

‘SOMETIMES I THINK WOW I'M DOING FURTHER MATHS...’: TENSIONS BETWEEN ASPIRING AND BELONGING

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Students draw on educational and social discourses of quality when they aspire to study further maths A-level. Historically these discourses are associated with privilege and inequity since many schools do not teach this subject. One recent government-funded project has set out to redefine knowledge about doing further mathematics. I use one student's account to illustrate how the practices of further mathematics engage with practices of the self. The reasons given for aspiring to study further maths are linked to claims for belonging in maths. They also raise challenges to belonging. Students face the choice of exclusion or aligning themselves with a neoliberal model of self-improvement.

BACKGROUND

There is a small but prestigious qualification for school-leavers in England and Wales that informs access to elite universities. This is Further Mathematics A-level: usually shortened to Further Maths (and officially capitalized). Over the last thirty years, Further Maths has changed in structure but remained at the centre of overlapping discourses about rigorous mathematics and widening participation. This inspired me to examine the ways in which one particular context can inform us about quality and equity in mathematics and how they are linked to western, liberal understandings of aspiring and belonging as practices of subjectivity.

A-levels are the traditional academic qualifications in England and Wales, taken by 40 per cent of students at 18+. Students usually specialise in three or four subjects over two years. Mathematics is one such subject and, uniquely, supports a second qualification. Further maths is a relatively stable, minority subject in a changing educational environment; its longevity heightens its visibility and positions it as an objective educational measure. It is thus given a gold-standard construction of quality: the gold-standard only has meaning because we no longer pay in gold but, by evoking the rationale of calculating back, it continually reinvents itself. So in further maths we have stories of a past golden age in which students were well-prepared in science subjects and competed to enter mathematics degrees; and these stories have currency today, even as we accept that practices have changed.

The practices of further maths also construct issues of equity. Students do not have equal access to studying further maths: they are constrained by ‘individual’ factors such as prior attainment, and ‘social’ factors such as school resources. Alongside official knowledge about A-levels, teachers and the media frequently disclose a hidden, ‘expert’ knowledge that certain subjects have greater exchange value, and these include further maths. White, middle-class students tend to seek more expert advice about their choices and choose these high-status combinations. Information

about further maths is thus differentiated by class and ethnicity. Moreover, student choice is constrained by what schools can offer. Students in state comprehensive schools are 3 times less likely to study further maths as those in independent and selective schools (Vidal Rodeiro 2007). Further maths is thus a context in which individual differences in opportunity, treatment and outcome are made visible as structural differences between schools, and it poses a problem to neoliberal explanations of social inequity as individual choice. My research examines a recent project to promote further maths to students and schools, the government-funded Further Maths Network (hereafter FMN), which ran from 2005-9. The FMN provided branded promotional and teaching resources and regional centres that recruited locally, employed tutors and collected data. These two distinctive features, branding and local expertise, acted as ‘selling-points’ to schools. Heads of maths effectively subcontracted further maths teaching for a group of their students. In return, the centre agreed to teach on a concentrated schedule, typically a weekly 2-hour after-school session.

My research traces how further maths has been reworked through the changing institutional technologies of the FMN, and in the practices of students and teachers. These new knowledges about ‘doing maths’ (Mendick 2006) in turn construct, and are constructed by, the ways that students experience themselves as aspiring and belonging to the identity/ies of further mathematics student. In this paper I use one student’s accounts of his experience to exemplify how representations of further maths as an ‘imagined community’ (Anderson 1991) intersect with liberal ‘practices of the self’ to enable and disable choices about how and whether to belong.

METHOD

My theoretical base is a poststructuralist perspective. I insist that power circulates within local practices: it is at the levels of schools, teachers and individuals that knowledge is constructed and reconstructed about *who* can study further maths and *how*. I aim to take Further Maths out from its capitalised seclusion, and examine how (small-f) further maths is constructed by practices, technologies and talk, and so open to questioning and revision rather than closed off behind an official meaning. Martin (2006) suggests that the best way to understand equity is to ask how students live and explain their day-to day experiences of mathematics in relation to school, community and sociohistorical contexts, and how this interacts with the senses of the self that are have meaning for them. I find this compatible with a poststructuralist methodology, analysing in detail “what is given to us as universal, necessary, obligatory” (Foucault 1991, p45), and how it co-exists with whatever is presented as “singular, contingent, and the product of arbitrary constraints”.

My analytic focus is what Foucault (1990) calls ‘practices of the self’: the knowledges and processes that inscribe what it means to be a successful individual within a particular history or culture. Practices of the self establish the norms and means by which people explain themselves, govern themselves, and engage with

others. I have explored the intermingling of discourses of further maths and discourses of the self by analysing textual data that gives accounts of choosing and studying mathematics and further maths. This data comes from 31 interviews and follow-up e-mail questionnaires with twenty-four students in three FMN sites, chosen for their differing sociogeographic settings and further mathematics teaching practices. The sites were in a London borough, a market town and an industrial city; students either met at a weekly FMN lesson to study AS-level over two years or were visited by a FMN tutor and could pursue the subject to a full A-level. The participating students belonged to seven different ethnic communities; ten were girls and fourteen boys; some were working-class by parental education and employment; others middle-class. There is not space here to discuss effects of gender or community but this overview shows that I found no 'standard' profile of a FMN cohort. Although I go on to consider participation in further maths in terms of individual choices, it is worth noting that it was at school level that students were first excluded from further maths and then included via the FMN.

Students attended semi-structured interviews in year 12, and again in year 13 for A2 schools, with half-termly emails in between. I asked direct questions about choosing AS subjects, how their class interacted in lessons and how they fitted in with others in their class or who they had met at FMN events. I was concerned that students should have opportunities to take up and compare different subject positions so I also included indirect questions that involved talking about school and mathematics in unfamiliar ways. For example, I asked students to select from a list of adjectives (such as *disciplined, crazy, independent*) to describe themselves as learners, and talk me through their reasons. The emails asked standard questions, eg reflecting on A2 choice at the beginning of year 13, and also allowed me to follow up interesting responses in a reflective email conversation. I coded the students' accounts for descriptions that suggested collectives, such as further maths students, family and friendship groups; then summarised how and in what contexts they positioned themselves as belonging or not belonging.

I have chosen one student, Mario, to discuss here because he often appeared uncomfortable with seeing himself as a further maths student. He positions himself very explicitly in relation to collectives of maths and further maths, and illustrates some of the tensions there are in belonging to those collectives. It is his quote that gives my title:

Sometimes I think Wow I'm doing Further Maths, but then I think am I actually doing any good?

In our conversations Mario positioned himself variously as successful and as struggling, as a natural and as an outsider, and tried out different ways of justifying his decisions to continue. I interpret the ways in which he argues whether doing further maths is 'doing any good' as examples of what he aspires to by doing mathematics, and thus how he participates in constructing quality. Mario also describes the practices and positions that he sees as threatening his engagement in

mathematics. I see these personal accounts as examples of the ways-of-knowing which individual agencies make use of thereby contributing to re-creating discourse and re-forming social patterns.

MARIO: ASPIRING AND BELONGING

Mario lives in the centre of a relatively deprived English industrial city. The somewhat run-down school he attended until age 17 was replaced by a new business-sponsored academy that specialised in mathematics and science. Mario is White and his family show characteristics of both middle-class and working-class cultures (Ball, Maguire, and Macrae 2000): his father is employed in engineering and insurance, and his mother as a secretary, neither attended university, and he receives a government education maintenance allowance. Mario's passion is rock guitar. He and his best friend, Randall, both dream of making the improbable happen and finding a career in music production.

Mario started year 12 with maths, chemistry, physics and further maths AS-levels. After he had chosen those subjects, the further maths teacher fell ill and Grants arranged weekly after-school tuition with the FMN instead. For year 13 the academy appointed a new teacher to take on Mario's maths class of eight students and his further maths group of four. Mario also dropped chemistry before year 13, so that further maths joined physics and maths at the core of his school experience.

Mario and Randall take all the same subjects, and chose to be interviewed together. They interrupt and predict each other's talk in a way that emphasizes how their experiences of learning have been jointly constructed around shared ambitions and interests in and out of school. In particular, in year 12 they tell me that they make choices together: *our choices are like influenced because we love music.*

Aspiring: using maths to be an individual in education and beyond

In his first interview Mario describes his initial subject choices as based around maths – the *four core Maths subjects*. He presents evidence he has gathered to support this claim for the centrality of maths: all university courses want high grades in maths, and maths *comes into everything*. His claims for maths are based on its power as a widely accepted currency and a knowledge that will be relevant even – and especially – when he attempts a more idiosyncratic career linking science and music. Mario then describes further maths as a way of proving that he can make a success in unexpected ways:

First of all when I said about Further Maths my mum was ... 'This is... No, you can't do it.' And I was okay at Maths at GCSE but never like that star, that everyone else was like getting full marks all the time. And when I said Further Maths she was quite shocked and didn't think I could do that. And that made me want to do it even more.

Here Mario ascribes his mother's doubts to measurement in the national examinations at 16. The tests position him compared to others and so can be understood as excluding him. I have suggested above that further maths invokes quality as a gold-

standard. Mario draws on this representation to challenge the measurements of GCSE: for him, choosing further maths is a way of standing out as being different but just as good or better than other people. He has however set the stakes high by making a comparison with ‘full marks all the time’. I suggest that the sociohistorical context that positioned further maths as rarified because it was restricted to certain schools, has been reinterpreted as a practice of individual choice so that further maths aligns the chooser with extreme personal qualities of ability and dedication. It offers a possibility of measuring oneself against what seems to be an objective standard rather than against other students.

Although the first implication of his choice is to stand away from school measurements, Mario also argues that further maths conforms with school’s expertise and technologies. He describes how his work-experience mentor encouraged the academic route to his dream; he could take a physics degree and then work with sound either on stage or acoustic consultancy. Mario cites universities as telling him further maths is the right preparation for physics, and his teacher’s view that it gives you a head-start at university. The reasons, and their authoritative institutional sources, suggest that he is aspiring to a breadth-plus-depth construction of quality. He aspires to study further maths because it is broad enough to provide both academic certification and application in a ‘real-life’ setting, and because it is deep enough that he can use it for a ‘head- start’, making sure that he is included in the niche he has picked out as desirable.

Belonging: further mathematicians as the archetypal maths student

For Mario, maths is a rational choice in two, connected ways: it is about *right or wrong answers*, and it provides and denies access to certain careers. This absolute binary structure carries over to define collectives of maths students. There are two kinds of students studying maths: those who really belong and those he positions as less rational, the people who just *choose it on a whim*. He sees the dependable, rational structure of maths as making it objective and accessible to him - *you can see what you’ve gotta learn* – but he also needs maths as a tool for exclusion: not everyone can be equally enabled by this structure. This means that his statements about belonging have to be made boldly and require a positive modality: for example *we are a lot more clever than them*, and *you’ve just gotta be so dedicated*. For Mario, doing further maths is a way of demonstrating the depth of his involvement in mathematics. He stresses that *it’s the hardest subject*, that *it helps, really helps* at university, that by doing it *we are immediately more mature*, that he may get told he is a *geek* and *insane* but *this in turn makes me feel more determined*. Using this kind of statement Mario constructs further mathematicians at the extreme of mathematicians but also at the centre. I picture him as placing them at the very top of a conical heap. By aspiring to further maths, Mario legitimates his claim to belong to maths itself. At the same time he awards himself approved qualities such as cleverness, maturity and determination.

Challenges to belonging: doing cool and doing clever

There is both pleasure and surprise in Mario's 'Wow, I'm doing Further Maths'. However he is more frequently concerned about how others construct maths and further maths collectives, and how he might not belong. When Mario's AS grades were lower than he wanted, he was once again threatened by measurement. Other students in the class excused their low grades by citing reduced teaching time. Nearly all stopped further maths; but Mario and Randall continued. At the end of their second year I asked why they had chosen differently. During the discussion (lines 576 to 649), Mario deals with conflicting understandings of what studying further maths means to them and about them:

577 We were a lot more clever than them.

594 I think a lot of people say it's the hardest A level.

596 And everyone knows it as well. Which makes us feel cool...

602 It's just it's... I didn't mean it makes us feel cool, it makes us look stupid.

622 And it doesn't make you... People makes ... think it makes you a genius.

624 We should be really clever, but something about it, maybe a bit of common sense, like we just... sometimes we just, like maybe the time of the day, or what mood you are in, but sometimes we feel really stupid.

In this exchange, Mario is conscious of how further maths can position him and Randall as clever, cool and different-but-not-alone. These feelings are described as resulting from common choices and so personal to *both* of them. Further maths starts as a way for Mario and Randall to mark themselves out compared to others through belonging with 'the hardest A-level'. But Mario ends up worried about the exclusion that is implied by this emphasis on difficulty and depth. He recognises that 'it' – maybe further maths itself, maybe what 'everyone knows' about it – compares him with the 'genius' model he has just helped to build. Mario not only has to defend his sense of belonging against structural threats such as AS grades but also against how he explains his self-practices to himself. If he doesn't 'feel' clever, how can he belong? In line 624 he calls up an explanation which supports two interpretations: either self-doubts are momentary irrational lapses from cleverness, or cleverness is not related to common sense and practical experience, and further maths does not have the 'broad' application that he originally aspired to.

Mario is also concerned by the way that schoolteachers portray further maths. Describing students collectively is a common classroom practice. Mario described his resentment when teachers asked questions which the class could not answer – something that was a pedagogic problem for the *whole* class or for the teacher – and then diverted responsibility onto the further maths students. His physics teacher would typically address a question first to the whole group, then again to maths A-level students, and finally end up asking the further maths students. This progression reinforces the embedding of further maths students as archetypal mathematicians. It constructs them as more able and/or more knowledgeable than other students but still less knowledgeable, though not necessarily less able, than the teacher. The repeated

questioning suggests too that there are reasons for their lack of response, perhaps they are too shy or self conscious to contribute in class or are not as knowledgeable as they should be; it calls attention to this and holds them to account for it. So Mario, and other individual further maths students, feel that they are the ones positioned as at 'fault' when the larger group cannot answer the teacher's question. They are constructed as failing: either as not really belonging in further maths, or as belonging but embarrassed to admit it, or as belonging to something that is useless. Mario and Randall particularly object to their physics teacher positioning their further maths knowledge as deeper than other school knowledge. They recall their teacher's words and how they felt in response:

M 'You should be learning' ... 'You should know this; you do Further Maths'. But we just learnt about complex numbers, we haven't learnt about...

R Yeah. We just learnt about the root for minus 1, don't they? Not how to... Not what black matter is or whatever, dark matter.

Here they are not only resisting the way that they as individuals are being associated with the teacher's personal representation of what further maths students 'should' be, but the way their collective school further maths experience is being represented in terms of obscure learning such as 'dark matter'.

Belonging as inauthenticity

In the previous section, I showed how Mario articulates the dangers of being potentially excluded by other people's constructions of further maths as well as his own positioning of it as being something worth aspiring to. In both of these it is how further maths is how positioned as achieving quality through depth that serves to exclude. In his experiences of learning maths in school, these positions dominate the discourse at the expense of the alternative position that further maths achieves quality through breadth of application. Images of depth such as 'genius' or 'dark matter' call on wider social images (Mendick, Epstein, and Moreau 2007) of the mathematician as an outsider who risks losing touch with society, whereas Mario had aspired for maths to include him in a specific masculine social role. Mario takes this risk of losing touch inside himself and rephrases it in terms of his personal qualities when he wonders:

whether I'm patient enough to actually go through all the Physics and stuff, and be good, really good at it at the end, or go straight into it and build up experience in it.

Here he is linking education with having to be 'really good', and contrasts having to 'go through' a degree course with actively 'building' authentic, direct experience. Staying in post-compulsory education, and studying more abstract disciplines are the types of choice that re-produce structural class inequalities (Atkinson 2007). Here Mario is constructing them as threats to belonging based on a potential 'true' understanding himself as practical and concerned with the present. Later in this interview Randall, too, positions studying maths and physics as inauthentic, and

suggests that by opting for a university route Mario is excluding himself from their dream:

Randall: I'm going to be there. But Mario's gonna be like working out all these equations.

Mario: And I'm gonna be paid ten times more than you.

Randall: And I'm gonna be the happier one. It's not all about money Mario.

Mario: No. I'm gonna be happy.

Mario has to go on the defensive. He uses maths to make a claim for economic success but Randall excludes him not just from practical experience but from happiness. Gaining self-knowledge so that you can pursue personal happiness is central to neoliberal subjectivity (Rose 1999). Here the construction of further maths as desirable-through-depth reappears as a tension between understanding oneself as excluded either from maths or from one's authentic self.

Working at belonging

Despite these threats to belonging, Mario makes a final push for success in maths and further maths. He presents this as having to work on himself by changing his past practices: *I'm trying just to picture in my head what it's gonna be like getting the results and knowing that I've worked as hard as I could have like now, this time.* He describes motivating himself by recalling previous personal emotions, such as *I know the feeling that I'll get in the summer,* and imagining family disappointment: *my mum paying for my re-sits,* and he changes his previous attitude to finding a tutor:

through GCSE and AS I never did because I thought, oh I just wanna do it myself, you know get things done. But then I thought comes August and I think, what if I haven't achieved could I have done any better, so I thought I'd give it a try.

Through these and other descriptions of his efforts in further maths, Mario suggests that he can belong through changing who he is. He puts aside the images of 'effortless achievement' (Jackson 2006) that accompany the genius model of further mathematician, and instead firmly promotes effort as the way to align oneself with further maths. Further maths involves personal qualities such as intuition - *you've gotta be very intuitive* to know how to tackle the questions, and *the maths side has to be natural to you.* However rather than accepting these qualities as being located in himself as an outsider individual he now stresses how that performance depends on engagement and work: *I need to be quicker. And that's linked to being natural, having it natural, coming naturally to you. And that comes from experience, and that comes from time revising.* He is starting to see what is natural to him as subject to continued work, demonstrating his adherence to a neoliberal view of life as a project. Belonging in the further maths collective becomes part of identifying and acknowledging essential characteristics of one's maturing self so that by year 13 Mario says: *I can't believe I even considered dropping it.* Although Mario has been unsuccessful in using further maths to challenge the public gaze of examinations, he

now uses it as a way of exercising the autonomy over what appears within his control: in his words, to *mould myself*.

SUMMING UP

I have used Mario's account to introduce representations of mathematics and further mathematics students, and illustrate how an individual can position himself as in relation to these actual or imagined collectives. These representations and positions were not unique to Mario, but he voiced them particularly clearly. He and Randall were the only two students in my study to continue with A2 further maths despite getting some low AS level grades, and certainly led them to question what they were getting out of the experience. I have summarised five themes in Mario's accounts of his relationship with maths, further maths and other collectives. First, aspiring to study mathematics is a means of controlling how one is valued as an individual in education and in a competitive, masculine, 'real' world such as rock music; second, representing further mathematicians as archetypal maths students positions doing further maths as a means of belonging in maths. Thirdly I note that the practices of 'doing cool' and 'doing clever' that support these aspirations equally construct challenges to belonging, and are negated by public effort or muted success. Rejecting further maths as obscure and deep is a way of protesting against these challenges but can position continued belonging as inauthenticity. Finally, accepting the need to work hard in further maths devalues it as a way of claiming success outside education but allows a position as a maturing identity-worker.

Mario and Randall are caught in what Hall calls the 'deep ambivalence of identification and desire' (1992, p255) that results from meeting collective representations of your group that are created by dominant discourses. Identification with such collectives involves internalising the 'self-as-other'. Hall gives the examples of the ways that black men both fear and desire the representations of noble savage and violent avenger constructed by racism, and women produce and contest the representations of weak and feeble females and strong castrating women. So further mathematicians, like Mario, want to belong to further maths in part because they want power over unspecified future knowledge, but they are only too aware that it cannot offer them guarantees and certainties. In Mario's case the image of the able, committed, archetypal further maths student is so dominant that it too produces a doubling of desire and fear. He aspires to wield the power of this position and particularly its privileged access to the kind of niche of cool, individualized masculinity suggested by mathematics, rock music and sound engineering. He reconstructs this representation of further maths in setting out the qualities that attract him as breadth-plus-depth: breadth of application that extends beyond school and connects him to the physical world, depth of learning that offers him a measure by which he can claim to belong. Problems arise for Mario because the ways in which he can show that he belongs to school further maths - by studying hard and by accepting that he needs help of tutors and teachers - are in tension with the reasons he aspired to do the subject.

Mario described his final push for success as deciding to change how he thinks about himself and his goals. In the process of including himself, he strips further maths of the quality of separateness that once attracted him, complaining that 'it should just be called different modules'. Excellence and depth are powerful constructions, but knowing how to include ourselves is accompanied by consciousness of how to exclude ourselves. It would be easier to continue further maths if it was practised and promoted as offering quality as breadth.

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