Choosing more mathematics: happiness through work?

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Background

Participation in advanced mathematics is a matter of ongoing concern in England and Wales (QCA 2006). Mathematics is promoted by the government as “the key for building a strong economy and highly skilled workforce” (dcsf.gov.uk pressrelease 20/08/09), and crucial for personal success and economic growth. Although much of the policy concern is, rightly, aimed at encouraging the majority of 16-year olds to continue learning mathematics, there is also a focus on “our very brightest young people” studying mathematics and science A-level subjects who “by doing so are ensuring that Britain has a bright future” (ibid). In such comments, policymakers blur the two different arenas of personal life-trajectory and global competition. They evoke the certainties of economic discourse to persuade individuals to choose mathematics for their own future goals. This rhetoric has inspired me to reflect on how work, choice and happiness are connected in discourses of education, and how these discourses contribute to young people’s subjectivities and the ways in which they can construct their lives. There is a wealth of recent sociological research that theorises the relationships between discourses of ‘labour’ and ‘rewards’ at a social level, and of work, effort and life-goals at an individual level (e.g. Ball, Maguire, and Macrae 2000; Jackson 2006; Rose 1990). I draw on this to investigate the particular context of mathematics and further mathematics A-levels, with the dual aims of testing the explanatory power of the theories and using them to examine a recent initiative to promote mathematics.

How individuals make choices is important at A-level because students select only three or four subjects from a wealth of options offered by their schools. If we want to promote mathematics we have only two options: encouraging students to choose mathematics instead of another A-level subject, and/or finding ways for students to study more mathematics alongside other subjects. The first approach asks students to compare the work and rewards of mathematics and other subjects within expected school practices; the second approach asks them to consider whether additional work in mathematics would justify changing their school practices.

Further mathematics is a second mathematics AS or A2 qualification that extends the A-level curriculum. Around since the 1960’s, it has played a minor but significant role in identifying academic achievers and preparing them for mathematically demanding degrees. This gatekeeper role of further mathematics positions individuals in relation to institutions, and provides another example of how personal and strategic interests are
blurred in educational discourse. Traditional mathematics education research (e.g. Kitchen 1999) has understood that institutions, such as universities and employers, are agentic in using the positioning power of further mathematics to select from a pool of passive candidates; but recent policy represents the students as the active ones, enabled by the further qualification “to distinguish themselves as able mathematicians in the university and employment market” (FMNetwork). Perhaps this empowerment inspired them instead not to offer themselves up for selection or exclusion. In any case, changes in A-level teaching structures and student choice-patterns caused further mathematics numbers to plummet steadily from their 1980’s high, particularly in state schools. In response to this drop, a national government-funded initiative, the Further Mathematics Network (FMN), ran from 2005-9 with the aim of promoting further mathematics and teaching it where schools could not. One notable feature of the FMN promotion materials (e.g. Stripp 2007) was that it combined both the approaches identified above. It represented AS level Further mathematics as an extra course of study that complemented AS-level mathematics, and also as a subject you could continue to A2 in its own right, either as well as, or instead of, other subjects.

Participation in further mathematics has more than doubled since 2005, with the greatest growth in state schools (Searle 2008). There are however differences in how mathematics and further mathematics are located within the spatial, temporal and social practices of schooling (Beard, Clegg, and Smith 2007). FMN students typically take further mathematics as a fourth or fifth subject, attending one 2-hour after-school lesson per week taught by a visiting FMN 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 practice will produce different tools and tensions for constructing student identities.

I believe that if we want to promote mathematics, it is important to understand more about who does decide to study more mathematics, what reasons they give, and also how school and social practices affect those reasons and choices. There are several recent analyses of participation in mathematics, both qualitative and quantitative, that map trends in who completes A-level in relation to prior attainment, gender and class (Vidal Rodeiro 2007; QCA 2007; Noyes 2009), and students’ reasons for choosing mathematics (Hernandez-Martinez et al. 2008). However, trends show us the overview: 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 school, community and sociohistorical contexts (Martin 2006) and how these bear upon the choices that students make in how they work at their mathematics and how they talk about their mathematical experiences and choices.

**Theoretical Structure and Research Questions**

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 what inscribes us as autonomous, but our choices are made in social and discursive contexts that construct knowledge in particular ways that we cannot ignore. Agency and structure are thus interlinked. Individuals know themselves as agentic through using and thus reconstructing the same discursive practices that inscribe what positions they can take. (For example Mendick (2003) has shown how girls can choose mathematics as a way of ‘doing’ masculinity and expressing something about themselves; they thus use and reproduce knowledge that associates mathematics with men). This model of an autonomous individual expressing preferences 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 is produced as universal through the technologies of the media and education (Atkinson 2007). Studies of how identity narratives reflect class positions (Skeggs 1997) and ethnic community knowledge (Martin 2006) suggest that individuals can resist and adjust such dominant positionings but cannot ignore them.

For Foucault, work and happiness are simply examples of discursive concepts that have the potential to be involved in practices of the self. There are two reasons I have focussed on them in my analysis: their prevalence in educational discourse, and the availability of sociological theories of how work and happiness are involved in the practices of the self typical of advanced liberalism. Education is enormously concerned with managing work as an output and as a process; and teachers and students talk about working as a synonym for studying or learning. We are used to hearing mixed messages about work and its goals. For example, when I observed mathematics A-level lessons, one teacher regularly started by reminding students that they must all work very hard in mathematics, and then presented the rest of the lesson as ways to make work ‘easy’. This was very familiar practice, that only became ‘strange’ when I used a theoretical to analyse how teachers talked about work. It illustrates that classroom discourse allows us to call 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 in that classroom discourse?

Sociological theory offers help in unpicking these messages. The seemingly ‘natural’ positioning of work and happiness in education is that they are opposed to each other. In his analysis of the ‘spirit of capitalism’, Weber deems a personal ethic of lifelong 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 formed individuals into the workers of capitalist society. The importance of this theory to me is not historical but discursive: 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. We can trace this position in the contesting adolescent discourses such as ‘uncool to work’ (Jackson 2006). When students emphasise their opposition to work, they position themselves both as autonomous in refusing a dominant discourse and as part of a ‘natural’ community who find work unpleasant. This opposition also underpins positions of conformity. For example, studying mathematics in order to gain qualifications or a prestigious career reconstructs this way-of-knowing because the
promise of deferred gratification constructs work in the present as an unhappy experience.

The next construction is that of ‘managed’ work allowing individuals to be happy. Bauman (2001) suggests that individuals do naturally find pleasure in their own work, so that the key role of mass education was to habituate individuals to an ethic of working with and for other people and not themselves. Leaving aside historical motivation, Bauman’s positioning illustrates that work and happiness can be aligned for individuals in certain circumstances, typified by craftsmen working independently. In his analysis of the self-governing individual in society, Rose (1990, p119) recognises a trend of promoting practices that align individual happiness with work. Twentieth-century western schools and workplaces became increasingly structured by “institutional technologies” that found ways to mitigate the unpleasant aspects of work. Examples of these technologies are ergonomics, fitting the right person to each job, or choosing the right GCSE’s. Schools are necessary institutions in this management because they are expert in selecting individuals for the working roles needed by society and providing them with the tools and circumstances in which they can both work and be happy. This move is accompanied by a change in an understanding of happiness not as a passive state but as a universal 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). Notice that society is concerned with making promises to individuals, not with social justice.

There is one last significant positioning of work and happiness that arises from the neoliberalism of recent social policy in the UK and USA. 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)

Working on what interests us, or ‘loving our work’, is an ideal of being-a-self that is promoted by communications media, educational and workplace. This is exemplified in Ball, Maguire, and Macrae’s (2000) study of young people’s pathways by those who understand career choices as choosing a life-style and its ways of being happy. What they do is synonymous with who they are; its relevance is as a present state not a trajectory to a future one. This is an inclusive positioning for students who have the financial and cultural resources to support their quest for combining work and happiness. It is also an excluding knowledge: students who are positioned, for whatever reason, as
unsuccessful in work are viewed as unhappy, and students who don’t enjoy the outcome of a choice such as work in mathematics understand themselves to be unsuccessful in it.

As Rose makes clear, this neoliberal alignment of work and happiness does not replace other understandings but is layered with them. I have introduced three constructions of work and happiness to be my framework for analysis: *opposed*, *managed*, and *work on the self*. I suggest that students use these different constructions of work and happiness to take up different, multiple and overlapping positions within the discourses of selfhood and mathematics learning. Work can be necessary and unpleasant; can be mitigated by technologies, and can be the way to find happiness. Happiness just happens to us, and it is the aim we work towards; individuals may have to be helped by institutional technologies and they may be responsible for their own happiness. All these are ways in which work and happiness function as discursive tools that we can use in combination to explain ourselves as autonomous subjects. My research examines how FMN students use such positions in accounts of choosing and studying mathematics and further mathematics. I ask:

- How do students describe managing 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 FMN sites, chosen for their differing sociogeographic settings and further mathematics teaching practices. Almost all A2 and AS further mathematics students at each site agreed to participate in my study, plus two mathematics-only students. One site, Capital, was in a London borough, where students from five schools met at a weekly FMN lesson to study further mathematics AS-level over two years. My seven participating students in this site belonged to six different ethnic communities; two were girls and five boys; they had low socio-economic status and were in small mathematics cohorts continuing to A2. The second site, Grants, was a new city academy where students’ timetabled further mathematics lessons were subcontracted to the FMN 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 solid AS subject in this school. The third site, Moorden, was a market town whose two secondary schools took up the FMN’s offer of teaching further mathematics A-level as an after-school extra to support thriving A-level cohorts. Nine of the participating students were white and one mixed white/asian; three were boys and seven girls, and they had mid- to high-socioeconomic status. There is not space here to discuss effects of gender, ethnicity or community but this overview shows no standard profile of a FMN class.

My research data consists of semi-structured interviews with students in year 12, and again in year 13 for A2 schools, with half-termly emails in between, and observations of two to six further mathematics lessons in each site. I interviewed students singly or in groups of 2-3, by their choice, and on their school premises. I included direct questions
about choosing AS subjects, memories of learning mathematics, how their class interacted in lessons and how they personally had worked on a topic. I was concerned that the interaction in interviews should allow students opportunities to take up and compare different subject position 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 warm, talkative, cloudy) to describe school subjects, and talk me through their reasons for picking them. The emails asked students standard questions, eg reflecting on A2 choice at the beginning of year 13, and also allowed me to follow up any interesting responses in a reflective email conversation (Mann and Stewart 2000). My analysis involved selecting and coding descriptions of work and happiness in the student accounts, reviewing coded text to summarise how and in what contexts individuals related work and happiness, and then reorganising the data by emerging themes.

Findings

Managing work and happiness

The students’ talk illustrated how they govern their lives using imperatives concerning work and happiness, each of which has its roots in discourses of self and society. I identified four recurrent themes in their talk. It was notable that these 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 those themes below, and return to how experiences in further mathematics contributed to them in the next section.

You have to work: students described how they had to put a lot of effort into mathematics, and found that doing this could be painful. Here they drew on the positioning of happiness and work as opposed, suggesting a natural and rational desire to avoid work that conflicts with the demands of education. This conflict recurred when the students talked about whether maths work was necessary in that they usually contested their own statements. For example, Charly contrasts the qualities of independence and confidence 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, Moorden A2)

She is proud of her personal qualities: she stresses that they are what she naturally ‘just thinks’, and casts herself as satisfied with herself rather than lazy. But alongside this, Charly constructs another position: work is necessary 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. Charly is thus drawing on the ‘opposed’ relationship between work and
happiness to do some ‘work on herself’. She is 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 progress and is becoming mature.

Jodie also describes the position of ‘effortless achievement’ (Mac an Ghaill and Haywood 2006) in mathematics, 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, Moorden A2)

Jodie acknowledges the accepted power of ‘talent’ by placing it first in her argument, but then echoes ‘talent’ in her description of those who have to work, raising questions about its predominance. Jodie continues by referring to a classmate’s jealousy about her good module results. Backed by the authority of performance, she can go further and claim that pride in effortless achievement 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 a powerful claim for belonging in her mathematics class that is supported by contesting the relationship between work and success in mathematics. Although Charly and Jodie position themselves differently as individuals with respect to choosing to work, they both reproduce a position of effortless achievement as a means of including or excluding others from success. Equally they both suggest an imperative to work as indicative of maturity and engagement with the education system.

**You have to not work:** above I have described how avoiding work is cast as naturally desirable, but in that form it was constructed as a natural preference rather than an imperative. There were two ways that not working was seen as a position that one had to take. The first was described by Clive (Moorden AS) as 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. Although this kind of statement works within the ‘opposed’ relationship of work and happiness, he is also taking on responsibility for ‘managing’ the condition in which he works and thus can also be read as working on the self. It’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). As well as popularity and high-achievement, I would add employability as a third concern of the modern ‘Renaissance child’. For example Clive typifies many of the students’ attitudes to finding time for ‘extras’: I always like to do that sort of thing because it helps you along. Employers think ‘Oh they tried extra so they can do the extra bit’. When Clive decided that mathematics required too much of his time spent studying he chose to drop both mathematics and further mathematics. His family and teacher strongly persuaded him to continue with mathematics by stressing the exchange value of an A2 grade and how he could be helped, but this perception influenced his choice of
economics degree when he deliberately ruled out any maths-based courses that would just drive me insane. Clive uses the ‘opposed’ and ‘managed’ discourses to suggest he does not work happily at maths and cannot imagine circumstances in which that is possible; giving up is then rational and is indeed a practice of the self that displays his capacity to act on self-knowledge.

The second imperative not to work was associated with the social positioning of further mathematics students as having immediate effortless access to knowledge. Practices that reinforced this position were when teachers in physics or mathematics directed rapid extension questions at further mathematics students, or reactions from peers to their subject choices. Randall (Grants, A2) contrasts the imperative to be ‘a genius’ with his experience: 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 positioning of instant success because it is unrealistic. It does not match his description of further maths as ‘all mixed into one’, and his recommendation to future students of how to succeed: 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 - and is not suited to the particular work ethic of mathematics. When he considers how they can be ‘managed’ then he blames the schools technologies - teachers, lesson timings and physical conditions - for leaving too much responsibility for him. Finally, the mis-match between his own experience and the positioning of further maths makes it difficult for Randall to work on himself by ‘doing’ a successful further mathematics student. 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. Throughout his second interview Randall struggled to find ways to talk about himself and further maths, and is one of the few students who talks explicitly about pursuing happiness. When I suggest that he feels that his D grade is not valued enough 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 leaving school will let him ‘fluke’ his way 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 positioned as coming originally from other people and the judgements that others might make. Both lead to decisions not to continue studying mathematics: Clive because he is successful in constructing an identity that precludes time working on maths, and Randall because he is unhappy with how his experience of work positions him compared to dominant discourses about ‘doing’ maths. Clive draws smoothly on all three positions of work and happiness as opposed, managed and working on oneself to produce himself as autonomous and rational in choosing to give up maths. Randall seems to search for a way to describe himself as successful. The way he tries to ‘manage’ himself as a realistic, maturing student is to work harder, but since all work appears to rules you out of being a
proper further mathematics student, the only permitted awareness is that you should not continue.

**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 suggested that happiness was at least a significant ongoing concern. One explicit use was in citing enjoyment as the strongest imperative for making course choices. Students associated it both with a general consensus and the advice that their close relationships would give them: *my parents and stuff just mainly said to me – do what you are happy with.* The liberalism of such attitudes is considered to be characteristic of the middle-class who can afford such considerations (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. It was interesting that there were clear differences for the ethnic minority students. These seven students did consider happiness as one factor in making choices but it was usually secondary to the status and utility of the subjects chosen. For example, Bob, a British-Asian student studying AS further mathematics alongside mathematics, physics and accounting at Capital described how he still regretted giving up his favourite subject, Art, because it would not qualify him for medicine or business. Simon (Indian, Grants A2) told me that although he enjoyed being with other people, he chose to work alone as he felt ‘better’ if he was not able to make comparisons. In Simon and Bob’s cases the imperative to be happy was present as a background understanding which had relevance to choice but which was able to be suspended in the face of the imperative to succeed.

**You have to work at making yourself happy:** this is the imperative of neoliberalism, and it was made explicit by denying its ‘other’. Students ruled out the possibility of working for unhappiness: *you are not going to do good in something you don’t enjoy because you are not going to put in the effort.* The students did not often admit to being unhappy but if they did this was presented as something to work on. For example, in a pair interview, AgentX initially denied ever being unhappy but when he was challenged by his friend Tom (both Grants, AS) they entered into a competition about who was most unhappy:

AgentX positions an abstract ideal student as never unhappy and then repeats this for him and Tom, using the mover between ‘you’re’ and ‘we’re’ to position them as ideal students. When he accuses Tom of being unhappy and just sitting there moaning, he is making a pointed counter-attack that he knows Tom cannot accept (*Sorry, Tom*) suggesting that they both recognise this imperative to be happy in your work. Tom is prepared to resist and admit unhappiness for himself and for AgentX but only temporary unhappiness. He acknowledges that AgentX worked on his unhappiness by getting a
Choosing more mathematics tutor, and this ends the dispute. Working to resolve unhappiness is a practice that shows autonomy and success, and the conversation then continues by describing this work on the self. This is significant imperative for mathematics and any other challenging school subjects: if being unhappy demands a solution and the only solution is to give up.

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, for example, negotiates her 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, and Randall was an example of this. The next section looks at two themes that recurred as significant when students described how experiencing working as unhappy was problematic, and what they could do to transform those experiences into ones that produced happiness.

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

There were two characterisations of mathematics that students drew on to legitimise their claims of being able to transform mathematics work into happiness. Firstly, they characterised mathematics as predictable and thus dependable, and secondly that it involved working with others. The first was stated explicitly as a truth about what ‘mathematics is’; with its truth-status supported by familiar representation of mathematics as logical, rational and calculable. This characterisation was reinforced at the level of practice when I analysed the school situations that students juxtaposed with explanations for being happy or unhappy in mathematics, and successful or unsuccessful in being able to do their work. The second characterisation – that mathematics involved working with others - also arose in the analysis of which school practices were described for what purpose. It was reinforced implicitly when students talked about the adjectives task. Many students chose to discuss whether or not mathematics could be considered as ‘talkative’, often by identifying teachers whose mathematics lessons were pleasant because they involved students interacting with each other and the teacher about tasks. I describe these characterisations below, wherever possible using quotations from students I have already introduced (Charly, Clive, Jodie, Tom), to convey a richer picture of how individuals present their experiences. However some pertinent statements and opposing views were given by other students; to ease reading these citations are either unattributed or longer ones are followed by a name and details.

**Dependability**

The first theme is the construction of mathematics as dependable, logically consistent, and predictable. This theme occurred repeatedly as a way for students to explain how they could enjoy working in mathematics. Dependability allowed students to connect schoolwork with happiness by factoring out risks and uncertainties associated with time and chance. The certainties of mathematics discourse were borrowed to instil certainty into an individual’s life-trajectoryI just as ‘the charm of numberese’ gives
control over social futures (Sfard 2009). I interpret this as drawing on several of the discursive positionings of work and happiness.

Firstly, it relates to ‘deferred gratification’: studying mathematics is associated with higher future earnings (as just one indicator of success). If mathematics is understood to guarantee this link, the rational calculation of present effort against future rewards is tipped towards present work. Secondly, practices that emphasise this knowledge are technologies that help to mitigate the opposition of work and happiness. This sets up relationships between individual goals and the school curriculum as a means of achieving them. 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 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 it is clear that her certainty about future success does not just allow her to predict happiness in the future but positions her as feeling happy in the present. It fits with a neoliberal collapsing of the future into the present which understands an individual as responsible for possible life-trajectories by making current choices. This argument reinforces itself in that feeling happy about her mathematics work in the present can in turn justify Jodie in predicting future success. I conjecture that the multiple links between the dependability of mathematics and different discursive positions about work and happiness are at the root of how it was used to explain what practices were enjoyable and problematic.

It was possible to represent mathematics as dependable in this way because the school and examinations reproduced discourse through practices that ensured connections between students’ current work on different timescales and linked this to their future success. Lessons were described 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. This could be taken as 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, white-irish, Capital AS)

The connections also mean that work can be depended on to give results: whereas in Mathematics you know what you've got, You can tell. The recurrence of ‘whereas’ suggests a special role for mathematics as dependable in an uncertain world.

Further mathematics differed because the pace of teaching meant students could not be sure that success in current work would bring success in the future. 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”. Further mathematics 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, she also contrasts it with the personal certainty she prefers.

The dependability of mathematics also allowed students to manage some conflicts between having to work and having not to work, which was again threatened in further
Early in AS mathematics Clive had 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 calculate how much time spent working will bring success: “I’m not going to sit there for two hours thinking; there’s no point”. Many students expected to ‘skim’ mathematics lessons, gleaning enough in class to complete the work later on at home. They felt they had the option of not working all the time in mathematics. This led them to complain that in further mathematics, “if you don’t listen for one little bit then you don’t know what to do”. A few students interpreted this as a fault of the school or the FMN in allowing after-school lessons. Constructing further mathematics as a faulty educational technology suggested that neither individuals nor mathematics itself were to blame for the students’ failure to enjoy the lessons. (Francis, Skelton, and Read 2009) (2009) found popular high-achieving students combining socialising and high-achievement in class work, so that a failure to do so could well be seen as a threat to a privileged identity that has to be distanced from one’s own control. Again, for students like Randall, this conflict between the concentration needed in further mathematics lessons and the portrayal of mathematics as straightforward appeared unrealistic and didn’t acknowledge their modest achievements as exceptional or even satisfactory.

**Working with others**

Whereas dependability appeared mostly in students’ reasons for choosing and liking mathematics A-levels, working with others was a theme that appeared when they described what they actually did. Both mathematics and further mathematics were described as *talkative* subjects. All students represented working together as essentially pleasurable, and as part of working on the self. For example, students found power and pleasure in helping each other and described this as progress to autonomy and adulthood. For almost all students, interacting with the teacher and others was seen as the essence of 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.

Many of the A-level teaching practices built social interaction into mathematics. Lessons usually included time for students to work together, they 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 mathematics and further mathematics as essentially interactive because its shared, factual tasks enabled individuals to collaborate by leaving space for differences of approach. They contrasted this with ‘creative’ subjects that were concerned only with private opinions: you can’t collaborate on an essay. Students linked all 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”.

Despite time pressures, further mathematics lessons were also largely based on teacher-student talk. There was an exception, and the students concerned were very critical of a tutor who allowed “no room to openly discuss”, some wanting to drop out of the *stale, painful* experience. A dominant positioning, then, constructed as experience in
both further and ‘normal’ mathematics was that work was pleasurable because it was collaborative. In some cases this collaboration was simply as a natural source of happiness arising from being together; in others it was a technology offered by particular teachers to help students learn and enjoy their work.

Problems arose 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 so unhappy experience, but one that was necessary in further mathematics and in mathematics by year 13. Some students did find ways to resolve the tension. Paul restated his individual commitment to mathematics, 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. (Paul, white male, Moorden A2)

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 as not work he has to do, but an activity that is pleasurable and successful as a lifestyle choice. This kind of response places him amongst those who have achieved success in their self-project even if their mathematics doesn’t work out. Four out of the twenty-four students I interviewed made this sort of claim, all confident of top grades. It seems likely that high-achieving students have fewer tensions in aligning their identity-work with independent solitary work in mathematics.

Many more students limited their solitary work by scheduling opportunities to collaborate. Sometimes these opportunities were negotiated individually with teachers out of lesson times. Students told me about schoolteachers who supported mathematics learning by being readily available to work through questions in lunch times, registrations or other lessons, and FMNetwork tutors who answered questions by email, text and phonecall. In addition, students got together regularly in free lessons. Tom and Helen jointly described a pattern of work that combines working together with putting 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'

(Tom, Grants AS, and Helen, Grants A2)

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.
Conclusions

In this paper I have argued that students use imperatives concerning work and happiness to construct narratives of themselves as mathematics students. These imperatives discursively inscribe the practices of the self that construct a mature educated autonomous individual and urge them to work, not to work, to be happy and to work to be happy. There is a central tension in these relationships: is it possible to work hard and to be happy? My theoretical framing of the work/happiness relationships as ‘opposed’, ‘managed’ and ‘work on the self’ identifies three public, historical discourses that position individuals differently as working and desiring subjects. These are public and historical because they are produced through educational and media technologies as ways of understanding how individuals have, do, and should understand themselves within society. I use this framework to examine students’ accounts of their participation in mathematics and further mathematics, trying to hold together, in one space of attention, students’ engagement in individual practices of the self and institutional practices of school mathematics. I have shown that students make some use of all three of these discourses in justifying their interpretation of experience in mathematics. The opposition and management of work and happiness tended to underpin their descriptions of everyday learning; however even students who rejected the neoliberal pursuit of happiness as a main career driver were led to reflect on ‘what kind of person they were’ by the practices of A-level and university choice (and of course the interview process). Many students paid considerable attention to how they constructed themselves in relation to me as an interviewer, their school and their peers, and used the opposed/managed discourses of work and happiness as part of this identity work. So for example, the way that they resolved tensions between imperatives to work/not work in mathematics was used as evidence for being engaged in ‘work’ towards a maturer self. Moreover, students offer two main solutions to the imperative that one should resolve personal unhappiness: to work harder and to drop mathematics. When they cannot resolve tensions about work and happiness in maths, the rational solution is then to give up.

The second part of this study concentrated on the contexts of mathematics and further mathematics, trying to identify the practices that mattered in producing subject positions as mathematics students. Two main themes were used by students to manage their accounts of work and happiness: the dependability of mathematics and the pleasure of working with others. I suggest that A-level teaching and assessment practices produce mathematics as dependable, positioning it as a technology that manages the transformation of work into rewards and giving it relevance to individual subjectivities through a neoliberal concern for avoiding risk. Equally, students described what they did in mathematics lessons as individual engagements in shared, public tasks, where collaboration was feasible and necessary for learning.

Students characterised unpredictable work and working alone as the causes of unhappiness in mathematics and further mathematics. Some could address this by restating their personal commitment to mathematics as a pleasurable lifestyle, but this was sustained only by high-achievers. A more robust strategy was scheduling free time to work with others, limiting the unpredictability and isolation of homework by providing both structure and help. These students identified themselves as taking over from teachers in creating collaborative learning spaces.
Finally, my analysis suggest that the way students manage work and happiness relates to how they ‘do’ independence in mathematics. Students said that they could not enjoy further mathematics because it was not dependable but, equally, A2 students located its value in the way in which they had to become ‘independent’ and ‘very intuitive’. The particular challenge of further mathematics was described as:

it's so much harder you've gotta use everything and you don't know what kind of... Does this... Will this... Do we use this or not? And not... In Mathematics you are used to that guidance, like use the chain rule to find this. In Mathematics... In Further Mathematics it'd be like... I don't know.

Students constructed A-level as a life-stage involving a move towards independence that involved both pleasurable and painful experiences. When independence was seen as being simply left to work alone, very few students found ways of experiencing this as pleasurable either as working on mathematics or on themselves. However the unhappiness derived from losing certainty in the way mathematics was presented could be addressed by teaching practices where teacher and students interacted to work on students’ problems. I finish on an optimistic note by citing Bob’s description of how his interactions with his further mathematics tutor had led him, not to the further dependence often caricatured as spoon-feeding, but to experience himself as becoming independent:

I look back and I see that it's not as hard as I initially thought and because of my Physics and my further mathematics and ability to work independently and work for myself and know that I have to know these things and I have to do this and that. Learn the processes of breaking things down, especially [my teacher] was very helpful in doing that. You know, she shows you when you've gotta break it down, you've gotta do this and that, and I think that's one of the key skills that I learnt from further Mathematics, and that helped me in every other aspect of my life to be honest with you, especially education-wise.

This suggests possibilities for future research in investigating the practices that help students view independent learning as a state that they can work towards rather than something that is done to them.

References


This document was added to the Education-line collection on 16 September 2009