LOOKING FOR MATHEMATICS

Heather Mendick, Marie-Pierre Moreau

Institute of Policy Studies in Education, London Metropolitan University

Debbie Epstein

School of Social Sciences, University of Cardiff

We use data from our research on maths and popular culture to investigate the question: 'What is maths?' In a survey of Year 10 students asking for examples of maths and mathematicians in popular culture, as well as some perhaps predictable references to things like A Beautiful Mind *and* The Curious Incident of the Dog in the Night-Time*, there were many more surprising or controversial entries, including game shows like* Deal or No Deal *and even action movies like* Mission Impossible. *We then carried out group interviews with some of these same students once they reached Year 11. We look at their answers and, in particular, we identify the way that learners overwhelmingly define maths in relation to the presence or absence of number and explore their alternative ideas about what makes something maths.*

INTRODUCTION

This paper draws on data from the Mathematical Images and Identities research study (www.londonmet.ac.uk/mathsimages), funded by the Economic and Social Research Council (RES-000-23-1454) and follows on from Heather's earlier doctoral research, supervised by Debbie, into how people choose mathematics (Mendick, 2006). We are exploring these questions:

- What discourses are there about mathematics and mathematicians within contemporary popular cultural representations?

- How are these discourses deployed by learners in constructing their relationships with mathematics?

- How are these discourses and processes gendered, classed and raced?

Our data collection is focused on two groups of participants: Year 10 to Year 11 pupils and second to third year undergraduates. We carried out a survey, group and individual interviews with participants in both groups and analysed key texts.

On the survey we explained to participants what we meant by popular culture:

> By popular culture we mean activities related to mass communication. Our list of these includes TV programmes, films, radio programmes, websites, puzzles, computer games, other games, magazines, music and books. But you may be able to think of some more.

However, we deliberately avoided defining mathematics. Perhaps as a result, some of the examples of maths in popular culture that came up surprised and perplexed us. The question *What is maths?* is something we decided to explore further within the group and individual interviews and is the theme of this paper.

Here we only have space to discuss some of the survey and group interview data from the school students. The students were in three different schools that we have called: Shelley, a London comprehensive, with a diverse intake in terms of social class and ethnicity; Franklin, a rural comprehensive in the South West with a largely white middle-class intake; and St Joan's, a Catholic comprehensive in a large town in the South West, with a mainly white working-class intake. We carried out the survey on the entire Year 10 cohort at each school and then carried out 15 group interviews, five at each school, with between four and seven Year 11 students each.

SURVEY DATA

In the survey we asked participants some closed questions about where they had seen or heard of maths and mathematicians in popular culture. We then asked an open question on this:

Thinking about images of maths and mathematicians in popular culture, pick 2 you remember clearly and fill in the information about each in the boxes below:

Name and where you saw it:

Describe the main things that you remember about it:

What were your opinions and feelings about it?

The first overwhelming finding is the absence of recall of specific images of mathematics and mathematicians. Looking across the school students and the undergraduates, this question was left blank by 24% of participants (157/648), and 49% filled in only one example (318/648). However, as we found out in the group interviews this blankness coexists for most with an acute awareness of the stereotypical figure of the mathematician.

For the many that did come up with examples, the Top 10 for the Year 11 students is shown in the table below:

BBC bitesize	116
Countdown	75
Mymaths	32
Sudoku	30
A Beautiful Mind	23
Quizzes, horoscopes, articles in magazines (*Cosmopolitan*, *Sugar*)	12
The Curious Incident of the Dog in the Night-time	11
Deal or No Deal	7
Good Will Hunting	6
Numb3rs	5

The second overwhelming finding is the dominance of school maths. BBC bitesize (http://www.bbc.co.uk/schools/gcsebitesize/), a revision website supported by TV programming, is way out in front and only the long-running game show *Countdown* can knock Mymaths (http://www.mymaths.co.uk/), a curriculum support website used heavily by Franklin school, into third place. We discussed whether to include these as examples of maths and popular culture because of their direct links to school curriculum and assessment. However, sheer numbers are persuasive, as are the ways that these sites use popular culture techniques to 'deliver' school maths.

Looking lower down the rankings we have: the Get Rid of Your Maths Gremlins adverts, monopoly, radio quizzes and sport (cricket, tennis, football, darts, snooker) with four entries each; newspaper items (financial and about maths), *Rainman*, *Stand and Deliver*, Stephen Hawking on *Simpsons*/*Richard and Judy* and *The Da Vinci Code* (book) with three entries each; *Back to the Future*, *Catch Me if You Can*, Einstein, *My Wife and Kids*, *The Da Vinci Code* (film), *The Weakest Link* and *Who Wants to be a Millionaire?* with two entries each; and a proliferation of examples with 1 entry each: *The Apprentice*, *Beauty and the Geek*, *The Brain Game*, Chess, Come Together (Aerosmith), *Dambusters*, *Digital Fortress*, Don't Know Much About History (Sam Cook), Dr Kawashima's brain training, *Dr Who*, *Eggheads*, *Enigma*, *Friends*, *Futurama*, Google, *Grange Hill*, Unpredictable (Jamie Foxx), Johnny Ball's stage show, *Jurassic Park*, Kiddy.com, Knights of the Old Republic, Logic puzzles, The Lottery, Mambo Number 5 (Lou Bega), *Matilda*, *Mean Girls*, *Mission Impossible*, *Mission Impossible 3, Newsround*, Number Criss Cross, Pi, *The Price is Right*, primes on the radio, Puzzle Pirates, Runescape, Russ Noble, *The Simpsons*, Solitaire, *Test the Nation*, Tetris, *Tweenies*, Wikipedia and Yellow Submarine (The Beatles).

The process of exploring these texts raised many questions.

- Does the variety across examples suggest that maths is everywhere? Do we exaggerate the influence of particular films with mathematicians in, while the spread of examples is more suggestive of a diffuse influence?

- How far does this range reflect the way that people have different definitions of maths? And, what is the relationship between the examples of maths and mathematicians in popular culture and the ways that people construct maths?

GROUP INTERVIEW DATA

In order to explore these questions further within the group interviews we used:

- An open approach beginning by asking participants to tell us something about how they feel about maths?

- Video excerpts from: *Stand and Deliver* (http://www.imdb.com/title/tt0094027/), *Good Will Hunting* (http://www.imdb.com/title/tt0119217/), Bad Dad/Bubblegum Gremlins adverts (http://www.dfes.gov.uk/get-on/downloads-2k5.shtml), *Deal or No Deal* (http://www.channel4.com/money/ontv/deal_or_no_deal/index.html).

- Examples of sudokus, asking: Are they maths? What about if they used letters or colours instead of numbers? What makes something maths for you?

We also asked once again for examples of maths in popular culture.

We coded the data from the group interviews using the qualitative analysis package NVivo and then worked through the codes looking at key bundles of meanings, or discourses. We identified four bundles of meaning in relation to *What is maths?*:

- Maths: as numbers, as doing stuff with numbers, as broader than this but limited by school maths, including, for example, shapes and pi charts.

- Maths: as a way of thinking, involving some combination of logic, puzzles, patterns and problem solving.

- Maths: as compared to other subjects, comparing and contrasting with science, music, computing, English (and other ʻcreativeʼ subjects) and languages.

- Everyday maths vs. esoteric maths: with trigonometry, Pythagoras and algebra most frequently positioned within the latter, useless, category.

At the BSRLM conference, all four of these were discussed; here we can only offer a taste of the ways that the first two discourses were deployed with and against each other in the often heated group discussions on sudokus. Below a long extract of transcript, from a mixed gender group interview at St Joanʼs, is interrupted by our commentary. The analytic approach owes a lot to the discourse analysis tradition (MacLure, 2003, Potter & Wetherell, 1987).

Johnny:	It's, no [sudokus are not maths] because, you don't have to add up or divide or, equations.
Jenny:	Yeah you're not working, well you are working something out, but.
Johnny:	I don't think it's maths.
Nathan:	But it's problem solving and that's maths.

There seems to be an early consensus around the idea that maths is more than numbers, it is doing something with numbers as in school maths. Then Nathan, who enjoys maths and wants to continue studying it, mobilises a contrasting version of maths drawing on the second bundle of meanings identified above in which maths is understood as a way of thinking.

Johnny:	Yeah but there's like a formula for moving a little thing round a block … We did four pieces of coursework on it so … Sliding puzzles. … [With sudoku] there's no formula, no way of doing it, it's just a random thing.
Nathan:	Have you tried to make a formula?
Johnny:	There isn't a formula, otherwise people wouldn't be so brilliant.
Artemus:	What's the formula? N plus. [laughter] …
Johnny:	It's just not maths, to me it's basically if you can see you can play it.

Here, uniquely within the group interviews, a recent piece of coursework on sliding puzzles is used as a resource for understanding what maths is. It is the possibility of finding a formula for sliding puzzles and the impossibility of finding one for sudokus that is key to Johnny's position. Nathan does not dispute the need for a formula for something to be maths. But he does dispute the easy location of sudokus within the realm of the un-formulisable and thus the un-mathematisable. Nathan's intervention provokes ironic humour from Artemus, while Johnny persists in contesting his position. He argues that the pairing of the accessibility to all of sudokus and the brilliance of some at them supports the impossibility of finding a formula for them (although both of these could apply to sliding puzzles as well). In a related move, in other group interviews, distinctions were made between doing sudokus which did not involve maths and creating sudoku puzzles which did.

Heather: But Naomi you definitely said straight off I don't do it because I don't do maths, so you definitely think it is maths.

Naomi: It's basically logic and, I can't remember who, but someone told me that maths is logic but put into equations … So if that's like logic then it's basically you've got, some aspect of it is to do with maths but maybe not all of it is based around that actual subject of maths. If you know what I mean.

Heather: So you're talking about things which aren't numbers, you're talking about problem solving, you're talking about logic. What about you, do you think it's maths, or not?

Katie: Yes.

Heather: Yeah, you do, and that's because of what?

Katie: Numbers.

Here Heather intervenes. Perhaps wanting to bring the girls into the discussion, she addresses direct questions to Naomi, referring to an earlier contribution of hers, and then to Katie. After all the talk of working things out, problem solving and logic, Katie's single word answer 'numbers' is a reminder of the powerful ties between maths and numbers.

Heather: Numbers right. So if it didn't have numbers, if it was like colours, instead of like one to nine, if it was like red, yellow, blue, green and stuff, or like letters maybe, A, B, C, D?

Katie: That wouldn't be maths right. …

Johnny: See I don't agree with that.

Naomi: Yeah, but like, saying 'oh yeah right I'm 13' is that's maths as well? …

Naomi's intervention, an attempt at a reductio ad absurdum argument, can be related to her conscious positioning as separate from the other group interview participants. In a similar move in another group, participants questioned whether phone numbers, or even the W5 bus, were maths?

Artemus: Yeah like 13 years after they were born.

Johnny: Yeah, I can see where you're coming from there but that's … that's why I say that's not maths because you couldn't just change the numbers for something, because people associate numbers with maths, like she just did there.

Naomi: She just straightaway, automatically thinks that 13 years is maths but like say that was like what you say, A, B, C, people would say it's not maths.

Nathan: But it is maths though because like you said we did the sliding puzzle, that wasn't numbers.

FINAL THOUGHTS

The nature of mathematics is long-contested and our analysis is in its early stages, but we wonder whether there is a potential role for popular culture as a Trojan horse for troubling absolute, objective, people-free conceptualisations of maths within the curriculum? This is brought out clearly in the work of Sarah Greenwald (e.g. Greenwald & Nestler, 2004) and Peter Appelbaum (1995). We also wonder whether there a role for popular culture as a resource in developing different relationships with maths? This is suggested often within the group interview discussions as people shift positions and question previous assumptions. We give the last word to Dominic from Shelley School:

Dominic: Before I came to like this meeting I just thought that maths was a like thing that has divide, times and plus and minus and all that stuff and that's what I would say.

Heather: And now you've changed your mind?

Dominic: Yeah, it's made a little bit of difference to what I understand. … The question 'what is maths' I don't think it will ever be answered because it just goes on and there are so many different things and I think you have to spend like at least I don't know, more than a life time thinking about what maths is, I don't think it's possible to put it into like simple logic.

REFERENCES

Appelbaum, P. M. (1995) *Popular culture, educational discourse and mathematics* (Albany, State University of New York Press).

Greenwald, S. J. & Nestler, A. (2004) Using popular culture in the mathematics and mathematics education classroom, *PRIMUS - Problems, Resources, and Issues in Mathematics Undergraduate Studies*, XIV(1), 1-4.

MacLure, M. (2003) *Discourse in educational and social research* (Buckingham, Open University Press).

Mendick, H. (2006) *Masculinities in mathematics* (Maidenhead, Open University Press (McGraw-Hill Education)).

Potter, J. & Wetherell, M. (1987) *Discourse and social psychology: beyond attitudes and behaviour* (London, Sage).