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Discourses of time and maturity structuring participation in mathematics and further mathematics

This paper examines how young people account for choosing mathematical subjects, and how these processes sustain, or not, their continued participation. It draws on a 2-year qualitative study of 24 young peoples' accounts of following advanced mathematical pathways within a widening participation programme. Working within a poststructural framework, I combine two arguments: firstly, that local discourses of time, age and maturity position contemporary adolescence as a time of 'becoming' that aligns personal aspirations with mathematical progress, and secondly that students' accounts of choice and aspiration require multiple imaginings of present and future selves. I identify distinct discourses –*moving/improving* and *getting ahead* - that structure the intelligibility of participation in mathematics and further mathematics respectively. I argue that tracing the alignments between students' accounts of themselves and/in mathematics offers potential to understand emergent practices in mathematics participation but also how exclusions are re-inscribed along classed and gendered lines.

Keywords: Time; mathematics; aspiration; inclusion; social class

Introduction

The educational choices of young people are defined by the texts, tools, rhythms and social systems that structure time in educational settings (Lingard and Thompson 2017). Mathematics, which was once understood as culture-free and timeless, is now pressed into service as the 'bright future' for individuals and nations. Policy drives to raise mathematics attainment have joined equity concerns to renew interest in the participation of under-represented groups on economically-privileged mathematics pathways (Adkins and Noyes 2016). It is in this context that, in England, between 2005 and 2018, the government funded a national programme specifically to widen 16-year-olds' participation in an advanced mathematics pathway, called Further Mathematics (FM).

Academic –track 16-year-olds in England and Wales typically choose three or four subjects, of which they continue three ending in a full ‘A-level’ examination after two years. Mathematics and FM are chosen as separate subjects and, while mathematics is offered by all schools, FM had entered a spiral of decline, available in the private sector and in large, selective or well-funded state schools. Since 2005 the FM programme has promoted FM in schools, trained FM teachers and provided extracurricular tuition where the school cannot do so. FM remains a small subject: completed by 4.8% of academic-track students in 2018, while 27.4% complete mathematics.

This study conceptualises the FM programme as a serious attempt to reimagine ‘from above’ the structures of participation that reconstruct social patterns of exclusion (Gale and Parker 2015). It is the kind of policy intervention necessary, but not perhaps sufficient, to challenge deficiency models by which disadvantaged young people are held responsible for the scope or failure of their aspirations. It draws on the accounts of 24 young people in a situation from which new meanings and practices could emerge: their schools offered the new option of studying with the FM programme. These are analysed to trace the discourses that describe and construct these young people’s choices and lived experiences, focusing on the senses of time, age and maturity that shape identities in relation to future and past selves. I argue that this lens is useful to understand how some individuals are able to negotiate new forms of participation while others are led to exclude themselves.

Theorising subject choice and time

This research was part of a wider project examining the functioning of school- and policy-level FM initiatives through the post-structural stance that choosing mathematics

is a discursive practice of the self, a way that power is circulated by producing knowing beings who judge their own and others' behaviour with respect to social norms (see, for example Smith, 2010). A sense of time frames people's actions, explanations, purposes and imaginations, collectively and individually (Lingard and Thompson 2017) and thus time was identified as a fruitful, and previously unexplored, focus through which to examine how discourses align locally to enable or prevent young people's participation in mathematics.

I approach this argument and analysis using the Foucauldian concepts of discourse and positioning. Discourses can be understood as webs of practices "that systematically form the objects of which they speak" (Foucault 1972, 49). They are historically and culturally contingent, but they present as unarguable regimes of meaning that gain currency through use. People are positioned relationally by discourse, by how they fit within webs of practices (Davies 1989), and they also understand themselves and position themselves through discourse. Thus discursive practices are "at once local and global, minute in their detail and enormous in their reach" (Walkerdine 2007, 138). In this study, discourses - of mathematics, of schooling, of class and gender, of aspiration - form the subjectivities of the choosers, the circumstances in which they have previously been excluded from FM and those in which they now choose. A post-structural method focuses on regularities in discursive practices, traces how these arise, how they align or interact, and the positions they make available. It thus shares a concern with Bourdieuan and cultural theory in how social patterns of aspiration are reproduced through individual behaviours. However, its relational emphasis supports a focus on the diffuse and productive functioning of power through particular situations, such as the FM programme, and through specific social constructs, such as time and age. To ground this argument, I next consider what macro- and micro-level discourses have been

proposed by previous research in the four areas of: choosing mathematics, contemporary adolescence, negotiating age imaginaries and possibilities for changing aspirations.

Discourse at a macro-level: choosing mathematics as a practice of the self

Choosing a subject to study or a career trajectory is an individual activity in a social context. Within modern Western societies, choosing functions as a “practice of the self” (Foucault 1990) since it is constituted as a means by which individuals are enjoined to express themselves as agents with autonomy and subjectivity. It is also a means by which individuals are governed: either visibly through constraining their choices, or less visibly, in neoliberalism, by conferring responsibilities on the chooser for the processes and outcomes of those choices (Rose 1999). An important theoretical point to take from this is that what it means to be a teenager choosing mathematics is as much a social construction as are the norms and frameworks of the school setting, and the messages of culture and policy. All are negotiable in pedagogic interactions but constrained by what is intelligible to oneself and to others.

Students’ accounts of choosing to study mathematics have been identified as a practice of proving something *about* oneself in ways that are contingent on dominant discourses about the nature of mathematics. (Mendick 2005; Smith 2010; Stinson 2010). Mendick argues succinctly that mathematics is discursively aligned with masculinity through its positioning as hard, competitive, rational, requiring natural aptitude and real understanding. Thus young people who choose mathematics, whether male or female, are necessarily “doing masculinity” (Mendick 2005, 235) and this is a way they perform gender work. Stinson (2010) has shown how disadvantaged African-American students speak about their successes in “White male” mathematics as a counter to other

racialised narratives of deficit or rejection. Although such accounts of resistance are welcome, Stinson notes their perceived rarity is part of what lends them discursive impact. When they feed back into the enabling discourses of mathematics, they may create exceptions rather than challenges. This recalls Foucault's argument that discourses survive because they produce meanings as well as constraining them: "‘oppressive’ discursive positionings carry immense pleasure and power for the individuals occupying them" (Mendick 2005, 239).

Discourse at a macro-level: adolescence as an emblem of modernity

Being a young person is itself a modern cultural construction with roots in historic narratives of education. Lesko (2001) argues that neoliberalism and modernity privilege a *development-in-time* view of adolescents as always 'becoming', held between childhood and adulthood, at risk to themselves and others, and comprehensible in time without knowledge of their contexts. Thus "adolescence is an emblem of modernity and time is the defining mode" (Lesko 2001, 239). Lesko's argument rests on demonstrating how two main conceptions of time and maturity are woven into current educational and cultural discourses of adolescence. Through *panoptical* time, adolescents are continually watched and measured normatively by age (for example, by schools' progress trackers); through *expectant* time they are positioned as not-yet-adults, unable to act until given social permission (e.g. leaving school). Together, these temporalities construct knowledge about progressing towards a desirable end. This is the particular kind of knowledge that is most valued in the modern episteme, in what Pels calls the "cultural dictatorship of the not-yet" (Pels 2015, 787). Thus the ideal subject of contemporary society has been seen as a person in development, an adolescent and not an adult (Furlong and Cartmel 2007).

A main claim of Lesko's argument is that this construction of adolescence is not neutral: it recapitulates cultural stories about the progress of nationhood and masculinity towards Western civilisation. She identifies discursive patterns that align childhood with nature, women, colonised peoples and past traditions, and adulthood with civilised, middle-class White men, and the future. The developmental discourse is connected to power relations found in race, gender and nation, so that adolescence is a site in which cultural concerns about power are addressed indirectly. It can therefore be fraught with tensions, fears, and desires both for young people and those reacting to their behaviours. This is the case especially when young people attempt to make choices that are not those expected of them.

Discourse at a micro-level: negotiating age imaginaries

Young people make their subject choices in interactions with teachers, families and their peers, guided by institutional norms and narratives. The meanings of their choices are constructed in a web of competing and aligning discourses. One example of competing 'truths' is the claim that young people are characterised by low aspirations for future education and employment (Department for Education 2014), whereas research shows that disadvantaged young people's intended careers are *more* ambitious than those they see around them (St Clair and Benjamin 2011), and are increasingly oriented to professions and to further study (Rose and Baird 2013). Of course, one explanation of this is that schools, who are required to respond to dominant discourses, have already taught young people to "express acceptably ambitious vocational outcomes" (St Clair and Benjamin 2011, 514) even as they simultaneously consider contradictory futures with 'dream jobs' or 'realistic' outcomes (Archer, Hollingworth, and Mendick 2010).

These multiple, concurrent constructions of young people's future identities can be understood using the notion of "age imaginaries" (Alexander 2014). Similarly to Lesko, Alexander suggests that time and age are central to modern youth in that young people's present conceptions of themselves are given meaning by the anticipation of consequence. Your dream job, your educational aspiration and your realism all contribute to how you are understood by others within the educational setting. Young people and their teachers, iteratively and interactively, negotiate age as an aspect of performed social identity, conjuring imaginings of adulthood, childhood and growing up. Alexander's research attends to what is mobilised in conversations as a marker of age differences – for example music choice or debt levels – and how transitions are organised. Whereas Lesko's work emphasised the dominance of one temporal discourse that treats adolescents as context-free, always 'becoming', Alexander (2014) suggests that contemporary youth have a mercurial sense of temporality: that is, they imagine themselves in relation to multiple concurrent age-imaginaries that both follow and resist dominant discourses. In his studies young people accept that modernity is characterised by a state of uncertainty which means that they continually need to change from who they are now.

Discourse at a micro-level: possibilities for change

A sociological view of educational choice needs to address why aspirations and outcomes are unequally distributed in society, and recognise how these are framed by "obviousness (what people like us do) and necessity (the limitations of social and spatial horizons), and the complex and sophisticated nature of individual and familial decision making" (Reay, David, and Ball 2005, 161). Bourdieu's influential notions of doxa and habitus (Bourdieu and Passeron 1994) underpin the idea of competing logics of

aspiration (Zipin et al. 2015). A *doxic* logic comes from discourses that circulate in institutional settings. Doxic aspirations appear to embody universal rationality but codify the norms of those already in powerful class positions.

In contrast, habituated logics are embodied, grounded in childhood settings, and lead to “deeply internalized, latently felt estimations of probable futures” (Zipin et al. 2015, 234) that congeal into classed and gendered social positions. For example it is a doxic logic that studying science, technology, engineering and mathematics (STEM) subjects brings success in a modern economy; nevertheless students are only likely to orient themselves towards such employment if their families have ‘STEM capital’ in the form of resources, awareness and behavioural patterns related to a range of STEM careers (Archer, DeWitt, and Wong 2014).

When considering their subject choices at 16, young people are thus negotiating ideas of what those choices mean, what is appropriate for them at different ages, and following taken-for-granted, doxic and habituated logics of aspiration. The space for agency in this self-positioning is limited, but Alexander (2014, 159) finds “moments of improvisation and alterity” in young people’s accounts of their lived experience. Zipin et al. argue for an emergent logic of aspiration, recognisable when young people voice impulses towards alternative futures that are grounded in their lifeworld but do not recapitulate its past as their only present. Although always powerful, the multiplicity of discourses coming to bear on young people allows for emerging tensions and alignments, which can be fostered to imagine new possibilities. The question this raises is how emergent aspirations could be sustained as they meet the “regimes of anticipation” in schools that shape what is learned about hope, hopelessness, reality, possibility and the relationship between learning and the future (Amsler and Facer 2017,

7). These regimes are dominant and far-reaching; they maintain social patterns and close down possibilities for individuals to act otherwise.

In this context the FM programme can be seen as a potential institutional resource for encapsulating new structures of feeling about choosing mathematics and FM. The research question driving this longitudinal, interview-based study was thus:

What senses of time are circulated in the accounts of students choosing to study mathematics and FM in a widening participation programme, and what discursive positions do they make available?

Study

The data comes from 31 interviews and 51 e-mail questionnaires with twenty-four students in three sites in England. The sites were chosen because they relied on the national programme to enable them to offer the Further Mathematics (FM) course to 16-year olds. They exemplified differing socio-geographic settings: a 16-18 college in an urban, disadvantaged and ethnically-mixed area of London; a new school serving settled Asian and White communities in an industrial city; a predominantly White market-town school whose students had varying socioeconomic status. They also exemplified differing teaching contexts: FM was taught for 2-4 hours per week (compared to 5 hours for mathematics), either during school hours or after-school; preparing over two years for either a half- or full A-level qualification. Almost all FM students at each site agreed to participate in the study, plus two mathematics-only students, a total of ten girls and fourteen boys. Using parents' occupational classifications (Butler 1995), 5 were working-class, 8 from administrative middle-class, 8 from professional middle class and 3 were unattributable. Table 1 summarises all participants (given self-chosen pseudonyms), with their schools, gender (F, M), class (shown as W, AM, PM and x

respectively), and their FM pathway.

	No Further Maths	Stopped during first year	Stopped after first year	Stopped during second year	Completed two years
16-18 college (half A-level only)			Joe M, W Michael M, W		Bob M, W DoubleO7 M, W John M, x Li Mai F, PM Sukina F, W
New school (full or half)			AgentX M, AM Ricky M, x Tom M, AM		Helen F, AM Mario M, AM Randall M, AM Simon M, PM
Market town (full or half)	Ellie F, PM Hayley F, AM	Esther F, PM	Clive M, PM Steve M, x	Steffi F, AM	Charlotte F, PM Charly F, PM Jodie F, W Paul M, PM

Table 1

The research data consisted of accounts of study experiences and choices, collected over two years using semi-structured interviews, half-termly emails, and observations of 2-6 mathematics lessons in each site. The students were interviewed by me either singly or in groups of 2-3 by their choice, 18 during their first year after choosing A-level subjects and 21 in the second year; with 15 interviewed twice. Interviews included direct questions about choosing subjects, how their class interacted in lessons, how they worked at home, and memories of learning mathematics. I also asked questions that involved talking about school and mathematics in language that disturbed doxic patterns. For example, I asked students to choose from a list of 12 adjectives to describe school subjects (such as *warm*, *talkative*, *straight*; derived by me from research into perceptions of mathematics), and explain their selections. Emails were used to pose questions at significant transitional times, e.g. after receiving first module results, applying for and joining university, and to follow up any interesting responses in a reflective conversation (Mann and Stewart 2000). Observations documented lesson practices in mathematics so that I could trace their interactions with student accounts.

The longitudinal aspect of the study allowed me to follow discursive patterns in the students' accounts as they completed differing FM pathways (see Table 1).

Analysis involved coding the student accounts to locate language related to time or age (underlined in the following extracts), and examining whether/ how this language was associated with narratives of choosing and participation (Robson and Bailey 2009). The codes and subcodes relevant to this paper were Time (as a resource/ age-related/ memories/ futurity) and Further Maths (significance/similarity/difference to maths). Coded text was reviewed to ask, first, how, and in what contexts, students used these senses of time and age to position themselves and others as 'doing' mathematics/ FM; and, secondly, whether there were alignments or tensions between these uses. This resulted in identifying concurrent discursive patterns that structure relationships between 'what can be said' and the power effects of saying it.

Results

My argument in this paper is that discourses of time and maturity are mobilised when mathematics students account for their participation, but that the discourse in (standard) mathematics is different from that used for FM. The following sections show how these two discourses— that I named *moving/improving* (M) and *getting ahead* (FM) – are each constructed through language patterns that combine into understandings of mathematics and selfhood. These were patterns that occurred across the talk of the 24 students; the quotations I present below were chosen to demonstrate these similarities in language use, and to allow repeated citations from a few students in order to allow me to present some context. A post-structural analytic considers how language aligns to make some practices powerful. This means I do not look primarily for regularities in *who* uses these temporal discourses but for their local effects and how they interact with discourses of

choosing.

Mathematics as moving/improving

A discourse of mathematics as *moving/improving* was constructed through three discursive patterns that align the futures for individuals with the temporalities of mathematics.

Securing progress in modernity

The first pattern occurs in students' explanations that their present choices are shaped as responses to their conjoined awareness, firstly, of their own state of expectancy and, secondly, of how mathematics projects itself as foreseeable security. Students were asked 'What do you think is most important to you in choosing your subjects?':

Well, would they be helpful to me in the future? Would they look good on my application forms? Cos I don't want to do subjects well like - not being harsh - but subjects that aren't as well thought of, like easier ones. (Clive)

Job security and it's useful. It's useful in the world, because engineering stuff help us build... help us progress in the future. [...] If I don't do medicine I'd like to do something mathematically related to medicine, and engineering seems like a good prospect. (DoubleO7)

What I actually want to do in the future is own my own business but then I am just thinking of a way that you can actually get to that stage. (Steve)

In these three extracts, choosing a subject orients the young person to the future as a gatekeeper or talisman but is not in itself their future. Clive foresees a continuing process of being scrutinised, part of the *panoptical time* associated with adolescence. Within this process, as a White middle-class male student, he positions himself as knowledgeable about the relevant technologies of "my application forms" and the exchange value resulting from future employers' perceptions of subject difficulty. In a

later interview he described family conversations about school and university choices as “finding the right course where at the end of it you have got a job set in stone, ready for you”. As a relatively privileged student, security is both an aspiration and an expectation. He aligns doxic and habituated messages to subordinate the present value of learning mathematics to his employability outcomes.

DoubleO7 also emphasises a secure future career, conjured through the ongoing utility of mathematics rather than its exchange-value. Aged 17, his aspirations include medicine, a choice that positions him as high-achieving, and also as continuing and improving his British-Filipino parents’ health-service work. As for many working-class urban youth (Archer, Hollingworth and Mendick 2010), this aspiration is a ‘dream’ job and he knows the school does not expect him to attain it. He gathers his imagined futures by describing civil engineering and medicine as “mathematically related”. This illustrates how students reproduced mathematics as central in the progress and stability of modernity, and positioned themselves as sharing in that security through their choice.

The temporal characterisation of mathematics as ‘securing future progress’ was widespread among participants, and was both reiterated and critiqued during the interviews. Thus Steve’s quote oriented him towards an entrepreneurial future, but did not echo the certainty of his friend, Clive, that particular school subjects would secure that pathway. In the early interview, Steve explored invoking mathematics as an example of how he secured results: “Once I get started, if I can’t actually work it out then I’ll keep on going till I’ve worked it out”. He explained these qualities of persistence and discipline as values espoused by his mother and brother, who had recently gained accountancy qualifications. Later, he expressed his doubts whether any school subjects could get him into business, using these to account for dropping mathematics and considering employment rather than university.

It is worth noting that this characterisation was most prominent in accounts of choosing offered by boys. All ten girls used similar phrases conveying trust in a future utility of math; nevertheless their explanations of subject choice foregrounded reasons centred in the present, notably enjoyment (“I like Maths. That’s it”; Helen) or (externally-sponsored) ability (“Mum said I was good at it”; Ellie).

Doing mathematics as moving on

The second discursive pattern aligns the push-to-futurity of mathematics with individual experiences of learning mathematics as present movement. We see this above in Steve’s description of “not stopping” in mathematics until he had worked it out. It also appears in responses to the adjectives task. The two most commonly chosen for mathematics were ‘safe’ and ‘straight’, and students’ explanations positioned mathematics as having a totemic function of guaranteeing movement in time:

Straight because sort of the way the course runs, you sort of run straight through it and each bit will use everything you've used before. (Paul)

Safe because in a way I know Maths is the one thing I can do it if I put my mind to it. I do have to work at it but I can do it. Hopeful: it could like go somewhere. (Jodie)

When you learn one thing it goes on to another all the time. You are always progressing slightly. It gets harder as you go on through. (Joe)

This pattern is marked by a combination of linearity and repetition that conveys an *enduring* sense of time, with “each bit” of the student’s future inspired by their present. There is ambiguity over who/what is progressing – ‘you’/ ‘I’ and/or mathematics/ ‘it’ - and repetitions that bring the person close to the subject, associating the future portent of mathematics with the individual. The continuity of past going to present and future is emphasised, producing a sense of measured, dependable

improvement. There are echoes of Lesko's (2001) discourse of expectant development in "you are always progressing slightly", and in looking ahead to the endpoint of "hard" adulthood. There is also a *cyclical* sense of time in the ebb and flow of repeated statements that guarantee improvement.

Inheriting mathematics

The third pattern that supports the discourse of moving/improving combines enduring and cyclical temporalities to position mathematics as inherited. This aligns with a dominant discourse that mathematical ability is 'natural' and timeless rather than achieved (Foy, Solomon, and Braathe 2018; Mendick 2008). Students themselves summarised this concisely in one of the reasons most gave for choosing both FM and mathematics: that they had always been good at it. When asked for memories or images of themselves doing mathematics, some chose primary school successes but many gave examples of events involving parents. Fathers featured notably in mathematical memories, re-scribing the discursive alignment of mathematics and masculinity, and mothers featured as discussing choices. This emphasised mathematics as a natural and enduring inheritance heightened through family stories:

[Dad] migrated over from Vietnam and ever since then he has just been reviewing maths with me and he has been teaching me since a young age. (Michael)

My dad always has this story [laughs] when I was about 5 [...] And dad finds this story so funny. He just sort of "oh we knew back then she was going to do maths." (Charly)

My dad bought me for Christmas [a] book about algorithms, and I think he thought I was going to put it on the shelf, but I actually started reading it on Christmas Day and it was actually very interesting. (Charlotte)

In such stories, a child-like experience of ‘doing mathematics’ is understood as relevant to a present sense of belonging and extendable to the future, connecting the age imaginaries. Both Charly and Charlotte are girls who had chosen FM. The humour in their stories serves to mark their mathematical engagement as surprising, as recognised in other performances of high-attainment amongst girls (Francis, Skelton, and Read 2009), and mitigates a risk of appearing precociously separated from ‘normal’ adolescence.

The negotiations of concurrent temporalities of youth and growing up, described by Alexander (2014), are visible in the case of Joe. His account of choosing mathematics starts with forward-looking expectations that frame his present family roles and freedoms. He couples this with a strategy of looking back, and suggests that mathematics can be natural and handed down in the family:

I have got such a big family you know. But I'm only the second person in my family that is going to go to university. Yeah so it's like my whole family have got expectations of me. They don't force me or tell me to go into this or that. They just take it. I think they know that I will make the best decision for myself. The only thing I can say is that my dad, he was really good at maths you know. Even when I was young he used to do maths with me, and he actually made me quite competitive, I feel, in that sense ...which was quite a good thing.

So does he do maths in his job?

No not at the moment no. He was just naturally good at it.

Joe describes his father as passing on mathematical practices that produce the child Joe as competitive and aspirational. These continue in adolescent Joe, helping him make his own decisions, and the hand-over is more complete because Joe's father now lives apart because of deteriorating health. Joe reiterated the experiences with his dad as being the source of his good feelings about mathematics: “I remember we used to ask for more as well. I used to go up to him and say ‘Dad can you give me some more

questions?’” These memories position Joe within the family but also as agentic. Mathematics is inherited *and* it prepares him for the challenges of adulthood. Thus this discursive pattern positions mathematics within the dominant *expectant* time of adolescence – progressing without arriving - but layers this with concurrent, connected imaginaries (Alexander 2017) of childhood and future.

Together, these temporal language practices associate mathematics with opportunities to harness security into the future, continue present movement, and claim inheritance, in a discourse of steady moving/improving. It might be expected that learning FM would provide similar positions, since it comes from the same discipline. In the next section I show that instead the analysis revealed rather different senses of time.

Further mathematics as getting ahead

The discourse of FM as getting ahead arose from the combination of three discursive patterns: ‘doing extra’, ‘a head start’ and ‘im/maturity’. All make use of the sense of *time in advance of itself*, that Gurvitch (1964) argues is associated with speculation and risk, where the present is used to compete for the rewards of the future.

In the adjectives task, the modal distinction that participants made between mathematics and FM was to describe the latter as not safe but rather as *new*, *cloudy* and *hopeful*. Even Charlotte, a White middle-class girl and one of the highest achieving students, echoed the uncertainty of further mathematics both in her future understanding and her lived experience:

It is more hopeful. Probably the one that I was always a bit uncertain. So I was more hopeful that I will understand. I usually just hope for the best when I do

questions, because in Further Maths I find it difficult to know if I have got it right or wrong. So it is more just might write it down and hope for the best.

The certainties she described when working through mathematics questions are absent, and it is this lack that she (at least temporarily) found “difficult”. “Hopeful” was thus a way of talking about FM that positioned students flexibly in relation to the risk that their progress might not be secured by FM and that they might be held responsible for this. By hoping, they could either be seen as confident in their choice despite being unable – as an adolescent - to control its risks, or as sensibly never entirely committed to an uncertain trajectory. All FM students struggled with the tensions of hope: it was not simply the case that students who continued found it more predictable, and those who did not find it predictable gave up.

Further mathematics as doing extra

‘Doing extra’ positions students as consuming time in a way employers will like. It indicates the value of activities that run alongside what is seen as normative development. Doing extra is not a guarantee in the way that straight mathematics is; rather, it concerns appearance and impressions:

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, good’, again looks as though as though you're doing extra.. (Clive)

To start with I did it because it was an extra A-level and I thought it would look good, to be honest. (Charlotte)

‘Doing extra’ thus presents as an age imaginary of an adolescence supplemented with some aspects of adulthood – hard work, awareness of the adult gaze - and expecting rewards from this alignment.

A head start

The second pattern treats time subtly differently: it accelerates the normal linear progress of mathematics towards adulthood. Many students reported hearing from family, friends or teachers that further mathematics resembled university work. They thus spoke of it as positioning FM students as “one step above everyone else”. In choosing FM they expressed themselves as willing to secure a “head start” and project themselves into the future.

If I've already learned it now it's obviously gonna help me in university. (Simon)
At university they go straight into stuff... They go straight into the university stuff, they don't give you... They don't teach you the in-between stuff. I am glad I do Further Maths because that way I've kind of got a head start to students who aren't doing Further Maths. (Sukina)

These two comments, from two FM students, show the rationality and the pleasure in this reasoning. Sukina, especially, emphasised the fast pace of university mathematics, that she has adopted early. Together, these understandings of FM as getting ahead accelerate the dependable, staged progress of mathematics, and move students more quickly towards an imagined next stage.

Although Sukina presented herself very strongly as belonging with/in mathematics, her aspiration to study university mathematics is a way that she and her British-Bangladeshi family are constructing new stories - ‘emerging aspirations’ (Zipin et al. 2015) – grounded in their lifeworld. Her account of choosing foregrounded her relationship with her elder sister, who had left school at 16 to get married, but then returned to study in Sukina’s cohort. Sukina emphasised how this re-alignment of temporalities retained strong family connections: these educational pathways were supported by Sukina’s new brother-in-law, a science teacher who provided her “inspiration” for aspiring to attend university and become a teacher herself.

The FM discourse of “getting ahead” can function as an enabling discourse that provides doxic ways for more students to claim a privileged position. Nevertheless, this can very easily be threatened, as Sukina found when she visited a prestigious university admissions event:

I said to [the tutor] 'I am doing Further Maths AS out of college. Can I still apply for maths?' He said 'No. You need Further Maths A-level'. And then he goes 'You can take a gap year and finish it off'. And I'm like 'how dare you. Take a gap year to finish off Further Maths'! And then he goes 'Frankly we get enough students doing Further Maths A-level'. I was like 'Right I don't want to come anyway'.

In this encounter, Sukina’s understanding of the ‘AS’ (half qualification) in FM as ‘getting ahead’ was dismissed when the tutor insisted on the (full) ‘A-level’ course, unavailable at her school, and suggesting adding a pre-university year. Although a “gap year” is part of the adolescent story for White middle-class students, and for this tutor, it was unthinkable for Sukina. The age-imaginaries offered by the admissions tutor were incompatible with the ways that Sukina and her family were negotiating new imaginaries of young adulthood that combined cultural and institutional narratives within contemporary constraints (Smart and Rahman 2009). Although the discourse of a ‘head start’ holds out the promise of accessing a privileged academic position, that privilege depends on other, unstated expectations about how adolescents can stay in expectant, educational time.

Bright lights and im/maturity

The discourse of doing further mathematics as *getting ahead* was used by all the students at some point in the study, whether or not they initially chose the subject. FM students were commonly described by others, and described themselves, as layering their futures with their presents: they were missing the “play” appropriate to their age,

no longer having a social life or adolescent interests in sport and television. Seen positively, this marked an acceleration to adulthood. In the Grants site, this dominant discourse was also used, but reversed, by several students in distancing themselves from FM and questioning the apparent maturity of those who continued. Thus FM as im/maturity is the third pattern forming this discourse. In the following series of excerpts, two Grants students looked back over a year of study and contested the discourses that led to their original choice:

AgentX I kind of thought about it as kind of bright light syndrome. You hear about Further Maths and you ... You know, I heard it from somewhere that it was nearly degree level mathematics.

Tom It's because it's worth more.

AgentX Is what I heard. So I thought to myself 'oh that'll be good', you know universities would like that.

Tom That's the lure of that. People that are doing any sort of standard A-levels [...]. Further Maths is something that's... something that's more, that's extra.

Tom and AgentX aspired to careers in the engineering/computing industries, similar to the kind of work their fathers do. After middling examination results, they had both decided not to continue Further Maths and to concentrate on their “core” subjects. Although Tom described still feeling “the lure”, he framed his decision as developing maturity, a matter of understanding his own limitations and “sacrific[ing] one thing to be better at other things”. He constructs maturity as attending to the appropriate technologies of expectant adolescence: aiming for realistic gains now rather than possible superiority in the future.

Temporal discourses of schooling supported AgentX and Tom in their account. Their attachment to maturity was showcased in their use of school planners, targets and deadlines to demonstrate that they are becoming independent and disciplined. These

artefacts were markers of age imaginaries, rendering maturity visible within panoptical time. The two boys contrasted their present stage of becoming mature with the earlier demands of the FM programme for after-school learning: “really we shouldn't have been made to do that anyway, should we, at this age? We're still in A-levels”.

This extract shows a layering of child and adult imaginaries used, very effectively, to question the decision of friends who had continued with FM, positioning them as immature and precocious. The lure of FM was deemed forgivable only for young or “clever” students. The metaphor “bright lights” further suggested that claiming such cleverness may in fact be a self-deceiving performance as naïve and unrealistic as celebrity or the entertainment industry. This tension was also current among those who continued, for example Randall and Mario debated whether they could describe themselves as “independent” since they studied FM but “I'm used to my mummy making my lunch for me”. In another paper (Smith, 2011) I have examined the way that the abstract and the pragmatic are aligned with FM and mathematics respectively to render choosing FM an inauthentic choice. Here, focusing on temporalities, I argue that students who started both mathematics and FM found that the discourse of FM could position them as over-civilised, over-accelerated learners, thereby distancing them from the normative performance of doing mathematics as practical, progressive, future earners, steadily moving on in time.

I have given these longer examples of Sukina's, Tom's and AgentX's accounts because they illustrate how time-related discourses of further mathematics as ‘getting ahead’ strengthen each other but also inspire oppositions and resistance that come from institutional practices and habituated logics. These tensions have to be revisited in one's own identity project if one considers continuing or leaving the subject. Although

articulated most clearly at one site, the implication that ‘valid’ FM students require visible high attainment was borne out across sites and, nationally, in grade profiles. Such talk shows how negotiating these tensions involves practices of the self that construct maturity alongside gender and class (Archer and Leathwood 2003; Currie, Kelly, and Pomerantz 2006; Skeggs 1997). As with adolescence, doing FM gains meaning in relation to its end points, so that student claims of being ahead of themselves are precarious, and can change rapidly into a lack of control signified by/as inauthenticity.

Discussion

This analysis suggests how students incorporate senses of time and age imaginaries in forming temporal discourses of doing mathematics and FM. Culturally, mathematics is positioned via a sense of enduring time, as a relevant force in a technological future, offering security in an uncertain world (Beck 2007). Students associate these qualities with mathematics; but the *moving/improving* discourse does more: it enables them to claim them for themselves through the practices of choosing.

The sense of enduring time positions students within the developmental view of adolescence, subject to panoptical and expectant temporalities (Lesko 2001). Students follow the anticipatory regimes (Amsler and Facer 2017) expected of young people, forming their present through their consciousness of the future. Future utility is a reason given for many subject choices (Rose and Baird, 2013), but the practices of school mathematics bolster this anticipation of consequence. By drawing attention to the ways that students presently experience moving/improving within mathematics, they position themselves as making that future tractable, with dependable, measured progress to a foreseeably valuable outcome.

I have also shown how childhood and family can be evoked in the discourses of choosing mathematics, giving a sense of time as inheritance that adds continuity to students' projects of the self in mathematics. Mathematics is a doxic choice for students with prior achievement, but this discursive pattern locates it as arising also from family practices and sustains a sense of selfhood as authentic and persisting through time. In the school setting this creates a sense of belonging in mathematics (Bauman 2001) that partially insulates the students against threats such as poor test results. I have argued that the temporality of inheritance layers and threads age imaginaries together rather than keeping them apart. It is an example of positions becoming available within local discourses that resist the cultural imperative for individuals to attend to their futures rather than their pasts (Rose 1999). It mirrors Alexander's (2017) finding that young people produce life trajectories where imminent and distant futures are mixed.

There is a different sense of time in further mathematics discourse, namely that of *getting ahead* in career intentions and in mathematics. This sense of time in advance of itself allows students to construct themselves as not merely oriented towards the future but accessing it now. The age imaginary in play is that of the next stage, and is a privileged one. It provides a way of proving themselves within the school environment and justifies thinking in terms of neoliberal dreamscapes (Walkerdine 2003) in which they achieve more than others expected of them.

Nevertheless the discourse of getting ahead is precarious. It is readily intelligible by students but so are ways of resisting it. These take the form of positioning advance as illusion and precocity. Illusion can be opposed to maturity; so it becomes a marker of maturity to discipline oneself to the educational technologies of the present and resist aspiring to the bright lights of FM. In this discourse, a FM student is excluded from being an authentic adolescent and teeters between being a child and an adult. Lesko

argues that precocious individuals (young drivers, young mothers) are understood as dangerous in the dominant discourse of development because they raise concerns that subordinate positions will become entwined with dominant ones. This cultural concern about precocity renders FM student choices fragile. The opportunity given to them of joining the FM program as ‘an extra’ sets them in opposition to the normative understandings of the school. They become ‘impossible subjects’ (Butler 2004), only able to sustain their position through visible ‘cleverness’ that renders them exceptional. While students use this tension productively to perform new forms of aspiration, these are easily threatened by calls to become appropriately mature and by encounters (such as Sukina’s) with inflexible institutional temporalities.

It is important to note the particularity of these local practices of studying advanced mathematics through the national FM programme in England and, more recently, Wales. Nevertheless, many jurisdictions offer their 16-18 year olds a range of mathematical pathways stratified by content and abstraction (Smith and Morgan 2016) or by the perceived abilities of those who study them (Foyn, Solomon, and Braathe 2018). This study suggests that the discourses and hence the lived experiences of students can be significantly different, even for two relatively similar academic pathways. This study speaks only of participants who initially chose mathematics, not those for whom by 16 it seemed fearful, boring or repellent. Even for this apparently unified group, the discursive pattern of M-mathematics is used to sustain one feeling of secure progress, while FM-mathematics offers contrasting hopes, aspirations and risks of acceleration.

Within these two discourses there are opportunities for inscribing new possibilities but also of revisiting familiar exclusions. Class emerges as an exclusion in the discourse of getting ahead. Firstly, as in Sukina’s case, accelerated practices require

material support. In schools, this is made possible by the ways in which the FM programme acts as a reimagination from above that relaxes the structures of subject choice (Gale and Parker 2015). There is continued temporal flexibility in the middle-class practices of gap years or specialised extra tuition that exist in the discursive space between schools and families (Ball 2010), but neither are achievable or imaginable without financial resource and a broad re-imagining of logics. The discursive layering of FM aspiration and im/maturity allows another form of exclusion, at an intersection of class and gender. Here, maturity is performed as a pragmatic acceptance of constraints, playing into habituated fears among working class boys that doxic aspirations will lure them away from authentic and realistic achievements (Archer, Hollingworth, and Mendick 2010; Archer and Leathwood 2003). This is not to imply that working class students are at fault in performing such self-exclusions; rather that the concurrence of discourses of mathematics and of developing adulthood and masculinity inhibits their alignment with the hyper-accelerated potential of FM.

This analysis also raises questions of how girls are positioned by, and position themselves with, these available temporal discourses of choosing mathematics. The study replicates others' findings that girls' accounts of choosing mathematics include the same reasons that boys give, but organise them to emphasise a strong personal alignment with the subject. In particular, the discourse of moving/improving aligns with qualities of risk-aversion and conformity associated with girls' classroom practices and with non-elite mathematics (Mendick 2005).

In this study girls either chose against FM early or continued to a second year. Unsurprisingly then, most did not seek to distance themselves from FM. Nevertheless, even accounts of continued participation are subject to dominant discourse, and the difficulties posed by overlapping age imaginaries of childhood and adulthood within an

overall requirement for adolescents to mature, slowly and without precocity. I return here to the ways that girls such as Charlotte, Charly and Sukina (and boys, such as Joe) emphasised family relationships in justifying their choices. Other research (e.g. Mendick, 2008) has traced how inequities in mathematics are defended by the discursive positioning of ability as ‘natural’, which I have linked to enduring and inherited senses of time. I suggest here that this positioning can also downplay the temporally-constructed threats to participating in FM: the imaginary of childhood is emphasised over the imaginary of ‘being ahead’ because it is a position of subordination that is gendered as feminine (Lesko 2001) and so more defensible. This is not to say that students can escape the dominant ways in which constructs such as ability, diligence, rationality position mathematics and FM as masculine, but to show, similarly to Stinson (2010), that systematically exclusionary practices nevertheless allow niches for individuals to take up locally powerful, but exceptional, positions.

Finally, I consider what this means for advising students about studying mathematics. It is striking that the discursive opportunities of each pathway were so different for students in the years after the moment of choice at 16, and not before. Overwhelmingly, these students relied on mathematics for security in the performative world of school classrooms and examinations; they felt hopeful but less safe accepting that FM-mathematics requires risks. Knowing that you will do well in maths tests, and then actually doing well, was a strategy for simultaneously and publicly controlling time and success. Despite their attainment, losing the opportunity to produce this narrative of self-governance evoked the same reactions as with the majority of students who had already rejected the subject aged 16. This suggests the importance of creating a discourse that supports cognitive risks in the mathematics classroom and provides ways

of valuing learning for what it makes possible in the present as well as the examination-mediated promise of future selves.

Conclusion

An original contribution of this study has been to draw together theoretical framings of how society conceives of adolescents within time - and how adolescents think of themselves, and to use these to examine discourses of choosing mathematics. I used Lesko's senses of time as tools to show how the contemporary framing of adolescence as a time of 'becoming' is aligned with discourses that construct powerful connections between maturity, mathematical progress, and the need for the (idealised) adolescent to secure a future, and indeed to get ahead. Lesko's argument emphasises the way that adolescents are caught between past and future selves. My argument also needed the insights from Alexander's (2014) approach that recognises multiple imaginings of present and future selves. I have shown how individuals embrace and bring together the context-rich imaginaries of child and adulthood in ways that support their accounts of the self but can also serve to reinscribe wider patterns of inclusion and exclusion. For educators, my study suggests caution in vaunting mathematics students as unusually mature, and attention to narratives of success that allow for variations in attainment, interest and perceived security. For policy, it illustrates that a participation program gains traction by attending to the micro-level practices framing choices *within* 11-18 education, but needs also to make the next stages of progression intelligible and accessible to many students.

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