Equity and Empowerment in Mathematics: Some Tensions From the Secondary Classroom

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This paper draws on a study of the mathematics departments of two London secondary schools, and explores some of the ways in which the classroom environment impacts on students' learning of maths. In particular, it looks at the ways in which one school's efforts to promote equity had some unwanted side effects in terms of limiting the possibilities for students to take responsibility for their own learning. This is set against the very much 'freer' environment in another school, where the opportunities for students went hand in hand with greater inequalities. While resisting a straightforward comparison between the schools, the idea of a 'trade-off' is used to illuminate some of the issues that arose in the two settings. Some suggestions are made for ways to capture some of the best of both schools, but it is argued that there is no panacea, and that ultimately, decisions about how to structure learning must be allowed to reflect the values of the teachers concerned.

At last year's MERGA conference I presented a paper in which I discussed some of the implications for students of being grouped according to their ability (Bartholomew, 2003). The paper highlighted some of the ways in which the hierarchical structures in place in schools serve to limit the range of possible student identities available to individuals, thereby entrenching differences between different groups of learners. This was related to policy initiatives which set schools up in competition with each other, with the result that different students have very different 'value' to schools.

The study on which the paper was based was an investigation of the mathematics departments of two secondary schools in London, England. The study, focusing on the ways in which individuals are positioned (and position themselves) in mathematics lessons, and the implications this has for their experiences of the subject. Differences between the two schools meant that very different issues were brought to the fore in the two settings, and the paper was concerned with the experiences of students at the school I named Springfield.

In this paper I return to the same study, but this time discuss both schools and focus in particular on the school I named South Park. At South Park, teachers had resisted many of the pressures associated with the marketisation of education; the school saw itself as serving its local community, and by comparison with Springfield (and many other schools in the UK) took a very low key approach to marketing and image management. Students in all years were taught in mixed ability groups for mathematics despite considerable pressure to 'set' students. The school's caring ethos was immediately apparent to me as a visitor to the school, and in maths classrooms the atmosphere was supportive and co-operative to a degree unimaginable at Springfield; the kinds of issues raised in relation to Springfield (ibid) simply did not arise here.

This is not to say, however, that maths lessons at South Park were entirely unproblematic, and although teachers here had experienced very real success in mitigating many of the inequities evident at Springfield, their approach brought with it its own drawbacks. While I want to resist setting up a straightforward comparative model between the two schools, which differ in many subtle and complex ways that cannot be reduced to a set of variables, it is interesting to consider them in parallel. Working in both schools gave

me a better understanding of each of them, as well as bringing some more general issues into sharper focus. While carrying out the fieldwork for this study I repeatedly found that after a spell in one school I stopped believing that the other could really be so different. Spending time in either setting tended to normalise it, and by working in both I was able to make strange the everyday practices that made each school what it was.

The paper begins with a discussion of maths lessons at the two schools, and highlights some key respects in which they differ. I then focus on South Park, and discuss some of the implications for students' mathematics learning of the school's approach.

Maths Lessons at Springfield and South Park Schools

Recent years have seen a growing interest in the ways in which the classroom environment affects learning. Where psychological models focusing on individual cognitive processes previously dominated, researchers in mathematics education increasingly recognise the social elements to learning (Lerman, 2000). One strand of work in this tradition is that which focuses on classroom cultures, and it has been argued that the specific demands that teachers make on students serve to define the tasks set and affect the ways in which they engage with the subject (Corno, 1988). For example, Doyle suggests that "teachers affect tasks, and thus students' learning, by defining and structuring the work students do, that is, by setting specifications for products and explaining the processes that can be used to accomplish the work" (Doyle, 1988). My aim here is to paint a picture of maths lessons at Springfield and South Park schools which draws attention to differences in classroom culture of the kind that Doyle describes, and to illustrate some of the implications for students' learning at the two schools.

First Impressions

At both Springfield and South Park Schools members of the maths department are enthusiastic teachers with a strong commitment to the SMILE scheme, an individualised mathematics programme with an emphasis on problem solving and investigational activities and the main teaching resource in both schools. Maths is a popular subject with students and my own feeling is that maths is well taught at both schools. Yet the departments differ in many important respects, and associated with the particularities of each setting are a range of problems and benefits.

When I began visiting the schools the first impressions I formed of maths lessons were very different. Lessons at South Park are characterised by their calmness, and by the extent to which students can and do 'get on' with the minimum of direction. The head of maths, Gillian Brown's, lessons are particularly striking in this respect; the following account, which relates to my second visit to the school, captures something of the atmosphere in her lessons:

> We (Gillian and I) arrived a few minutes after the pips, and when we came into the classroom students were already in the room and quiet. Most were in their seats and several were working. Gillian said, "Seats then" and almost immediately everyone was sitting in silence ready for the register to be taken. After the register Gillian gave the class a few quick reminders, and then told them to start work.
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> Ten minutes later, and with no further direction from Gillian, 3 students were working at a computer, 2 were standing with a tape measure and measuring each other, 2 were at the filing cabinets looking for work and everyone else was working quietly, mainly individually but occasionally discussing their work with a neighbour. Gillian was moving round the room offering help and advice to individuals and groups. 7B, South Park

At Springfield the fact that students are taught in ability groups means that different classes have very different characteristics, but lessons here are almost always much 'livelier' than lessons at South Park. Students arrive more noisily to lessons and continue chatting amongst themselves until the teacher addresses the class. It is not uncommon for teachers to spend several minutes at the beginning of a lesson settling the class. During lessons, noise levels that would be quite unacceptable to most teachers at South Park are typical. While these differences are superficial they provide a useful basis for a discussion of some more fundamental differences in approach that I wish to discuss in this paper.

Routines and Regulation

At South Park considerable time and energy is devoted to developing a supportive environment in which students are able to work cooperatively with each other and no one is allowed to dominate in lessons. This is largely achieved through a number of routines and structures that operate in lessons, so for example, when students here want help with some work that they are doing, the rule is that they have to write their name in a 'help book' at the front of the room. This ensures that students get seen in the correct order, that help-seeking is made less public, and that teachers can monitor the amount of help that students ask for. It also contributes to the calmness and smooth running of the classroom, but this was not the initial motivation for introducing the system. Similarly, a seating plan, changed every half term, ensures that all students work with a wide range of their classmates.

A feature of the instructions that teachers give at South Park is that they provide ground rules that are applicable in the longer term. For example, I rarely heard teachers here speak to a whole class about the fact that there is too much general, background noise. Instead they consistently pick up on individual infringements of particular 'rules', so for example, I have heard a teacher tell a student not to 'talk across tables', even though she was not contributing noticeably to the general noise level in the room, or, in the midst of lots of lively noise, ask the class, "Who's talking about what they saw on television last night?" Although these remarks, and many others like them, were very specific, and often only directed at one person, they clearly refer to long term and general expectations, and convey a very clear message to students about what will and will not be acceptable in future maths lessons. At Springfield general appeals to the whole class when it was considered that the room is getting too noisy, are much more usual, and teachers do not use these requests as opportunities to set down guidelines for the longer term in the same way.

At Springfield more is left to chance, and this means that individual students have greater freedom to decide for themselves how they will behave in lessons. The example of how students go about getting help in lessons offers some insights into the implications of this difference. While at South Park the system is well understood by all, and rigidly applied, at Springfield there is no system. My own impression as a visitor to the two schools was that lessons ran much more smoothly in this respect at South Park than at Springfield, yet when I asked students at the two schools about getting help in lessons, those at South Park reported greater dissatisfaction, with more of them saying that they couldn't get help quickly. At South Park many students are frustrated by the greater restrictions in lessons, and they are relatively helpless to take steps to further their own learning. This was further highlighted for me when I realised that, while at Springfield it was not uncommon for a student to stop me or their teacher as we passed, to ask a quick question or share a new discovery, such interactions are outlawed at South Park, where the only way that a student can initiate a discussion with their teacher is through the help book.

The Learning Environment

At both schools teachers sometimes broke from the SMILE scheme in order for some class activity, and it is interesting to consider two lessons, which appear on the surface to be very similar, in the light of the discussion above. In one of Gillian's lessons with 7B students were working in groups on 'probability packs'. Before they began Gillian spent a long time discussing the sorts of things they should be doing during the lesson. It was explained that effective group work should save time, and that in order to work as efficiently as possible, each group would first need to plan what they were going to do. While students were working in their groups Gillian moved from table to table, looking at what students were doing and suggesting how they might change the ways they were working. For example, students on one table had been asked to find the likelihood of getting certain combinations when they tossed 4 coins, and had been tossing a coin each simultaneously, repeating the experiment if one went on the floor, and recording their results slowly and unsystematically. Gillian spent a long time with them, suggesting that they ought instead to split themselves into two groups, each taking a different part of the experiment to test (different numbers of coins), with one person tossing the coins and the other recording the results—"I want to see you all working, not just sitting around tossing a coin every so often, that's not working". She had similar conversations with each group.

At about the same time as this lesson, I saw a year seven lesson with 7A at Springfield. Here too they had been given a task at the beginning of the lesson, and while they were working in groups the teacher, in this case Susan Robinson, spent most of her time moving between the groups giving advice and help. Despite these similarities, the differences in the ways the two teachers managed these lessons meant that the students at Springfield were engaged in a very different activity from those at South Park. In this case students were collecting survey data on each other, with each group researching a different topic (which they had chosen themselves)—religion, music, hobbies, newspapers etc:

> This involved much noisy chatting and clambering about the cramped classroom, and also only really provided a job for one member of each group—and Susan tried to encourage one person only to do it, though there was nothing for the others to be working on until the data had been collected. Daniel was collecting the data for his group (4 people in total) and at one point returned to the table and said, "hobbies is too wide-ranging. It's just too wide-ranging", explaining that he was being given all sorts of answers, "ranging from rifle-shooting to horse-riding to collecting medieval weapons - people are just saying anything" After a discussion, in which he was doing most of the talking, he went off to question some more people.
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> The lesson continued in this way—throughout there was a lot of noise, a lot of moving round the classroom and always a number of people talking amongst themselves or sitting quietly doing nothing. Two or three times during the course of the lesson Susan, who was mostly walking round answering questions, and looking at what people were doing, stopped the class and requested that only one person from each group ask the questions. She clearly felt the lesson was getting out of hand, and at one point asked that everyone return to their seats, saying 'you've collected enough data now, sit down'.
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> After this the class did sit in their seats for a while and many began analysing their data (working out percentages and drawing pie charts), but all but one group had not finished collecting data, and after a while some resumed this. I think that Susan had no intention of stopping the data collection completely, but she wanted the class to calm down, move about less etc. and so outlawed collecting any more data. At the end of the lesson Susan spoke to the whole class, saying that there had been many interesting points discovered, and inviting groups to share them with the class.
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> 7A, Springfield

Susan's concerns in this lesson were very different from Gillian's in the lesson referred to above. Gillian's directions to her class related to many different aspects of the working environment, and her discussions with groups of pupils as they worked were as likely to be about the way in which they were approaching the activity as the mathematics involved. The lesson included many of the features that are characteristic of Gillian's lessons, and those of other teachers at South Park, and illustrates the extent to which she is concerned with the ways in which students are occupied at all times. The high degree of regulation in this lesson compared to the Springfield lesson is related to the fact that it was not only students' behaviour, but also their *learning*, that was being regulated.

The scope of the directions that Susan gave to her class was much narrower, and apart from maintaining an acceptable level of order in the room, she made few attempts to impose her own views about how students should carry out the task; the instruction that students return to their seats and collect no more data was a response to the noise level and general disorder in the room, and was successful in reducing these, but once the class had calmed down Susan did not insist that they follow it. This was familiar to me from some of the lessons I had seen the previous year; Susan sometimes began lessons by informing students that no talking would be allowed at all, unless she gave particular students permission during the course of the lesson to talk quietly about maths, but would never repeat this during the lesson, and clearly didn't really expect (or want) a silent class. It is as if she issues instructions of this kind in the hope that students will bend the rules just enough to achieve the desired effect.

These differences between the two lessons had important implications for the experiences of the students involved. The activity with which students at South Park were engaged was that of completing the task set in a way that would satisfy Gillian, and Gillian's interactions with students focused on this more than on the mathematics. At Springfield, students were free to perform the task set in any way they wanted (with certain provisos—the class mustn't be *too* noisy), and this resulted in greater diversity in the activities taking place in the lesson. For some, this freedom led them to take control of the activity in a very real way, for example by re-defining the question in the light of problems encountered; others spent most of the lesson talking amongst themselves and doing very little.

The South Park Experience

One implication of the degree of regulation of students at South Park, and something that emerged as an important theme in the interviews with students that I conducted here, is that students are relatively powerless to take control of their own learning. At South Park teachers work hard at developing a good working environment in their classrooms, and think a great deal about their students' learning, but students have few opportunities to reflect on this for themselves and to take responsibility for their own work. Their learning is 'organised' for them by means of the rules and routines discussed above and students' input is minimal. In maths lessons they jump through the hoops, but for some the activities have little meaning:

> I just don't feel comfortable with having the cards, and then just doing the questions on the card and then you move onto another card. And then another card. And so it just feels like you have to get it all out of the way rather than take it in. Do you know what I mean?
>
> Alison, group 4, South Park

Ostensibly this criticism relates to general aspects of the SMILE scheme, and as such might be expected to apply equally to all SMILE schools. However, although some students at Springfield did make comments of this sort there were important differences between the ways in which students at South Park and those at Springfield regarded the scheme. In maths lessons at South Park, learning must take place within a tightly defined framework, and it is students' compliance with the department's 'rules' that comes under the closest scrutiny in lessons. The assumption is that if students work through the cards they have been set in accordance with the procedures that have been laid down by their teachers, then learning will follow, and in this way the focus is shifted away from the mathematics and onto the mechanics of the system. All cards must be treated similarly, and a consequence is that students are likely to see all cards as equally important. Students here are more frustrated than students at Springfield by cards that they perceive as pointless because, with greater freedom to make decisions about their learning, Springfield students can concentrate on those cards they consider most useful:

R If I don't think I'm going to get anything out of [a card]—if I don't think it's going to be any good to me in the long run—then I'll just ask someone else if they know the answer, or know how to do it, and they'll explain it to me. Whereas if it's like—if I can see that there's a method behind it, and I'm going to need to know it in the future, then I'll go up and ask the teacher and I'll get it explained properly, make sure I get a grip on it before I go.

HB So you make some judgement about how useful the card is?

R Yeah

HB And decide how seriously you'll take it?

R Yeah (laughs)

Rhiannon, set 1, Springfield

In deciding how much time to spend on a particular card, Rhiannon thinks not just about the demands of the card itself, but considers whether "it's going to be any good to me in the long run". She appears to see completing SMILE cards as a means to an end—namely, furthering her own understanding of mathematics—rather than an end in itself. In order to decide how useful a card is likely to be she must draw on some sense of the wider subject that is independent of the cards she has been set, and think about how the card in question relates to what she already knows. At South Park, students' freedom to transcend the student role as defined by the teacher is much more limited, making it difficult for students to take responsibility for their own learning in this way. Alison, the student whose interview I quoted from above, was frustrated that, for her, completing the cards *had* become an end in itself, and her comments echo Schoenfeld's observation that in many 'traditional' maths classrooms "learning is an incidental by-product to 'getting the work done'" (Schoenfeld, 1988).

This parallel with traditional maths teaching is somewhat paradoxical, given the school's rejection of such an approach. At South Park, teaching students in mixed ability classes, using a scheme that includes many open-ended activities and incorporating lots of group work are all in response to the problems teachers here perceive with class teaching from a textbook. Yet in many of the comments that students made, I heard echoes of some of the criticisms that have been made of this type of teaching. In most schools, teachers employ a variety of strategies to help students, but typically these involve breaking questions down and emphasising the algorithmic nature of the method they are expected to use. Boaler's work shows that, far from making it easier for students, this tendency to fragment the curriculum denies students access to real understanding and limits their

ability to apply what they have learnt (Boaler, 1997). At South Park teachers try to make maths 'safe' for students by relying on a range of structures to ensure fairness, minimise differences between students and create a supportive working environment. In both cases, the feeling, that students reported, that they don't really understand maths stems in part from the fact that their teachers are operating within a framework in which maths is understood as difficult and inaccessible to many, and that their job is to make it less difficult. The result in both settings is that students' attention is, at least in part, focused on completing their work according to some set of rules, and this limits the opportunity for students to 'stand back' and reflect on what they are learning. At South Park, cards need to be *done* but it is not always clear what they are *about* and this too leads to the fragmentation of the curriculum into individual cards that cannot easily be related to one another:

> You can't see what the card is about in its appropriate context. You can't see how it's connected to other things. E.g. you can do a card all about mappings but you don't see that it has anything to do with any other kind of maths.
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> Vanessa, group 1, South Park

Conclusion

In considering the issues that have been raised here, it appears that in some sense teachers at Springfield have 'traded' a calm and supportive environment, in which students are equally valued and treated very fairly, for one in which (some) individuals have real opportunities to take control of their learning. In thinking about how South Park could retain the incredibly equitable and supportive learning environment it achieves whilst introducing opportunities for students to take greater responsibility for their own learning, it seems to me that one way forward would be to work to develop a social justice ethic in students, whereby some of the responsibility for the creation of an equitable working environment is explicitly handed over to them.

Rather than attempt to make maths 'safe' for students, 'levelling the playing field' by devolving learning to participation in classroom norms, a more empowering model might be to return the focus to the mathematics, and work towards developing a classroom environment in which it is safe to think aloud, challenge each others' ideas and make mistakes. Such a move would be in line with a shift from a progressive educator model, towards the social change ideology of the public educators, in which the aim of mathematics education is to empower individuals "to be confident solvers and posers of mathematical problems embedded in social contexts" (Ernest, 1991).

In fact, South Park did change over the three years that I was conducting my fieldwork there, but not in this direction. The increasing dominance of market values, and the emphasis placed on league tables led teachers here to 'set' older students for maths, and introduce a more systematic approach to exam preparation—changes which represented a move towards the traditional approach to which teachers here are fundamentally opposed. The result was that teachers became less committed to what they were doing and, in my view, lessons were impoverished. One thing that my time at Springfield and South Park schools taught me is that there is no panacea and teachers are best at doing what they believe in. It seems to me that there could be very great value in encouraging teachers to critically reflect on the implications of their practice, with the aim of fostering an awareness of issues such as those raised in this paper and a spirit of experimentation. The tendency in recent years to de-professionalise teachers and impose models of 'effective

practice' (whether through the discipline of the market, inspection regimes or such initiatives as numeracy strategies) runs counter to this aim.

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