

I COULD BE THE BEST MATHEMATICIAN IN THE WORLD... IF I ACTUALLY ENJOYED IT.

Elena Nardi and Susan Steward

This article has come out of a one-year research project looking at ‘quiet disaffection in the mathematics classroom’. Pupils who are disaffected are usually seen as either ‘disruptive’ or as ‘truant’. There is, however, perhaps a larger group of pupils who often remain under-researched namely those pupils who are quietly disaffected and disengaged from the educational process. We wanted to focus on this group in maths – pupils who are ‘Really Here In Name Only’ – RHINOs [1] – invisible to their teacher because they present no problem but who would rather be anywhere but in a maths lesson. To a greater or lesser extent we discovered that there were a number of RHINOs in the classrooms we worked in. We became aware that, despite the fact that most pupils turned up to lessons and tried to do the work set, a substantial number were not actually *engaged* with the mathematics in front of them, although they did it unquestioningly. A large number certainly did not appear to enjoy the mathematical experiences their lessons provided.

Should we care whether students enjoy their maths or not? At a national level there is a push to ‘drive up standards’ but there are few opportunities for students themselves to say how they feel they learn best or whether they enjoy what is currently on offer. It is fairly uncontroversial to assume that greater engagement in a subject will lead to more success and self-fulfilment but does greater enjoyment necessarily lead to better results and understanding? Many of the students we interviewed think it does and hence the title-quote of this article. We want to question why a majority of pupils should not enjoy maths and feel positive about their mathematical experiences. Through their voices, we want to present examples of what students say they enjoy in their maths lessons and how they feel they learn best. We suggest strategies

for re-engaging those who are currently unlikely to reach their potential in mathematics and who currently want nothing more to do with the subject post GCSE.

The schools

To investigate these under-researched, quietly disaffected pupils in maths we chose to work with three Y9 maths classes in local schools. The three schools we worked with are all over-subscribed, successful comprehensives in a small city with an overwhelmingly white, English-speaking population; they have above average GCSE results both in general and in maths specifically. All three maths departments set into ability groups from the first year of entry to the school but are different in nature and in the resources they use.

The three teachers involved in the study and others in their maths departments represent very different teaching styles working within three very different schemes for teaching mathematics. The classrooms we visited are not atypical – most maths teachers would recognise similarities as well as differences if they compared any of the three to their own. The students themselves are also fairly typical – nearly all wanted to learn and to do well in school but very few were always well-behaved or well-motivated.

We describe the characteristics of the three mathematics departments and typical reactions of pupils to the resources used:

School A – we worked with set 4 (out of 8) – the lowest set of the top band which had a wide ability range. Perhaps as a consequence of setting and banding mathematics with modern foreign languages there were a larger number of girls compared to boys in the class (23 girls to 6 boys). The department were using new trial materials for

A substantial number were not actually engaged with the mathematics in front of them, although they did it unquestioningly.

the SMP textbook scheme:

Cheryl: *We've got new French books and they're nice and colourful and bright and I think that helps. But those maths books are older and boring really. White, black.*

In nearly all the lessons observed the students were taught from the front and worked on common exercises:

Vicky: *...just the same old thing going from doing section D to E in one lesson. I don't think that helps because it's the same thing every single lesson.*

School B – we worked with the third intermediate set from the top band (set 5 out of 12). The mathematics department were using a variety of resources although it is a named school in the mathematical enhancement project (MEP), co-ordinated by Exeter University. In nearly all the lessons observed students were given a brief explanation from the teacher at the beginning and then worked on exercises:

Gemma: *...the stuff in the books is so unoriginal . . .*

Amy: *...like you've done it all before.*

Pupils were re-grouped into sets each year from internal test scores although many students, in particular girls, did not like the half-termly tests because of the implicit threat of being moved down. They often felt they do not perform as well in tests as they did in class:

Laura: *...I don't know why but the atmosphere always puts me off, I start getting panicky and by the time I've finished the test I'm like "...oh my god! It's half my marks for the year."*

School C – we worked with set 4 (out of 5) which was in the half of the year that used SMILE (secondary mathematics individualised learning experiment). As this was a (perceived) low ability set there were only 17 students in the group. In nearly all the lessons observed the students worked on their individual matrix of cards though there were opportunities for group or pair work. Students could work at their own pace and level and, despite being a 'setted' group, levels spanned 4 to 7. The reaction of the students to SMILE was mixed and despite the fact that some students were very negative to this different way of learning (and teaching):

Jamie: *I'd rather he'd teach me than do SMILE cards. He doesn't seem to do anything – I think he should teach us.*

Alice: *...well half of them aren't even really good maths.*

a number found SMILE a much more positive experience than textbook approaches they had encountered in the past:

David: *I didn't have SMILE cards last year – ... we did normal work where the teacher tells you what to do from books. I prefer the SMILE cards because you can get on with your own work and you don't get any stuff from other people.*

Darren: *... in Y8 I didn't hear of SMILE. When I went in to the room in Y9 and he explained it, I thought that might be a bit weird but I've got Nathan so I can talk. But then I started getting alright, started getting through the cards quite good. I prefer it in [set] 4 now because we've done SMILE.*

The research

The aim over the first half-term was to get to know the three schools and to understand the philosophy and approach of each maths department by observing a number of lessons. In the second half-term students in the three classes chosen were interviewed individually or in small friendship groups. Given the qualitative nature of the research we have focused on students' individual and group attitudes and experiences rather than on any measured attainment. We rely on students' subjective impressions of how they relate to maths in school and how they themselves feel about their achievements in the subject; we have not tested them nor do we have any standardised scores for comparisons to be made. When students say 'I can't do maths' or 'I learn better if I enjoy it' these are subjective statements that have to be accepted as truthful representations of how they feel, not how they are perceived by others.

Three fundamental questions on pupil engagement arose from the observation period which were subsequently explored in the interviews:

1) Are students able to engage in what is being offered?

Before we began the research we had assumed that students would be able to do the work set in lessons and that any disengagement would be the result of a rational choice. However it became obvious that there are some students who cannot engage either because they cannot access the mathematics, despite 'ability' setting, or because they believe they cannot. During one observation lesson the students were asked to work on examples of combined prob-

ability, a concept that was far too difficult for any of the class. One by one they gave up because they could not make any sense of or progress with the exercise, at the end of the lesson many left feeling angry and dissatisfied. From the interviews we identified some pupils who have experiences like this every lesson and feel bad about themselves as a consequence. Students learn to expect not to be able to do maths because they compare themselves to others in their year or maths group; if they keep failing they may eventually give up – like Hannah who is now totally disaffected with maths because she believes it's all hopeless:

... I don't see myself as a sort of person that would get good marks on my maths GCSE or pass it or whatever. ... because I'm not good at maths and I'd sort of feel quite scared, ... even if I did know the work I'd just look at it and think I can't do this and just get put off.

Hannah had failed too often and could not break out of the 'role' that she had both created for herself and that had been created for her.

2) Is it worthwhile for students to engage in a task? Is engagement always profitable?

We had also assumed that engagement in school tasks generally is desirable and will benefit students in their learning however this was not always the case. During another lesson the students worked on an investigation – 'Jigsaws' that depended on them seeing the problem in a spatial way (they had to predict the numbers of corners, edges and inside pieces for a 'm by n' jigsaw). Most of the class focused on looking for number patterns (because this is what they always had to do in investigations) and, although they worked hard at the problem, they obtained few results. Most students learnt little from this exercise except that their attempts to solve the problem had failed. Engagement in this task was not worthwhile for most of the class because their thinking was not changed nor their understanding of the problem. Many students recognise that real understanding is fundamental to success in mathematics and without this understanding maths is a deeply unsatisfying subject:

Charlotte: ... when she tells us over and over again [...] how to write it out you remember how to write it out but not how to do it.

3) What constitutes real engagement in a mathematical task?

Many lessons that we observed entailed students 'going through the motions' of what was expected of them either by the teacher or the exercise in the

textbook / SMILE card. For most lessons students were not deeply or meaningfully engaged because they were not required to be. Most students did the work that was expected of them but actually did very little real thinking. In their words the lessons were 'boring', 'tedious', 'a null period', and the maths itself was 'grey', 'ugly', 'depressing', even 'parrot work'. Instead of identifying those students who were normally disengaged it became evident that there had been very few instances of real engagement by any of the students in the three classrooms. On the few occasions that real engagement was observed it involved perhaps one student for only a few minutes at a time. The following interview transcript with a group of hard-working, well-motivated girls illustrates their attitude to chatting in maths and the nature of their engagement with the mathematics they do:

Gemma: ... it doesn't really matter what you talk about. [...] if you're working and talking at the same time and you get it right, and get the work done as well.

SJS: If you need to concentrate on something, can you work and talk at the same time?

Alix: Well sometimes but if it's really hard, no.

SJS: ... have there been occasions when you've really felt that you can't talk because you have to concentrate?

Alix: Mm... not to my memory

We have been aware of a certain resonance with Jo Boaler's research [2] in which students in a textbook classroom, 'on task' for most of the time, achieved no better grades overall than students in a project-based classroom where students appeared to work for little of the time.

Secondary mathematics – the gloomy picture

The student interviews paint a rather gloomy picture of their experiences thus far in school mathematics. A number do mathematics not because they enjoy it and want to do it but out of a sense of obligation to the school, their parents, their own self-image. They may appear to be engaged but inside they are disaffected and disinterested. While a number of students had both positive and negative feelings towards mathematics there were a substantial minority who only had negative perceptions of the subject; sometimes they revealed painful experiences of maths lessons that led to extreme negative emotions:

Rebecca: I've suffered greatly over the past few years in maths.

There are some students who cannot engage either because they cannot access the mathematics, despite 'ability' setting, or because they believe they cannot.

On the few occasions that real engagement was observed it involved perhaps one student for only a few minutes at a time.

SCHOOL OF EDUCATION AND LIFELONG LEARNING



MATHEMATICS IN EDUCATION

The School was recently awarded a perfect score of 24 in its latest QAA inspection.

MASTERS OF EDUCATION (MEd)

An exciting and challenging postgraduate degree for mathematics specialists in education at all levels. This is a part-time, modular degree consisting of five modules plus a dissertation. Modules are available both on campus and by Distance Learning.

DOCTOR OF EDUCATION (EdD)

The Doctor of Education is an innovative taught doctoral programme based on five modules and a dissertation. This programme is specifically directed toward professional development through research and is available by part-time, full-time or Distance Learning study.

For more information please contact:
Graduate Studies Office,
Tel: 01392 264815.
Fax: 01392 264902.
E-mail: ed-cpd@exeter.ac.uk

www.ex.ac.uk/education



and extreme conclusions:

Chris: *Ban it!*

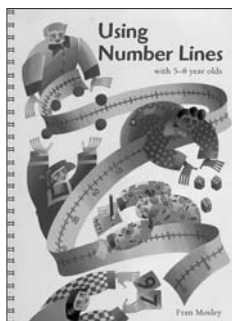
It must be reported that most of the students in our research do work hard in maths and do want to do well in it despite somewhat negative feelings. In the next issue of MT, by recounting some of these students' more positive experiences, we present some important issues for them in learning mathematics and how they believe it could be taught more effectively.

Dr Elena Nardi is a lecturer in mathematics education and Susan Steward is a research associate for the project at the University of East Anglia.

Part two of this article will be published in MT180.

References

- 1 Jerry Oakley: *RHINOs – Really Here In Name Only*, A Research Project about the Quietly Disaffected for The Norwich Area Schools Consortium (NASC), 1999.
- 2 J. Boaler: *Experiencing school mathematics: teaching styles, sex and setting*, Buckingham: Open University Press, 1997



Using Number Lines with 5-8 year olds

Fran Mosley

The three main sections of this book aim to give children a sound understanding of ordered numbers and to provide guidance in how to apply this effectively in calculations.

The starter activities are simple and practical relating to numerals and number lines. The main section illustrates effectively how to use different types of number lines and clearly relates to the objectives of the national numeracy strategy. The final section is made up of relevant photocopiable resource sheets - a great time saver!

Every concept of number line application relevant to 5-8 year olds is presented in a concise and easily accessible manner and the book is well worth considering as an aid to numeracy teaching.

Lucy Walker. At the time of writing, Lucy was teaching at Marlborough Primary School, Falmouth.

Using number lines with 5-8-year-olds, published by BEAM Education, 128 pages, price £17.50 plus handling charge, product code LIN1, ISBN 1 874099 95 2). To order a copy call the BEAM orderline on 020 7684 3330 or fax an order on 020 7684 3334

Numeracy Time No. 6

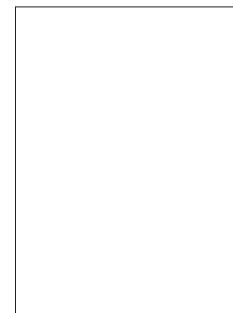
This publication provided a series of comprehensive lesson ideas covering estimating and rounding, mental calculation and data handling for Y3 and Y4. In my case, a weeks' worth of numeracy lessons on data handling for a Y4 class.

The first things that you notice are the lively posters used as a focus for the variety of activities. The cartoon style grabbed the attention of my class, who each day were excited to see what we would use next.

There were plenty of ideas providing differentiated activities. All of the resources necessary were in the pack and all that was needed was photocopying. However the work was by no means 'death by worksheet'. It provided a great deal of opportunity for discussion about data handling.

All in all it was a very rewarding week of numeracy and I'm looking forward to using the resources with my next class.

Simon Banner Y4 teacher, Marlborough Primary School, Falmouth.



Numeracy Time, issue no.6, Editor Jane Gartside, published by Scholastic, 2000, ISSN 1470-9759

Numeracy Time is a periodical resource for Y3 and Y4. Scholastic also publish a sister literacy pack. They are planning to publish a pack for Y5/6 in summer 2002. The pack contains: teachers' leaflet, 2 colour A2 posters, 2 sets of leaflets for children and teachers' notes. For a free trial pack contact the subscriptions department: 01926 816250.

The attached document has been downloaded or otherwise acquired from the website of the Association of Teachers of Mathematics (ATM) at www.atm.org.uk

Legitimate uses of this document include printing of one copy for personal use, reasonable duplication for academic and educational purposes. It may not be used for any other purpose in any way that may be deleterious to the work, aims, principles or ends of ATM.

Neither the original electronic or digital version nor this paper version, no matter by whom or in what form it is reproduced, may be re-published, transmitted electronically or digitally, projected or otherwise used outside the above standard copyright permissions. The electronic or digital version may not be uploaded to a website or other server. In addition to the evident watermark the files are digitally watermarked such that they can be found on the Internet wherever they may be posted.

Any copies of this document MUST be accompanied by a copy of this page in its entirety.

If you want to reproduce this document beyond the restricted permissions here, then application MUST be made for EXPRESS permission to copyright@atm.org.uk

*This is the usual
copyright stuff -
but it's as well to
check it out...*



The work that went into the research, production and preparation of this document has to be supported somehow.

ATM receives its financing from only two principle sources: membership subscriptions and sales of books, software and other resources.

Membership of the ATM will help you through

*Now, this bit is
important - you
must read this*

- Six issues per year of a professional journal, which focus on the learning and teaching of maths. Ideas for the classroom, personal experiences and shared thoughts about developing learners' understanding.
- Professional development courses tailored to your needs. Agree the content with us and we do the rest.
- Easter conference, which brings together teachers interested in learning and teaching mathematics, with excellent speakers and workshops and seminars led by experienced facilitators.
- Regular e-newsletters keeping you up to date with developments in the learning and teaching of mathematics.
- Generous discounts on a wide range of publications and software.
- A network of mathematics educators around the United Kingdom to share good practice or ask advice.
- Active campaigning. The ATM campaigns at all levels towards: encouraging increased understanding and enjoyment of mathematics; encouraging increased understanding of how people learn mathematics; encouraging the sharing and evaluation of teaching and learning strategies and practices; promoting the exploration of new ideas and possibilities and initiating and contributing to discussion of and developments in mathematics education at all levels.
- Representation on national bodies helping to formulate policy in mathematics education.
- Software demonstrations by arrangement.

Personal members get the following additional benefits:

- Access to a members only part of the popular ATM website giving you access to sample materials and up to date information.
- Advice on resources, curriculum development and current research relating to mathematics education.
- Optional membership of a working group being inspired by working with other colleagues on a specific project.
- Special rates at the annual conference
- Information about current legislation relating to your job.
- Tax deductible personal subscription, making it even better value

Additional benefits

The ATM is constantly looking to improve the benefits for members. Please visit www.atm.org.uk regularly for new details.

LINK: www.atm.org.uk/join/index.html