Choosing more mathematics: happiness through work?

Cathy Smith
Homerton College, Cambridge and IPSE, London Metropolitan University, England.

Homerton College, Hills Road Cambridge CB8 2PH; cas48@cam.ac.uk

This paper examines how A-level students construct relationships between work and happiness in their accounts of choosing mathematics and further mathematics A-level. I develop a theoretical framework that positions work and happiness as *opposed*, *managed* and *working on the self* and use this to examine students' dual engagement with individual practices of the self and institutional practices of school mathematics. Interviews with students acknowledge four imperatives that they use as discursive resources to position themselves as successful/unsuccessful students: *you have to work, you have to not work, you have to be happy, you have to work at being happy*. Tensions in these positions lead students to rework their identities or drop further mathematics. I then identify the practices of mathematics teaching that students use to explain un/happiness in work, and show how *dependable mathematics* and *working together* are constructed as 'happy objects' for students, who develop strategies for claiming control over these shapers of happiness.

Keywords: postcompulsory mathematics; identity; neoliberalism; participation

Background

Participation in advanced mathematics is a matter of ongoing concern in England and Wales (Matthews and Pepper 2007). Mathematics is promoted by the government as "the key for building a strong economy and highly skilled workforce" (Wright 2009). Much of this policy concern is aimed at encouraging 16-year olds to continue some mathematics, and rightly so, but there is also a focus on "our very brightest young people" studying mathematics and science A-levels who "by doing so are ensuring that Britain has a bright future" (ibid). In such comments, policymakers blur the two different arenas of global competition and personal life-trajectory. They evoke the certainties of economic discourse to persuade individuals to choose mathematics for their own future goals, and use the aspirations of individuals to 'brighten' political imperatives. This rhetoric has inspired me to reflect on how work, choice and happiness are related in discourses of education, and how these discourses contribute to young people's developing identities. There is a wealth of recent sociological research that theorises the relationships between

'labour' and 'rewards' at a social level, and work, effort and life-goals at an individual level (e.g. Ball, Maguire, and Macrae 2000; Jackson 2006; Rose 1990). This paper investigates the particular context of further mathematics A-level, with the dual aims of testing the explanatory power of these theorised relationships and using them to examine a recent initiative to promote mathematics.

Further mathematics

In England and Wales, A-levels are the academic preparation for university education, taken by 40% of 16-18 year olds. Students typically specialise in only four subjects in the first year, leading to 'AS-level' exams, and continue three subjects into the second, 'A2', year. The aggregate of AS and A2 assessment gives an A-level qualification in each subject.

Mathematics is unique amongst subjects in having two separate but dependent A-levels: 'Further Mathematics' extends the 'Mathematics' A-level curriculum by developing content in algebra and calculus, and including a wider range of applications. Since the 1960s, it has played a narrow but significant role in identifying academic achievers and preparing them for mathematically demanding degrees. Traditional mathematics education research (e.g. Kitchen 1999) has understood institutions (such as universities) as strategic agents using the positioning power of further mathematics to select from a pool of passive candidates. Recent education policy takes a different stance and represents students as active in their education, enabled by the further qualification "to distinguish themselves as able mathematicians in the university and employment market" (FMNetwork). Perhaps this empowerment inspired students *not* to offer themselves up for selection or exclusion. Further mathematics numbers plummeted

steadily from 15,000 in 1985 to around 5000 candidates in 1999 due to changes in student choice-patterns and A-level teaching structures, particularly in state schools.

In response, a national government-funded initiative, the Further Mathematics Network (FMNetwork), ran from 2005-9 with the aim of promoting and providing tuition in further mathematics. Participation in further mathematics more than doubled during this time, with the greatest growth in state schools (Searle 2008). From a widening participation perspective it is valuable to ask who these new students are, how they explain their decisions to study more mathematics, and how school and social practices affect their experiences.

There are several recent analyses, both qualitative and quantitative, that map trends in who chooses mathematics A-level. National surveys show that students from minority ethnic groups or from higher socio-economic classes are more likely to choose mathematics and to consider it important (Vidal Rodeiro 2007); that boys are more likely to enter mathematics A-level than girls given the same prior attainment (Noyes 2009); and that most mathematics students are all-round high-attainers (Matthews and Pepper 2007). Hernandez-Martinez et al.'s (2008) large-scale regional survey indicated relationships between students' cultural background and the reasons they gave for choosing mathematics: choosing mathematics for personal satisfaction was more common amongst White middle class students, while choosing mathematics to become successful was more common amongst ethnic minority groups.

Trends give us an overview, but not all clever students want to continue mathematics and not all those who struggle give up. Focussing on individual accounts adds to survey research by exploring the relationships between individual agency and

particular school, community and socio-historical contexts (Martin 2006; Cobb and Hodge 2002) and how these bear upon students' powers to position themselves (Mendick 2006). In this approach, the unit of analysis is not the individual, but discourse as used by individuals: the pattern of relationships between what students can or cannot say about studying further mathematics and the power circulated in authoring those positions. Discourse involves both language and practice so can be sensitive to local differences such as those that exist between school and FMNetwork teaching practices. FMNetwork students typically take further mathematics as a fourth or fifth subject, attending one 2-hour after-school lesson per week taught by a visiting FMNetwork tutor. The lessons may not be on their school site, and they may bring together students from one or more schools. In contrast A-level mathematics has four hours per week; it is taught in school, by teachers familiar with the school's culture and technologies. It seems likely that these differences in the spatial, temporal and social practices of schooling (Beard, Clegg, and Smith 2007) produce different tools and tensions for constructing student identities, and these in turn structure who continues with mathematics.

Theorising work and happiness

The relationship between work and happiness is central to 'practices of the self': the processes that inscribe what it means to be an individual within a particular culture (Foucault 1990). In post-industrial Western society, these processes are structured as a set of choices by which individuals position themselves economically, socially and psychologically (Rose 1990). We work on our identities by making choices and by explaining them to others and to ourselves. Choosing is a practice which tells us that we are agentic individuals, but our choices are made in social and discursive contexts that

construct knowledge in particular ways. Agency and structure are thus interlinked in subjectivity. Mendick (2006) illustrates this reflexivity of discourse in her analysis of how A-level students 'do' mathematics as a way of 'doing' masculinity. Choosing mathematics allows them to express something about themselves and, in performing that chosen identity, they use and reproduce knowledge that associates mathematics – powerfully – with men.

The model of an autonomous individual expressing selfhood by choosing amongst similarly-weighted options draws its roots from a white, middle-class perspective on individual subjectivity. However it is not restricted only to white middle-class individuals, but produced as universal through the technologies of the media and education. Identity narratives reflect class positions (Skeggs 1997) and ethnic community knowledge (Martin 2006). Individuals can resist and adjust such dominant positionings but cannot ignore them: it is in this sense that I refer below to discursive 'imperatives'.

For Foucault, work and happiness are simply two examples of discursive concepts involved in practices of the self. I have focussed on them in my analysis because of their prevalence in educational discourse and sociological theory. Teachers and students are enormously concerned with managing work: as a synonym for learning, as an output and as a process. We are used to hearing layered messages about work and its goals. In one A-level lesson I observed, the teacher started by reminding students that they must work very hard in mathematics, and then presented the rest of the lesson as ways to make work 'easy'. This was familiar practice that only became 'strange' when I used a theoretical tool to analyse talk about work. I use this example to illustrate how classroom discourse calls on different constructions of the relationship between work and happiness, and that

this can cause tensions: is it desirable to make an effort, or to avoid it? What desires, and whose, are being enabled by such practice?

Sociological theory offers help in unpicking these messages. The seemingly 'natural' relationship of work and happiness in education is that they are opposed to each other. Analysing the 'spirit of capitalism', Weber deems a personal ethic of life-long work to be "irrational" from the "viewpoint of personal happiness". A person acting autonomously would work sporadically and for immediate gratification. Weber suggests that education is the necessary "long and arduous process" (1930, p62) that constructed individuals as the workers of capitalist society. The importance of this theory to me is not its historical accuracy but its lingering discursive power: it positions the naturally uneducated – school children – as individuals who have to be taught to work beyond what they enjoy. Their resistance is assumed but will always fail because capitalist economics is positioned as inexorable. This relation leaves traces in adolescent discourses such as 'uncool to work' (Jackson 2006). When students emphasise their opposition to schoolwork, they position themselves both as autonomous dissenters who refuse a dominant discourse and as part of a 'natural' community who find work unpleasant. Balancing both positions allows them flexibility in their contestation of power.

This construction of work and happiness as 'opposed' is the first of three constructions that I have used as categories for analysing student talk. I have introduced it as a way-of knowing that challenges schooling; but it is also used to reproduce positions of conformity. A familiar example is the promise of deferred gratification obtained by studying mathematics in order to gain qualifications or a prestigious career. This reconstructs the natural conflict between happiness and work by positioning work in

the present as an unhappy experience that can be offset against future gains, but only by conforming individuals. Thus each discursive construction can permit more than one way of positioning individuals; and my analysis examines not just *what* relationship is used but *how*.

My second construction is that of 'managed' work permitting individuals to be happy. Bauman (2001) suggests that individuals naturally find pleasure in their own work, with the key role of mass education being to habituate them to an ethic of working *with* and *for* other people. He sees work and happiness as co-existing for individuals in certain circumstances, typified by independent craftsmen, so it is the *conditions* of work that need managing. In his analysis of twentieth-century western governance, Rose (1990, p119) explores the growth in practices designed to align happiness with work. Schools and workplaces are increasingly structured by "institutional technologies" that mitigate the unpleasant aspects of work: technologies such as ergonomics, fitting the right person to each job, choosing the right subjects. Schools become necessary for this management because they are expert in selecting the right individuals for the working roles needed by society, and providing them with tools and circumstances so they can both work and be happy. The move towards managing work is accompanied by a change in the understanding of happiness not as a passive state, a 'hap' that occurs by chance (Ahmed 2008), but as a goal. Two approaches to happiness are typical of Western post-industrial modernity: "the proclamation of pleasure, or happiness, as the supreme purpose of life, and the promise made in the name of society and its powers to secure conditions permitting a continuous and consistent growth in the sum total of the pleasure and happiness available." (Bauman 2001, p82).

My third significant construction of work and happiness follows from this goal of happiness and the neoliberalism of recent UK social policy. By neoliberalism, I mean a way of understanding the working of society and politics that constructs the process of governing as guiding and regulating free individuals in a quest for mutual – although not equal – economic success (Rose 1999). This position returns us to choice as a way of expressing individual identity, because choosing is itself viewed as work that we do in pursuit of happiness. Rose suggests that in seeking to explain ourselves and our choices, we equate work *for* ourselves with work *on* ourselves in a "biographical project of self-realization" (ibid, ix). Since work is then both psychological and economic, happiness becomes the same as success:

> The antithesis between managing adaptation to work and struggling for rewards from work is transcended, as working hard produces psychological rewards and psychological rewards produce hard work. Rose (1990, p119)

As Rose makes clear, this neoliberal incorporation of work and happiness into identity work does not replace other understandings but is layered with them. I suggest that these three theoretical constructions of work as *opposed to* happiness, *managed for* happiness, or *work on the self* allow students to take up multiple and overlapping positions within the discourses of selfhood and mathematics learning. Work and happiness function as discursive tools that we can use in combination to explain ourselves *to* ourselves and to others. This paper examines how FMNetwork students use these positioning tools in accounts of choosing and studying mathematics and further mathematics. I ask:

- How do students describe work and happiness?
- Which institutional practices in mathematics/further mathematics become practices of the self that matter in producing positions as mathematics students?
- What tensions are there in how subjectivities are constructed in mathematics and further mathematics and how are they resolved?

Method

The data comes from 31 interviews and follow-up e-mail questionnaires with twenty-four students in three FMNetwork sites, chosen for their differing socio-geographic settings and further mathematics teaching practices. Almost all further mathematics students at each site agreed to participate in my study, plus two mathematics-only students. At one site, Capital, seven participating students from five schools met at a weekly FMNetwork lesson to study AS-level over two years. Two were girls and five boys, belonging to six different ethnic communities; they had low socio-economic status and were in small A-level mathematics cohorts at school. The second site, Grants, was a new business-sponsored school which had subcontracted students' further mathematics lessons to the FMNetwork for one year in response to a staffing issue. Here the seven participants, one girl and six boys, came from local, established Asian and White communities employed in retail or industry; mathematics was a popular AS-subject in this school. The third site, Moorden, was a market town where two secondary schools with thriving A-level cohorts had joined the FMNetwork to offer their students further mathematics A-level as an after-school extra. The ten participating students included nine White and one mixed White/Asian student; seven girls and three boys, and they had mid- to high-socioeconomic status. There is not space here to discuss effects of gender, ethnicity or class but this overview shows no standard profile amongst three FMNetwork cohorts.

My research data consisted of accounts of A-level experiences and choices, collected using semi-structured interviews, half-termly emails, and observations of two to six further mathematics lessons in each site. The students were interviewed by me either singly or in groups of two or three by their choice, once during their AS year and again in the second year for A2 schools. I included direct questions about choosing subjects, how

their class interacted in lessons, how they personally had worked on a topic, and memories of learning mathematics. I also asked 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 *warm, talkative, cloudy*) to describe school subjects, and explain their reasons for picking them. Using email I could ask questions at significant times, e.g. when choosing subjects to continue to A2, and follow up any interesting responses in a reflective email conversation (Mann and Stewart 2000). My observations documented lesson practices in mathematics so that I could trace their interactions with student accounts.

The analysis involved selecting and coding descriptions of work and happiness in the student accounts, reviewing coded text to summarise how and in which contexts individuals related work and happiness, and then reorganising the data by emerging themes. These themes identify relationships between 'what can be said' and the power effects of saying it, and characterise a discourse of choosing further mathematics. I selected them because they were used to some degree by all the students, and in identifying the relationships I included the effects on students of saying something different. Individuals used different characterisations of work and happiness at different stages of talk, in contradictory or supportive ways. Since the analysis focuses on the relationships that form discourse it would be invalid to allocate individual students to themes. What an individual says is determined not only by that individual's position but by others' positions and what others can say about and to them. Here however, I have selected data excerpts to illustrate the themes from only ten of the students. This allows me to include some of the contextual details that places what they say about work and

happiness in relation to their choices and experiences in further mathematics. The following table indicates the site, study choices and pseudonyms of these ten students:

Site	AS Further maths	A2 Further maths
Capital	*Bob*	-
Grants	*Tom, AgentX*	*Randall, Simon, Helen*
Moorden	*Clive*	*Charly, Jodie, Paul*

Findings

The students' talk demonstrated their use of four thematic imperatives concerning work and happiness to explain how they govern their lives. They emerged mainly from the discussion of mathematics lessons rather than further mathematics, perhaps because it had the more central position in school life. I look at each of these themes below, and return to how experiences in further mathematics contributed to them in the section following.

You have to work:

All the students described how at times they had 'to put a lot of effort into mathematics', and found that doing this could be 'painful'. This opposition of happiness and work was presented as not needing any further explanation. The general question of whether you have to work at mathematics was, however, presented as arguable; it recurred often in their talk and especially in the ways in which they contested their own statements. For example, Charly contrasted the qualities that she shows in avoiding work with a growing awareness that it may be necessary:

> If my parents just be quiet and don't say anything I'll do the work 'cos I know I have to. But if they push me into it I just don't want to do it! I suppose lazy but not in the sense where I… I think I'm a bit complacent, I don't think that I need to work. And I think… Well I sort of know I need to but then there's a little bit of me that just thinks well if you don't, you're not going to do too badly so don't worry. But then that's so unrealistic 'cos you do have to really work to do well in your A levels.

Charly casts herself as satisfied rather than lazy. She is proud of her personal qualities of independence and confidence: stressing that they are what she naturally 'just thinks'. But alongside this, Charly constructs another position: work *is* necessary in mathematics and she is becoming realistic by accepting that. She emphasises that 'you do have to really work' and so associates herself with the authority and maturity of parents and teachers, critiquing her natural self as complacent. Here Charly is challenging the *opposed* relationship between work and happiness, and also drawing on it to do some *work on herself*. She constructs herself as someone who would naturally prefer to avoid work, and may be able to do so without repercussions, but also someone who reflects on her own goals and modifies her beliefs as part of becoming mature.

Jodie also acknowledges the existence of a position of effortless achievement in mathematics (Solomon 2009), but for her it is one she cannot occupy:

> You know some people just have the talent and can do it. Some people have that talent but they can't do it until they work at it. And I'm one of them people that has to try hard to do that work.

Jodie acknowledges the accepted power of 'talent' by placing it first in her argument, but then echoes 'talent' in her description of people who *do* have to work, challenging its predominance. When she describes a classmate who is proud of his easy understanding but also jealous of her better results, she is backed by the authority of her results to go further in this challenge and claim that his pride is a naïve individual position that ignores the structural power of technologies such as examinations:

> I guess it's one thing knowing the rules and it's another learning how to use them. I guess in a way because he knows the rules he thinks 'Oh I know that. I don't bother learning it' and you do have to. I don't think anyone can just walk a Mathematics exam. I think you do have to try it no matter who you are and how clever you are.

For Jodie this is an important claim for belonging in her mathematics class. She discounts the natural-seeming opposition of work and happiness, and becomes powerful through her understanding that you do have to 'bother'. Jodie does not try to change her self – in a

later interview she says that she still finds work frustrating - but she makes a claim to be successful through knowing and managing the technologies of learning mathematics. Although they position themselves differently as individuals – Jodie *needs* to work, and Charlie *chooses* to – both students use the imperative *you have to work* to indicate their maturity and engagement with the education system. They reject the place of effortless achievement in long-term success for themselves, but they simultaneously reproduce it as a means of including or excluding others.

You have to not work:

Above I have described how avoiding work is cast as a naturally desirable but immature preference in face of the imperative *you have to work.* However, not working was also constructed by the students as a position that one *had* to take. One explanation of this came with a light-hearted insult from Clive: you 'mustn't just be a little Kermit in your room doing work all day' . This was important to Clive because the amount of time he spent doing sport and paid work gained him respect from his friends and family, and also because of his view of himself as working to create a balanced life. So he claims: 'I could probably get five As. But I'd rather not be a sort of all working boy. I would rather have a life'. This kind of statement clearly draws on the *opposed* relationship of work and happiness, but Clive is also taking on responsibility for *managing* the conditions in which he works and the story he tells about himself, and thus I read him as engaged in *work on the self*. Clive's reflexive attention is similar to the 'onerous and consistent identity work' engaged in by 12-13 year olds aiming to 'have-it-all' academically and socially (Francis, Skelton, and Read 2009). During Year 12 Clive decided that mathematics required too much of his work-time and he tried to drop both mathematics and further mathematics.

His family and teacher persuaded him to continue mathematics by stressing the exchange value of an A2 grade. This tension remained influential however: when he chose an economics degree, he deliberately ruled out any mathematics-based courses that ‘would just drive me insane’. Clive used the *opposed* and *managed* discourses to suggest he does not work happily at mathematics and cannot imagine circumstances in which that is possible, giving up is the rational solution. Making that choice is a practice of the self that displays Clive’s capacity to act on self-knowledge.

The second reason students gave for *having to not work* was the social positioning of further mathematics students as having immediate effortless access to knowledge. Randall explained that his choice of subjects calls up an unrealistic imperative to be ‘a genius’: ‘I'm like 'Oh, well Maths, Physics and Further Maths'. They're like 'Oh. You must be a gen-...' No! You have to work hard at it to even –‘. He resents this representation of instant clarity because it does not match his experience of further mathematics as ‘all mixed into one’. His route to success is through hard work: ‘make sure you don't move on past anything until you absolutely know it. Keep on going back and revising it’. Randall has difficulties in representing himself as successful using any of the relationships between work and happiness. When he constructs them as opposed, then he is just like other people – ‘we all can be a bit lazy sometimes’ – so is not suited to the distinctive work ethic he sees in mathematics. When he considers how they might be managed, he blames the schools - technologies, teachers, lesson timings and physical conditions – for creating problems, and suggests they leave too much responsibility on him. Finally, the mismatch between his experience of effort and the imperative not to work, prevent him successfully ‘being/doing good at further mathematics’ as work on the

self (Mendick 2006). He expresses this frustration with jokes about esoteric obscurity: ‘We just learn about the root for minus 1, don't they? Not how to... Not what black matter is or whatever, dark matter’.

These tensions in working on himself have consequences for Randall’s choices. He is one of the few students who talks explicitly about pursuing happiness. When I suggest that his middling further mathematics grade is not properly valued within education, he disagrees – it is recognised but I'm not happy with it’ – and he introduces another space for pursuing happiness: ‘I think there's more factors involved in being happy than just your school work’. In the end Randall opts out of planning and university and hopes that a gap year will let him fall into something he likes. Despite his personal rejection of education he allows room for mathematics in his future: ‘[it’s] not necessarily the person I am but I will... I will use it, what I've learnt.’

These are two forms of the imperatives not to work; both described as coming originally from other people and the judgements that others might make. In each case the purpose of ‘not working’ is to display success to others and oneself. Both lead to decisions to stop studying mathematics: Clive because he is successful in constructing an all-rounder identity that precludes time working on mathematics, and Randall because he is unhappy with how his experience of working positions him compared to dominant discourses about further mathematics students.

You have to be happy.

Few students talked explicitly about an imperative to ‘be happy’ but their talk made constant reference to what they liked, preferred, and enjoyed, and this implied that happiness was a significant ongoing concern. One explicit use was in citing enjoyment as

the strongest imperative for making subject choices. Students associated it both with a general consensus and the advice that their closest relationships would give them: ‘my parents and stuff just mainly said to me – do what you are happy with’. At the extreme, work depended on enjoyment: ‘you are not going to do good in something you don't enjoy because you are not going to put in the effort’. The liberalism of such attitudes is considered to be characteristic of the White middle-class (Ball, Maguire, and Macrae 2000), but it was also the main criterion for subject choice given by the White working-class students in my study. The only real challenge to this imperative came from several ethnic minority students who described happiness as a secondary factor. Bob, a British-Asian student, described how he still regretted giving up his favourite subject, Art, because it would not qualify him for medicine or business. Simon, a British-Indian student, told me that although he didn’t enjoy working alone, he felt ‘better’ doing so as he was not able to make comparisons with others’ progress. In these examples, neither suggested that work could not be aligned with happiness, but described how they had managed their choices otherwise because of other imperatives. This corresponds to Hernandez-Martinez’s (2008)’s finding of a ‘becoming succesful’ repertoire amongst ethnic minority students. Simon and Bob’s narratives acknowledge that these choices to forego happiness need explanation, so they do not – maybe cannot – ignore the dominant cultural positioning of happiness in identity work.

You have to work at making yourself happy:

This is the imperative of neoliberalism, and students made it explicit by denying its ‘other’. They did not often admit to feeling unhappy (which would have contradicted the imperative above) but when I asked directly, they presented it as something to work on.

For example, in a pair interview, AgentX initially denied ever being unhappy but this is challenged by his friend, Tom:

> AX I suppose... I suppose … you're never unhappy. We're never unhappy.
> Tom During exams I've seen you unhappy. During the exams...
> AX *He* is unhappy moaning. Ok. He *is* unhappy. He moans... He sits in Geography like [yawn] 'Exam in five weeks time'. He moans a bit like that. Sorry Tom. But I've... Honestly I don't think I've ever been unhappy... ... You know, in schoolwork, maybe in an exam yeah, but in schoolwork I've never been unhappy...
> Tom You were unhappy before you got that Physics tutor.

AgentX first positions an abstract ideal student as never unhappy and then repeats this for himself and Tom, moving from 'you're' to 'we're' to position them both as ideal students. Tom contradicts him, challenging the legitimacy of the representation and/or AgentX's authority in making the claim, but softens the challenge by bringing in exams as special circumstances. AgentX counter-attacks; he accuses Tom of being unhappy and moaning even before exams. He knows Tom cannot accept this ('Sorry, Tom…'), suggesting that they both recognise the imperative to be happy in your work. Tom is still prepared to resist the imperative and admit unhappiness for both of them but only temporary unhappiness. When he acknowledges that AgentX worked on his unhappiness by getting a tutor, this is an acceptable positioning that ends the dispute for both. Their conversation then develops into describing AgentX's growing independence as evidenced by organising his own tutor. Working to resolve unhappiness is thus a practice of the self that shows autonomy and success. This imperative is significant for mathematics and any other challenging school subjects: if being unhappy demands a solution, sometimes the only solution is to give up. In the data excerpts I have already described, AgentX, Tom, Clive and Randall all suggest they are dealing with this imperative, and they were not unusual (nor were all examples male).

There are clearly tensions between these multiple imperatives concerning work and the neoliberal requirement to experience work as happiness. Not all the tensions were

problematic: using different identities at different times is also a way of constructing subjectivity. Charly and Clive, for example, negotiate their way skilfully between claiming personal empowerment and knowledge of how the world works. However some tensions were experienced as distressing and students sought practices and explanations to resolve them: Randall provided an example of this. The next section looks at two particular practices of mathematics learning that recurred as significant when students described problems of being unhappy in their work and what they could do to transform those experiences towards happiness.

Practices that matter in producing subject positions as mathematics students; tensions and resolutions.

The second phase of analysis considered the school practices that students juxtaposed with their descriptions of working in mathematics. I identified two sets of practices that students used repeatedly to contextualize explanations of why they were happy or unhappy in their work: the dependability of mathematics, and working with other people. Ahmed describes how "happiness is attributed to certain objects that circulate as social goods" (2008, p127), such as 'family'. Happiness is shaped by contact with these 'happy objects' and is intentional, directed towards them. Individuals work purposefully to keep these objects proximate, within their 'horizon of happiness'. I argue that 'dependable mathematics' and 'working with others' both function as 'happy objects' within school mathematics. To do this, I show how student talk attributes happiness/unhappiness to these concepts, and how the local contexts of mathematics and further mathematics teaching support these attributions and help or hinder students from claiming proximity. This discursive positioning of happy objects connects with my analysis of imperatives in the first section through the notion of self-governance. I consider students to be *managing*

happiness when they focus on the conditions and technologies that permit proximity to happy objects, and *working on the self* when they also rework what they say about their aspirations and feelings to achieve that proximity.

The two characterisations below were made in the talk of the majority of students, including students I have already introduced. Where possible, I have selected illustrative quotations from these same students because connections and familiar contexts add to the interpretation. However pertinent statements and opposing views were given by other students; these are included below but left unattributed unless biographical details are central to the argument.

Dependability

The first theme is the construction of mathematics as logically consistent, predictable and so dependable. Dependability supports students in aligning school-work with happiness by factoring out risks and uncertainties associated with time and chance. The certainties of mathematics discourse are borrowed to instil certainty into an individual's life-trajectory just as 'the charm of numberese' gives control over social futures (Sfard 2009). Practices that emphasise this knowledge include predictable exam tasks and the promise of high-status careers to mathematics students: these set up relationships between individual goals and the school curriculum as a means of achieving them. Students can use these technologies to manage the opposition of work and happiness. For example, Jodie enjoys applied mathematics modules because:

> It just seems to actually have a point and a purpose and a use, which makes me more interested. I guess that's. I can see it helping me get somewhere. I can do well in that, if I can do well in Mathematics and Further Mathematics it could totally change my future.

In this quote Jodie's vision of future success does not just allow her to predict happiness in the future; it positions her as feeling happy in the present. It fits with a neoliberal

collapsing of temporality which understands an individual as responsible for her life-trajectory by making current choices. Jodie expresses her desire to assert that personal control but also her hesitations: the final 'if *I* can' and '*it* could totally' resolve her personal uncertainties through the determinism of mathematics

It was possible to represent mathematics as dependable because school and examinations ensured connections between students' work in different settings and timescales. Students described their lessons as having 'safe', 'straight' progress from lesson-work to homework; from teachers' examples to students' follow-up work; from practice papers to exams; and from exams to grades. These connections mean that work can be depended on to give results: 'whereas in Mathematics you know what you've got. You can tell'. They also provided evidence that working was necessary:

> Whereas mathematics you have to work hard. I'm not saying that you don't in other subjects, but you have to do these questions, you have to know certain topics and you can't get away with not knowing one little bit. It is all connected, mathematics. It applies everywhere and one topic leads to another topic as well in mathematics. (Joe)

The recurrence of 'whereas' suggests a special role for mathematics as dependable in an uncertain world. Chance factors such as 'not knowing what you've got', or 'getting away with it' are eradicated, and there is the security that only people who don't work will fail.

In further mathematics, however, the pace of teaching meant students could not be sure that success in current work would bring success in the future; and this was used to illustrate unhappiness. Charly described 'normal' mathematics as making her feel 'warm' because 'even if I can't do it I still feel comfortable about the fact that I will be able to do it'. FMNetwork practices don't enable her to make similar claims: 'cos in further mathematics like we move so fast, if I can't do it I worry a bit'. Although Charly plays down her 'worry' in further mathematics, her use of contrasts attributes happiness to the dependable progress in mathematics.

This dependability also allowed students to manage their conflicts between having to work and having not to work, and again this was constructed as different in further mathematics. Early in AS mathematics Clive enjoyed the control he had about how and when he would work and could confidently state: ‘I have just got to put my head down a week before the exam, and get it in my head right’. He contrasted this with further mathematics where he couldn’t ensure that the time spent working would bring success: ‘I'm not going to sit there for two hours thinking; there's no point’. Other AS-year students also explained that they were used to having time to chat in mathematics lessons, knowing they could pick up enough in class to catch up at home. They complained that in further mathematics, ‘if you don't listen for one little bit then you don't know what to do’. High-achieving, popular students combine socialising and task-completion as working practices (Francis, Skelton, and Read 2009); so that a failure to do so is not simple laziness but a threat to a privileged identity. Several students interpreted this failure as the responsibility of the school for scheduling after-school lessons. By constructing further mathematics as a faulty educational technology they suggested that neither they as individuals nor their pleasure in dependable-mathematics were to blame for their failure to enjoy the lessons.

In all these examples, dependability is an object that both shapes happiness and is sought; it is a resource supported by teaching practices for aligning work and happiness. Further mathematics however challenges students to keep this happy object within their horizon of happiness. To borrow Ahmed’s (2008) phrase, further mathematics is a ‘conversion point’ – something that gets seen as turning good feelings into bad.

Working with others

Dependability appeared mostly in students' reasons for choosing and liking mathematics. Working with others, however, was a theme that appeared when they described what they had to and chose to *do*. All the students represented working with others as evidently pleasurable. Many represented it as part of their work on the self. For example, they found power and pleasure in helping each other and described this as progress to autonomy and adulthood. To some extent, then, working together can be seen as an object that shapes happiness independently of mathematics or education. For almost all students, however, interacting with the teacher and others was also described as central to learning: 'it helps you understand, to learn what they might say and then you might think that's what the teacher said and then linked together you understand it'. This kind of comment positions other people as important in the alignment of academic success and happiness.

A-level teaching practices contributed to this alignment by building social interactions into mathematics. Lessons usually included time for students to collaborate; they all worked on the same problems, and were encouraged to seek out and prefer other students' explanations: 'If you don't understand it then you need a different point of view of how to explain it to you.' These practices positioned mathematics as objective but in a world of subjective knowledge. Students characterised both mathematics and further mathematics as essentially interactive because their shared, factual tasks enabled working together: they created spaces for comparing journeys to the same understanding. When mathematics was contrasted with 'creative' subjects, it was not that either was more talkative but that in maths you talked 'about how you could get the solution' and in English, 'your opinion changes that solution'. It was also clear that students linked these

interactive work practices explicitly to happiness; for example describing taking part in the ‘little argument/ debate things’ going on in mathematics lessons as the marker that you ‘really really enjoy it’.

In further mathematics students reported pleasure that their lessons, despite time pressures, were also largely based on teacher-student talk. One exception met significant criticism - lessons with a tutor who allowed ‘no room to openly discuss’. This was given as the cause for students in that class feeling acute unhappiness and wanting to drop out of the ‘stale’, ‘painful’ experience. The dominant positioning, then, was that work was pleasurable because – and when – it was collaborative, and this was constructed as shaping experience in both further and ‘normal’ mathematics.

Tensions were associated with this characterisation when students described the work they did alone. As the ‘other’ to collaborative work, extended homework was positioned as a contrasting and therefore unhappy experience but one that was necessary for further mathematics and also for A2 mathematics. Only a few students found ways to resolve the tension: one was Simon, the student described above who disliked working alone but chose it as ‘better for him’. Another example is Paul, a white middle-class male who continued to A2 with after-school FMNetwork classes. Paul relinquished ‘working together’ as a shaper for experiencing happiness. He stated his individual commitment to mathematics by repositioning his solitary further mathematics work as pursuing individual interests:

> If some facts are interesting I'll read through the chapter. Look at more detail and learn about it and look it up elsewhere. If I’m still interested which isn't that often...But yeah, if things are going badly it can help if you go through the examples and just make sure you understand what you're doing and teacher's doing then it all comes together.

Here Paul avoids mentioning work, and minimises any idea of consistent effort with his throw-away phrasing, ‘*if*’s and ‘*just*’s. Although he is addressing a situation where

‘things are going badly’, he positions his response not as work he has to do, but as an activity that is a lifestyle choice, perhaps a happy object in its own right. This kind of response places him amongst those who have achieved success in their self-project even if their mathematics doesn’t work out. Only four out of the twenty-four students I interviewed made this sort of claim, all confident of top grades. It is worth comparing Paul’s response to Randall’s, when he struggled to position his need to work hard as anything but failure at being a genius. It seems likely that the successful grades of high-achieving students insulate them from the inherent threat of making failure personal when they align their work-towards-happiness with independent, solitary work.

The most common response to the problem of unhappy solitary work was to try to limit it by scheduling opportunities to collaborate. Sometimes these opportunities were negotiated individually with teachers out of lessons; students told me about schoolteachers who supported mathematics learning by welcoming queries in lunch times, registrations or other lessons, and FMNetwork tutors who answered questions by email, text and phonecall. Teacher availability was always valued but varied between schools, teachers and individual students. Students also got together regularly in free lessons. Tom and Helen jointly described a pattern of work that positions working together to put an end to individual uncertainty:

> Helen: We tend to like ask each other if we have problems and stuff sometimes
> Tom: What we usually do is we'll put... We'll sort of work on it ourselves and we'll get so far and then stop half way through or three quarters of the way through it. And leave some of the questions. Then we'll come in on a Monday and because we've got... Some of us have free periods on a Monday we'll sort of go through it together, see if we can...
> Helen: Tend to see each other, you're like 'Did you do this question? Because I can't do it'

They have thus planned how to avoid the dual unhappiness of solitary work and work that does not progress dependably. Since they understand other people as key to their

learning, working together has educational validity as a way to schedule and socialise aspects of work that are making them unhappy. From this perspective students are not feeling dependent on friends, but are taking over from teachers in creating collaborative learning spaces and thus becoming more independent. They manage proximity to one happy object – working together – to make up for the perceived loss of another – dependability – that they cannot so easily control.

Discussion

In this paper I have argued that students use imperatives concerning work and happiness to construct narratives of themselves as mathematics students. My theoretical framing of the work/happiness relationships as *opposed*, *managed* and *work on the self* identified three public, historical discourses that students could use to position themselves as working and desiring subjects. This approach to research proved useful because it considers mathematics experiences not in isolation but as part of students' identity work. The findings therefore retain complexity, and suggest further questions about context. I finish by discussing three issues with implications for current policy and mathematics education research.

First, the opposition and management of work and happiness ran through these students' descriptions of everyday learning. All the students had enjoyed mathematics, and several described enjoying the challenge of individual mathematics problems, but all expressed concern that further mathematics A-level work (and for fewer, mathematics work) could get out of control. Perceived difficulty is the main factor deterring 16-year-olds from continuing with mathematics A-level (Brown, Brown, and Bibby 2008). These students have already made that choice, and so could be said to have embraced an encounter with

difficulty. My findings show that later in their learning they do not lose that enjoyment but are unable to sustain identities as further mathematics students alongside other imperatives not to work (to be an all-rounder, to achieve effortlessly), to be happy (to be successful, not to choose painful practices), and to work at being happy. The balance that allowed students to keep on choosing to work at further mathematics was fragile and regularly threatened. This raises questions for further study: was this fragile engagement peculiar to the status of further mathematics as an extreme or extra subject, and if so what institutional practices worked to support students continuing in the FMNetwork and school? Is there wider application to students' participation in other forms of post-compulsory mathematics and the practices that structure their engagement?

Secondly, the latter part of this study started to identify practices-of–the-self that mattered in maintaining positions as successful mathematics students. I characterised two main themes as 'happy objects' used by students to manage accounts of their working practices while keeping happiness within reach. These were the dependability of mathematics and working with others.

Students described clearly how school practices produce A-level mathematics as dependable. Using this construction they could position themselves as powerful in two socially-reinforced identity practices: overcoming risk and managing the transformation of work into success/happiness. Does dependability equate to predictable tasks that mathematicians despise and many students would dislike as depersonalised rule-following (Nardi and Steward 2003)? Some students did express pleasure at working through a routine, and acknowledged that this could be seen as unusual. However this was only one aspect of dependability and the main focus was on managing risk in the

long-term: in their discourse, understanding was inseparable from confidence in future performance. This suggests that enjoying dependability in mathematics is not simply an individual quirk, but related to the social practices and technologies that guide choice-making for 16-18 year olds. Current assessment policy is moving towards less structure in mathematics A-level. Here we see further mathematics students – probably among the most confident and engaged – worried by such changes and considering giving up. What teaching practices work to support them in embracing the high risks that accompany the need to be 'independent' and 'very intuitive' for tackling further mathematics questions? Will those practices be useful in mathematics A-level teaching when assessment changes?

Thirdly, my last finding was that students described with pleasure the practice of mathematics lessons as individual engagements in shared, public tasks; indeed the majority saw collaboration as natural and necessary for learning. This perception does not however challenge the familiar perception that school mathematics is an isolated activity (Nardi and Steward 2003) since togetherness was marked as a classroom practice rewarding those who had chosen mathematics. Further mathematics practices that required working alone became causes of unhappiness. Some students addressed this threat to the imperative of happiness by restating their personal commitment to mathematics as a pleasurable life-trajectory, but this was sustained without reservation by only four high-achievers. More robust strategies involved scheduling time to work with others, limiting the unpredictability and isolation of homework by providing both structure and help. Students who did this identified themselves as taking over from teachers in creating collaborative learning spaces. They described themselves as

becoming independent through organising some dependence on others. Is this a sustainable and successful position to take in mathematics, and what institutional conditions and teaching practices made this possible? This suggests future analysis into students' perceptions of the roles of their teachers, other students and themselves in gaining independence in mathematics.

References

Ahmed, S. 2008. Multiculturalism and the Promise of Happiness. *New Formations* 63:121-137.

Ball, S., M. Maguire and S. Macrae. 2000. *Choice, pathways and transitions post-sixteen*. London: RoutledgeFalmer.

Bauman, Z. 2001. *Community: seeking safety in an insecure world*. Cambridge: Polity.

Beard, C., S. Clegg and K. Smith. 2007. Acknowledging the affective in higher education. *British Educational Research Journal* 33 (2):235 - 252.

Brown, M., P. Brown and T. Bibby. 2008. "I would rather die": attitudes of 16-year-olds towards their future participation in mathematics. *Research in Mathematics Education* 10 (1):2-18.

Cobb, P. and L.L. Hodge. 2002. A Relational Perspective on Issues of Cultural Diversity and equity as They Play Out in the Mathematics Classroom. *Mathematical Thinking and Learning* 4 (2&3):249-284.

FMNetwork. 2008. *Why study FM?* Available from www.furthermaths.org.uk/student_area/whystudyfm.php.

Foucault, M. 1990. *The History of Sexuality Volume 3: The Care of the Self*. London: Penguin.

Francis, B., C. Skelton and B. Read. 2009. The simultaneous production of educational achievement and popularity: how do some pupils accomplish it? *British Education Research Journal*: 36, no. 2: 317-40.

Hernandez-Martinez, P., L. Black, J. Williams, et al. 2008. Mathematics students' aspirations for higher education: class, ethnicity, gender and interpretative repertoire styles. *Research Papers in Education* 23 (2):153-165.

Jackson, C. 2006. *'Lads' and 'ladettes' in school: Gender and a fear of failure.* Maidenhead: Open University Press.

Kitchen, A. 1999. The Changing Profile of Entrants to Mathematics at A-level and to Mathematical Subjects in Higher Education. *British Educational Research Journal* 25 (1):57 - 74.

Mann, C. and F. Stewart. 2000. *Internet Communication and Qualitative Research: A handbook for researching online*. London: Sage.

Martin, D.B. 2006. *Mathematics Success and Failure Among African-American Youth*. London: Lawrence Erlbaum.

Matthews, A. and D. Pepper. 2007. Evaluation of participation in GCE mathematics: Final report. London: Qualifications and Curriculum Authority.

Mendick, H. 2006. *Masculinities in Mathematics*. Buckingham: Open University Press.
Nardi, E. and S. Steward. 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 - 366.
Noyes, A. 2009. Exploring social patterns of participation in university-entrance level mathematics in England. *Research in Mathematics Education* 11 (2):167-183.
Rose, N. 1990. *Governing the soul: reshaping the private self*. London: Routledge.
———. 1999. *Powers of Freedom: reframing political thought*. Cambridge: Cambridge University Press.
Searle, J. 2008. Evaluation of the Further Mathematics Network. Paper presented at *Improving Educational Outcomes Conference*. 19th September 2008. Durham University.
Sfard, A. 2009. Disabling numbers: on the secret charm of numberese and why it should be resisted. In *Mathematical Relationships in Education: Identities and Participation*, ed. L. Black, H. Mendick and Y. Solomon. London: Routledge.
Skeggs, B. 1997. *Formations of Class and Gender: Becoming respectable*. London: Sage.
Solomon, Y. 2009. *Mathematical Literacy: developing identities of inclusion*. London: Routledge.
Vidal Rodeiro, C. 2007. A-level subject choice in England: Patterns of uptake and factors affecting subject preferences. Cambridge: Cambridge Assessment.
Weber, M. 1930. *The Protestant Ethic and the Spirit of Capitalism*. London: Unwin.
Wright, I. 2009. New generation of mathematicians and scientists at heart of building Britain's future. DCSF press release. Available from http://www.dcsf.gov.uk/pns/DisplayPN.cgi?pn_id=2009_0151.