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INTRODUCTION

Current practices in the teaching of mathematics in secondary schools in the UK do not promote attainment for all. Commenting on national public examination results, a recent report from the Joseph Rowntree Foundation finds that 'as so often, all seemed not too far from well at the top, but stubborn problems remained at the bottom' (Cassen and Kingdon, 2007: i). Despite the fact that attainment (as measured by public examinations) has risen in recent years, 'England ranks internationally among the countries with relatively high average educational achievement but also high inequality in achievement' (1). The report shows that low achievement correlates significantly with indictors of disadvantage and thus it is the case that 'underachievement is a social justice issue' (Watson, 2011: 151).

The interplay between setting by previous attainment and "ability thinking" is discussed elsewhere in this volume in the chapter *Ability thinking*. There it is argued that setting practices and the "ability thinking" on which such practices are based suppress the achievement of those whose current levels of attainment do not earn them a place in the top set, creating the notorious long tail of underachievement whilst not enhancing the attainment of those at the "top". Thus the most significant way to begin working towards high attainment for all is to tackle these two interconnected "common sense" notions: that ability is a given, fixed characteristic inhering in individuals and that grouping learners on the basis of previous attainment raises achievement. Re-organising mathematics classes into all attainment groups, however, is, firstly, not on its own enough (Hart et al, 2004); and, secondly, is not within your gift as an individual teacher. In addition, many mathematics teachers in the UK who accept the desirability of all attainment teaching feel themselves ill prepared for the different pedagogical demands that they judge will be required. This is not surprising. As Susan Hart has noted, 'the search for pedagogical possibilities only *begins* once we have freed ourselves from deterministic notions about existing patterns and limits of human achievement' (original emphasis, Hart, 1998: 160). Here, drawing on a substantial body of existing research, are set out some of those pedagogical possibilities which are designed to promote attainment for *all* learners of mathematics.

The notion of pedagogy employed here encompasses classroom practices; classroom relationships; philosophical understandings of the nature of mathematics; and ethical judgements about the purposes in teaching and learning mathematics. Pedagogical stances generate and are generated by the culture of the classroom, in itself dependent upon teachers' attitudes, conceptions, beliefs, views of the world and, perhaps most importantly, their values.

I begin by rehearsing briefly what is known about the ways in which current practices are known to damage and alienate learners (including those in setted classes). From the work of Guy Claxton, I derive a framework for a pedagogy for attainment for all, drawing on four case studies from existing research to elaborate that framework. I conclude by considering the notion of 'transformability'.

WHAT DOESN'T WORK THAT WE CURRENTLY DO?

We know a great deal about what *doesn't* work - what doesn't work in terms of motivation and engagement and what doesn't work in terms of pupil learning, both damaging to attainment. In England, Ofsted recently reported that much - most - mathematics teaching is geared towards producing enhanced pupil test scores and this leads to a high level of fragmentation in the mathematics presented with procedural approaches to the fore. It is known that such a pedagogy does not create learners who can think mathematically; it also leads to alienation, demotivation and disengagement (Nardi and Steward, 2003). In an extended case study, Jo Boaler describes teachers seeming to fracture mathematics to help their students get answers and she notes that 'it was the transmission of closed pieces of knowledge that formed the basis of the students' disaffection, misunderstandings and underachievement (Boaler, 1997: 145). Meaning-making is ignored and a sense of hopelessness is generated. And, ironically, such practices can undermine test scores.

In a rare case of an attempt to compare directly a traditional and an alternative approach to teaching and learning (Bell, 1994), two parallel classes in the same school with the same teacher were taught fractions using two very different methods; one involved carefully and gradually graded exercises including a large number of examples worked through individually and the other involved the students working in groups at fairly hard challenges involving the production mostly of their own examples. Although the groups performed comparably at the beginning with comparable improvement at the end of the nine lessons, when they were tested again after the summer holiday break the attainment of the graded exercise group had fallen off to a lower level than before the work began whereas the learning of the other group was well retained. The first class went from being highly motivated to bored and lethargic whereas the interest and involvement of the 'conflict and investigation' class increased.

Conventional approaches to mathematics teaching in the UK also produce fractured classroom relationships. When learners are working through "bite-sized" exercises, they become separated from one another (Angier and Povey, 1999). Teacher-centred, test-dominated practices tend to encourage a competitive atmosphere which many learners find alienating: 'the students are unwilling to engage in this hierarchical game' (Nardi and Steward, 2003: 359). Teacher-pupil dialogue comes to be framed as question-response-evaluation exchanges generating passivity and a fear of public and private shame (Boylan, Lawton and Povey, 2001).

Activity
Reflect on your own experiences of learning, in and out of school, and your observations of contemporary classrooms. Which aspects of your own and others' experiences have caused under-achievement and alienation?

None of this analysis is new - we know what doesn't work. But we also know quite a lot about what does work - not enough attention is paid to this in current debates and this chapter is an attempt to redress that.

A PEDAGOCIAL FRAMEWORK FOR ATTAINMENT FOR ALL

Guy Claxton (2002) makes use of the notion of 'learning power' to help us understand how we can support young people to become effective learners. 'Learning power' refers to the personal traits, skills and habits of mind that enable a person to engage effectively with the challenge of learning - to be someone who knows what to do when they don't know what to do. Claxton highlights four key aspects of practice to which teachers need to pay attention if they are to succeed in enabling attainment for all.

Activity

According to Claxton (67), there are specific things of which you need to become aware in order to develop learning power:

- *how you talk to your students about the process of learning, the kinds of questions you encourage them to ask, the kinds of follow-up you expect and the visual images, prompts and records on the classroom walls;*
- *the kinds of formal and informal comments and evaluations you make of students' work and how you respond when they are experiencing difficulty or confusion;*
- *the kinds of activities and discussions which you initiate and what sense of purpose these engender in the learners;*
- *and, perhaps above all, how you present yourself as a learner - what kind of model do you offer, for instance, when things are not going according to plan or when a question arises that you have not anticipated.*

All of these considerations are highly relevant to a mathematics pedagogy for attainment for all. For each, describe a practice that would support the development of learning power.

I take these aspects as an organising structure for the rest of the chapter, with four specific case studies offering examples of alternative practice drawn from the research literature. I attempt to draw out some of the ways in which they exemplify engagement with these fundamental concerns.

Spenser - what is explicitly valued and shared with the whole class

Spenser School, situated in an urban area of high deprivation, had a predominantly white working-class intake and a very low level of achievement. The department decided to undertake a radical change in the way that they taught mathematics: they knew that research evidence suggested that all attainment teaching would support their learners and, 'as a way of being able to address any issues of underachievement that were due to low expectations and inappropriate previous educational experience' (Watson and De Geest, nd), introduced it into the first two years of secondary school. Many of the ways they changed their thinking and their practice promoted the learning power which is vital to generating attainment for all; lessons can be learnt for all classrooms.

Right from the start, they knew they needed their pupils to develop a wide range of ways to work on mathematics to promote their thinking and engagement and to lay down habits for future work. They drew on a wide range of existing resources and evolved curriculum planning based on pairs of teachers preparing resources on a topic including a summary of the main activities, games and ways to begin and end lessons; formative assessment activities and probing questions; key words and mathematical ideas; and anticipated difficulties and misconceptions. Crucially, they then worked on the mathematics together and discussed the associated pedagogy. In addition, they expected to spend time together at the end of the day, being around and sharing ideas. They recognised that they had to 're-educate students to work together, to talk, to take risks, to "have a go", to discuss, and to do mathematics in other ways that were not worksheet or textbook exercises' (Watson and De Geest, nd).

Having decided to work in this way, Spenser became the subject of a research project focused on interventions with previously low attaining students (PLAS). Across the projects, the researchers reported:

> When videoing for research purposes, as well as when videoing for dissemination, we observed excitement, engagement and pleasure in mathematical activity in nearly all classes for some of the time. Teachers connected pleasure to understanding, citing instances where students had said 'I get it now'. (Watson and De Geest, nd)

Spenser had a dramatic rise in mathematics results in the high stakes national test at age 14 not matched by similar increases elsewhere in the curriculum. As well as the move to all attainment teaching, two replicable key factors relating to this rise in attainment were identified by the researchers. First, with the first year students, there was to be a focus solely on mathematical methods of enquiry, returning only later to a programme of specific mathematical topics. Second, the teaching they observed was characterised by 'listening to learners, using their ideas, and developing reasoning' (Watson and De Geest, nd). Much of this teaching was by 'leading the collective thinking of a class through the orchestration of ideas' (Watson, 2011: 149) and, as the project developed, a sense of zeal 'for their students to understand key mathematical ideas' (149). Anne Watson writes: 'I am convinced that many learners learnt mathematics during those whole class episodes because of the methods of *knowledgeable mediation* used' (149, emphasis added).

There are two facets to the thinking and practice described here that link in with the first learning power focus: *what the teachers explicitly value and discuss with the whole class*. First, the teachers made direct and repeated reference to what kinds of mental activity were important and relevant to learning mathematics. This included some general effort and study skills but crucially also involved a wide range of specifically mathematical characteristics with which, it was made clear, everyone was expected to be able to engage.

Activity

Some of these specifically mathematical characteristics were:

- *visualising without prompting,*
- *being aware of difference and sameness,*
- *volunteering conjectures,*
- *creating examples to explore ideas,*
- *asking good questions,*
- *being aware some methods are more powerful than others,*
- *asking why and why not,*
- *providing answers that voluntarily include reasons,*
- *and taking time to understand mathematical ideas.*

Which of these mathematical characteristics do you want explicitly to share with learners in your classroom?
Choose one and explain why you value it. What might you do as a teacher to make it happen?

Second, the teachers were enabled to do this because they worked together themselves on the mathematical activities they were planning to use with their students. There was a focus throughout on the mathematics and 'planning was primarily about the best ways to give all students access to mathematical ideas' (Watson and De Geest, nd). This developed the depth of their own personal mathematical knowledge and thus their facility with responding to the mathematical thinking of their students as shared mathematical meanings were negotiated in their classrooms. It enabled them to give public praise for the sort of mathematical thinking they were wanting to encourage in their learners and to notice and reinforce such mental activity whenever it occurred; this in turn enabled all their students to become more effective learners.

Railside - talking to groups and individuals about their learning and achievements

Railside School, situated in the United States, had an ethnic and socially diverse intake and was on the "wrong side of the tracks". The mathematics department developed an effective approach to learning mathematics that promoted high achievement for all in absolute terms when compared to other schools and, most significantly, also reduced differences in achievement between learners (Boaler, 2008). Learners from all levels of prior attainment did well and substantially better than would be expected as the norm but without opening up the gap between high and low attainers; no "long tail" was produced, and systematic sites of disadvantage - gender, class and ethnicity - were overcome. The department was committed to all attainment teaching groups but, even outside that context, much can be learnt from studying their practices. Pupils' self-respect was developed as was their authority as learners and these qualities supported the growth of what Jo Boaler characterised as 'relational equity' (2008): pupils' respect and concern for their peers and for cultural and individual difference. Teacher behaviour which offers respect helps students to develop and enhance their self-image and their own expectations, which in turn enhance the students' academic achievement.

Central to the practices of the Railside teachers was a form of structured group work based on 'complex instruction'. They worked in class with mathematical problems having open and accessible starting points, ones which provided many opportunities for success: there were many more ways to be successful and many more students succeeded (Boaler, 2008). The key characteristics of their approach are summarised elsewhere (Boylan and Povey, 2009): they supported students to develop and carry out specific roles when working in groups; affirmed the competence of all and had high expectations of all; developed students' sense of their responsibility for each other's learning through classroom practices and forms of assessment including assessing collaborative outcomes; emphasised that success in mathematics was the product of effort rather than ability and all could succeed; and explicitly outlined the type of learning practices that would help students to learn.

Here I report on the practices of one of those teachers, Ms McClure who was successful in fostering collaborative interactions within groups that promoted the attainment of all. There is not room in this chapter to share all the useful things that can be learnt from Ms McClure's practices (Staples, 2008, 356-366); rather, here I attempt to draw out how in particular she built the students' learning power by *how she talked to groups and individuals about their learning and achievements*.

When students were working together in groups, Ms McClure expected any individual group member to be able to report the understandings of the group. If, when quizzed, it became clear that an individual did not fully understand the problem yet, she would leave the group explaining that she would come back, re-stating that she wanted everyone to "have it". She did not describe this initial response as 'incompetent or wrong, but rather as work in progress' and 'expected everyone in the group would understand'; she would comment "not that it's wrong, it's just incomplete", prompting groups to continue their thinking and build on the work they had already done (360). The tasks she chose were "group-worthy" and enabled a variety of approaches and solutions. Thus she was able to value each group's work and position each solution as 'evidence of competence and productive mathematical work' (361). She debriefed both on the mathematics and on the group processes, celebrating 'engagement, persistence, and good mathematical thinking' (357) always focusing on the whole group's achievement and the mutual responsibility for each other's learning that the groups had:

> "Many of you are really thinking hard about how to approach the problem and coming up with great ideas. I'm a little concerned however that not everyone in the group is together always. Sometimes a group member is being left behind. Groups, be sure everyone understands what's going on. And everyone, be sure you ask questions!" (357-358)

Thus, we see throughout that Ms McClure's way of talking to the students about their learning and achievements reflected a commitment to the idea that all students are capable of engaging with mathematics and achieving more, especially those whose current attainment is lower. This enabled them to become powerful learners and produced results for all.

Activity
What do you want to be the key characteristics of how you talk to groups and individuals about their work? And what do you most want to avoid?

Phoenix Park - what activities are selected

Phoenix Park was a school studied by Jo Boaler (1997) in which lower attainers benefited significantly and overall attainment at sixteen outshone a socio-economic comparator which used a traditional approach to teaching mathematics. Again, students at Phoenix Park worked in all attainment classes but some aspects of their teachers' practices contribute to building learner power in other contexts too. Here the focus is on the fact that the pupils worked on open-ended projects which they explored using their own ideas and mathematical knowledge.

> "You're just set a task and then you go about it … you explore the different things, and they help you in doing that." (17)

Such projects involved problem posing and problem solving - this creates a classroom in which it is alright to take risks, where questioning, decision making, negotiation are the norm, where there is an expectation that all have a contribution to make and no-one is offered a restricted and diminished curriculum. The open curriculum (and their all attainment groupings) created "can do" learners who could take their mathematics into their lives. They not only thought that they could use school mathematics in real world mathematical situations; they also thought that school mathematics had equipped them to tackle real world problems that were not mathematical. When asked about the role of mathematics, a typical response was:

> J: Solve the problems and think about other problems and solve them, problems that aren't connected with maths, think about them.
> JB: You think the way you do maths helps you do that?
> J: Yes.
> JB: Things that aren't to do with maths?
> J: It's more the thinking side to sort of look at everything you've got and think about how to solve it. (Jackie, Phoenix Park, Year 10) (100)

As noted in the chapter *Ability thinking*, the sense of self revealed by such responses had a long term impact, spilling over into their understandings of their life chances and their possible trajectories (Boaler, 2005).

Because the students worked on large problems, activities that were mathematically rich, time and intellectual space were generated within which they could make links both within mathematics and between mathematics and other experiences (Angier and Povey, 1999). Mathematics then had the room to grow as an open and creative subject, not restricted to a rule-bound set of procedures, which allowed students the opportunity to change their view of themselves as learners. We know that students, especially working class students, prefer informal relationships built on a basis of mutual respect (Povey and Boylan, 1998). In setted classrooms these are typically offered only to top set pupils and, more generally, less to working class pupils. At Phoenix Park there is a strong sense that these were offered to all, *growing out of the nature of the mathematical activities taking place*.

In both these ways, *the activities that the teachers selected* played a key role in building learning power: those activities could be approached in a variety of ways with a wide range of appropriate tools thus providing opportunities for learners to see themselves as active, as choosing, deciding, producing arguments for and against, assessing validity and generating questions and ideas. This sense of self was instrumental in generating productive relationships between teachers and learners and between learners and achievement.

Activity
Choose five such mathematical activities. For each, list what might be gained from using the activity in your classroom and what difficulties you think you might encounter.

A spacious classroom - how learning is modelled

The last case study involves a spacious classroom in which learning power was bulit by the way in which *learning was modelled by the teacher*. When describing how she worked with her students, Corinne Angier explained, "I was thinking about the students as being apprenticed as learners of maths and of me being a model learner not a teacher". She regarded it as key that, at least part of the time, the teacher and the students were engaged in the *same* activity: that is, learning to be mathematicians. This has a powerful effect on how learners think about themselves and of what they think they are capable.

> If one enters the educational enterprise with arrogance one's own views of knowledge quickly overpower the insights of the children. When the classroom norms are developed in such a way as to promote the exchange of student methods with mutual tolerance and respect, the children themselves become increasingly confident of their contributions and the system becomes self-reinforcing. In both peer relations and in adult-child interactions, *the roles of expert, teacher, learner, and novice, are flexibly drawn*. (Confrey, 1995: 41, emphasis added)

When the teacher is, at times, a co-learner, the expected source of mathematical authority - the teacher, the textbook and the answer book making up a united authority which needs no specification or justification (Alro and Skovsmose, 1996: 4) - is unsettled. In Corinne's classroom, there was room for the students to have insights she did not already have as they learnt together:

> "She treats you as though you are like ... not just a kid. If you say look this is wrong she'll listen to you. If you challenge her she will try and see it your way." (Donna)
>
> "She doesn't regard herself as higher." (Neil)
>
> "She's not bothered about being proven wrong. Most teachers hate being wrong … being proven wrong by students." (Neil)
>
> "It's more like a discussion … you can give answers and say what you think." (Frances) (Angier and Povey, 1999: 157)

And all the students interviewed knew that Corinne found passionate enjoyment in the subject they were studying together:

> "She loves doing triangles!" (Dan)
>
> "She loves it … she's right interested in it." (Frances) (151)

*A*lthough they smiled and found this strange, they knew it was a key element in their own learning. By modelling her engagement with the subject as one worthy of study, effort, application and the strive for understanding, she offered both the learners and the subject respect: and showed her students what it was to learn.

Activity

What difficulties would you experience in teaching a lesson where you did not expect to know all the outcomes in advance? What are the mathematical benefits and problems of unexpectedness?

Working on mathematics alone or with departmental colleagues also supports us in enhancing attainment. By doing so, we gain a deep understanding of mathematical activity which in turn helps us understand how learners are thinking (Watson, 2006: 175).

CONCLUSION

I have taken from four case studies specific characteristics related to the framework for attainment for all. Each of the studies gives a much richer account of pedagogical possibilities than has been able to elaborate here. However, what they all have in common is a notion of 'transformability' defined as:

> a firm and unswerving conviction that there is the potential for change in current patterns of achievement and response, that things can change and be changed for the better, sometimes even dramatically, as a result of what happens and what people do in the present. (Hart et al., 2004: 166)

As Watson notes, it is the belief that *can* learners can change which seems to make the difference (2006: 155). The transformability perspective echoes the concept of "learning how to learn" based on the development of learners' resilience, resourcefulness, reflectiveness and reciprocity (Claxton, 2002). It finds support in the work of Carol Dweck (2006) written about in the chapter *Ability thinking* about fixed and malleable mindsets which offers an alternative, evidence-based view of human capacity which has been found to improve motivation and attainment.

This pedagogic approach has three interrelated sets of purposes that can guide us in our practice:

- Intellectual purposes which include ensuring everybody has access to the curriculum that it is relevant and meaningful and that thinking and reasoning are enhanced
- Social purposes which include a focus on the inclusion of everybody and promoting a sense of belonging and community
- Affective or emotional purposes which include developing learners' confidence, security and control over their own learning.

We need our classrooms to be places where learners set up productive relationships with themselves as learners and with the processes of coming to know mathematics. Studying closely accounts of what teachers who have achieved this have done is both an inspiration and an effective way for us to learn, helping us to understand what more innovative pedagogical practices are available to us. Crucially, however, they also help us call into question currently dominant ideas about how to support attainment - setting, testing, targeting, differentiated expectations and so on - thus making a vital contribution to debates about how to enhance long term attainment by creating learners who both believe in their own capacity to learn and deem it to be worthwhile engaging in doing so.

Further reading

As noted above, each of the four case studies referred to in the chapter would repay exploring further. Each of them is accompanied by relevant references and I can think of no better further reading than engaging more deeply with these sites of practice.

Also recommended is *Inclusive Mathematics* by Mike Ollerton and Anne Watson (2001), London, Continuum. It is written by two highly experienced teachers both of whom are deeply committed to attainment for all and is based on the principle that all learners are capable of sophisticated mathematical thought. It presents the tools with which we can work to reach all students of mathematics.

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References

Alro, H., & Skovsmose, O. (1996) 'On the right track', *For the Learning of Mathematics, 16*(1), 2-40.

Angier, C., & Povey, H. (1999) 'One teacher and a class of school students: Their perception of the culture of their mathematics classroom and its construction', *Educational Review, 51*(2), 147-160.

Bell, A. (1994) 'Teaching for the test', in M. Selinger (Ed.), *Teaching mathematics*, London: Routledge

Boaler, J. (1997) *Experiencing school mathematics: Teaching styles, sex and setting,* Buckingham: Open University Press.

Boaler, J. (2005) 'The ‘psychological prisons’ from which they never escaped: The role of ability grouping in reproducing social class inequalities', *Forum, 47*(2&3), 125-134.

Boaler, J. (2008) 'Promoting 'relational equity' and high mathematics achievement through an innovative mixed-ability approach', *British Educational Research Journal, 34*(2), 167-194.

Boylan, M., Lawton, P., & Povey, H. (2001) ' "I'd be more likely to talk in class if …": Some students' ideas about strategies to increase mathematical participation in whole class interactions, *Proceedings of 25th PME Conference,* Utrecht, July, *2,*. 201-208.

Boylan, M. & Povey, H. (2009) 'Mathematics' in Cole, M. (ed) *Equality in the Secondary School: Promoting good practice across the curriculum*, London: Continuum, 247-269

Cassen, R., & Kingdon, G. (2007) *Tackling low educational achievement,* York: Joseph Rowntree Foundation. http://www.jrf.org.uk/publications/tackling-low-educational-achievement *(accessed 5/2/2012)*.

Claxton, G. (2002) *Building learning power: Helping young people become better learners,* Bristol: TLO.

Confrey, J. (1995) 'A theory of intellectual development: part III', in *For the Learning of Mathematics*, *15*(2), 36-45.

Dweck. S. (2006) *Mindset*, New York: Random House.

Hart, S. (1998) 'A sorry tail: Ability, pedagogy and educational reform', *British Journal of Educational Studies, 46*(2), 153--168.

Hart, S., Dixon, A., Drummond, M., & McIntyre, D. (2004) *Learning without limits,* Maidenhead: Open University Press.

Nardi, E., & Steward, S. (2003) 'Is mathematics T.I.R.E.D? A profile of quiet disaffection in the secondary mathematics classroom', *British Education Research Journal, 29*(3), 345-367.

Povey, H., & Boylan, M. (1998) 'Working class students and the culture of mathematics classrooms in the UK', *Proceedings of 22nd Psychology of Mathematics Education (PME) Conference,* Stellenbosch, July.

Staples, M. (2008) 'Promoting student collaboration in a detracked, heterogeneous secondary mathematics classroom', *Journal of Mathematics Teacher Education, 11*, 349-371.

Watson, A. (2011) 'Mathematics and comprehensive ideals', *Forum, 53*(1), 145--151.

Watson, A., & De Geest, E. (nd) *Changes in mathematics teaching project.* www.cmtp.co.uk *(accessed 6/2/2012).*