in the fixing of their potential achievement. Sla vin (1990) makes an important point in his analysis of research in this area. He notes that

as mixed ability teaching is known to reduce the chances of discrimination, the burden of proof that ability grouping is preferable must lie with those who claim that it raises achievement. Despite the wide range of research studies in this area, this proof has not been forthcoming.