The influence of students' life narratives on identification with learning mathematics

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Abstract

In order to capture pre-university students' subjectivities about learning mathematics, we draw on interviews focusing on students' experiences of learning mathematics in different pedagogic/curriculum cultures, and on their imagined futures about their education and careers. These seek to capture students' decision-making about learning mathematics, within the context of their motivations and professional goals. We are especially interested in cultural models (Holland, Lachicotte, Skinner, & Cain, 1998), which students use as discursive tools during the interview events in order to position themselves in certain kinds of ways as certain kinds of people, and how their beliefs about learning mathematics fits into this. The paper addresses the question, ***How does students' mathematical positions/disposition appear in their identity and career decision-making****?*

We found that usually students' identification with mathematics was not critical to their identities (for this sample of 44 students. Talk about learning and decision-making was dominated by a cultural model of performativity and this was tied up with where their saw themselves heading in their careers and who they wanted to become over the next few years. Mathematics fitted into their stories primarily as something that gave status as a tool that could make them look good and in this way they could be said to identify with mathematics. However, students seldom identified themselves as having a love of mathematical ways of thinking.

Implications for pedagogy are that dispositions towards learning mathematics can be resistant to change and that if it is to make a difference to students' lives in the longer-term then pedagogy will need to connect better with identity. However, this isn't the case in the current system, where (for our sample) students, learning mathematics is only rarely rapped up with a sense of who they are and who they want to become, so that they mostly cannot be said to have a mathematical identity. For the purposes of this paper, we highlight students' accounts of their decision-making about future careers that they said influenced their subjectivities about learning mathematics and their views of themselves as young people transitioning into higher education, getting nearer to embarking on their professional careers. The students selected are amongst those for whom mathematics might be expected to have some relevance given their choice of degree subjects, accountancy, vetinary science and computer science. For the purposes of this paper they were amongst those who revealed about their positioning with mathematics in non-trivial ways.

Background

The project *Opening doors to mathematically-demanding programmes in further and higher education (FHE)* (www.lta.education.ac.uk/TLRP.html) explores pre-university students' dispositions for further study, particularly in higher education, and particularly to study courses in which mathematics might be relevant. As part of this study (the full study involved a longitudinal survey and quasi-experimental study) we conducted multiple case studies of students as they progress through a year or so of further education (usual age 16-19 years) before when they might be expected to do on to study at University. Interviews were conducted with 44 students (up to four interviews, transcribed) over the course of a year or so during which their early pre-university course studies progress and when they make decisions about university applications, and secure the details of the following years.

The sample was selected to ensure that we included students likely to drop out of Pre-university mathematics due to 'risk' factors such as low previous mathematics grades. In interviews we (two full-time research assistants and four of the main investigators were involved) asked about their biography, their dispositions and future intentions (Williams et al., in press). This paper contributes to the third main research question of the study, *How do different pedagogic cultures mediate students' identification with mathematics and aspirations for further study?* In doing so, we consider values that influence students decision-making about further study, and consider how values about learning mathematics impact this decision-making process. This leads on to a discussion about identification with mathematics and pedagogy.

Earlier work, Davis et al (2008, working paper b) identified a number of cultural models (e.g. ideological values), which students drew upon repeatedly, either from a position of conformity or in resistance, and used to present themselves in certain ways when they articulated their decision-making about university and career choices e.g. as a dutiful son. These included: "*a woman's role is to serve a man/family"*, "*you have to play the game to get ahead*", "*its in my bones/culture to become a….."* We were careful to point out that this should not be seen as a definitive set of models that mediate decision-making. Other ideological values were also used by the students in their decision-making e.g. deference for the family, respect for parents/elders, autonomy, aspirational values for material wealth.

We found (Davis et al, 2008, working paper c) that mathematics fitted into the decision-making landscape for a significant group of students who drew on the value "you have to play the game to get ahead" in so far as they also shared a belief that mathematics is generally considered a hard subject and that they believed this could give them an edge when it comes to getting ahead to university or in a career, even if they did not expect to use mathematics in their studies. For example, Louise, who from the outset had not intended to study mathematics beyond further: "*I just chose Maths because I thought it would look good on my CV and I found it easy in Year 11 and I thought why not. That's why I chose it."* She later confirmed that she doesn't need maths for her chosen career as a nurse, *"I've researched it and you don't really need A level or AS level maths. But I did want to do it [AS Maths] just to gain me that extra boost and things so… I still want to be a nurse. I think, yeah, you'll have to use maths then but not this type of maths. Like, the maths we're doing, logarithms and things, you won't use it when you pop down to the supermarket or anything like that so I don't, even though I enjoy it, I still don't see the point why we have to do this, but then again, maths is just for a qualification. Even though you're learning this, it's in the end I'm not going to use it. I'm just doing it to get a qualification so I can get a job. Whereas some people might be using it because they enjoy it and they might need it in their career, like law or something. I don't…**….** I've already told [the teacher] that I'm intent on not doing A2 because it's a lot of hard work…"*

Another group was students intending on a mathematically demanding degree who valued mathematics primarily for its use. It was amongst this latter group of students where we witnessed some of the strongest identifications with mathematics. For example,

> *MP: How do you find Maths to be related to your [intended]degree? To the electronics?*
>
> *Vladimir: It is very helpful, because the electronics is Maths. If you know Maths it is much easier to learn about electronics, how circuits work and make your own circuits. Usually when we present some circuits in the electronics room and you usually get sine wave and using Maths you can calculate the voltages, sine maths equations and that is really helpful.*
>
> *MP: You like this connection.*
>
> *V: Yes.*
>
> *MP: Do you like what you do here is related to the course?*
>
> *V: Maths is essential to the choice.*

Or

> *Tony:* "*Yeah, I like maths. Because I'm doing electronics course and maths is very closely related to the engineering and the drawings and yeah, I think that's…if you're good at maths, you will be very successful in engineering so yeah. I enjoy maths. I think it's very important*."

In these earlier papers we presented a picture whereby many of the students had never intended on going onto a mathematically demanding degree such as science, mathematics, engineering, or computer science. In addition, the vast majority did not intend to become mathematicians - only two of the forty four students intended on taking a mathematics degree (and these proportions were also verified in the larger survey sample). Moreover with very few exceptions, students shared in a belief that they were studying in order to enhance their future careers (e.g. see Black et al, submitted), rather than for its intrinsic value, for the joy of learning and using maths and other in the moment rewards. For example, we can see Manjit identifying with participating in mathematics as she reflects on her experiences(such talk was rare for our sample).

> *M: In the designs and all the product making and stuff, you have to learn about different formulas and different techniques of building. Finding areas, dimensions and stuff like that. It's really quite fun to actually see the maths behind it, it's kind if like physics in a way, which I like. It has a lot of maths which is quite fun to do. Usually I'm one of the first people who gets it in class so that's fun as well. It's just so much fun. It's a different kind of maths, it's more algebra which is what I enjoy more than statistics, I've never really been good at it and I really don't..it's not really my choice to do but algebra links to more of what I'm doing. That's why I prefer algebra and doing it, physics and engineering is quite good.*
>
> *Interviewer: Is physics more fun or maths more fun?*
>
> *M: It's all kind of good. The physics bit gives you the kind of the world is all physics and the maths as well, it can be very hard but it's really interesting. The waves that you have to learn about is quite good maths there. You have to learn about the waves and halve the*

amplitude which is quite fun to do. The formulas you have to learn, it's mad., but so much fun.

Perhaps unsurprisingly, values about mathematics mattered most in decision-making about further study choices when students considered taking mathematically demanding degrees. For our sample students taking the decision about what to study at university acted as a bifurcation point in their identity trajectories with regard to their identification with mathematics. We found that a critical point in students' "identification with learning mathematics" trajectories was once they had received a firm offer of a place at university. Decisions to accept a mathematically demanding degree implicated a tendency for students to emphasise the relevance of learning mathematics for their futures, so that mathematics was valued both for its use and for its exchange to transition into the new educational or workplace context where maths was believed to be used. Decisions to take a non-mathematically demanding pathway implicated a tendency to emphasise the potential exchange-value of mathematics (Williams, 2008) to obtain goals that were not connected to using mathematics.

That how students talk about the value of mathematics in their lives was influenced by having a more concretised understanding of the place (or no place) they considered mathematics would have in their imagined future professional lives, has implications for how we might anticipate the quality of students' engagement in learning mathematics, for if, as appeared to be the case, there is little room allowed with which to value the personal and social development afforded by developing ones ideas in mathematics, little or no room to value being a lay mathematician, then we perhaps should not expect to find strong identifications with mathematics amongst students who do not intend to continue to study mathematics and to use it in their future careers. Such students tended to talk about learning mathematics as looking good on their cv. Yet we know from the survey data (Davis et al, 2008, working paper a) that approximately half of students taking AS mathematics did not intend on pursuing mathematically demanding studies, and that most of these never had an intention to take mathematics on further.

Earlier work in the project (Davis and Williams, in press; Davis et al, 2008, working paper c, Williams et al, 2008) has shown that pedagogic culture did impact how these students talked about their experiences of learning mathematics. Our concern for the project was to understand better how to widen-participation in mathematically demanding university degree programmes amongst our target group of relatively low mathematics grade sixteen to nineteen year old students, and we started from an assumption that pedagogic culture was key to transformation. Different pedagogic cultures may deter drop out from mathematics, and we wanted to understand better how this might work. We did so by studying students on two contrasting programmes of mathematics. The one programme, AS Mathematics is the established traditional mathematics course. The other, AS Use of Mathematics differed from this in several ways: its assessment is 50% coursework, the curriculum is based on mathematical modeling using technologies and there is an emphasis on interpretation (including an open book case study exam) and on application of mathematics. Some of the students taking Use of Mathematics were on a vocational programme in engineering (BTEC National) and these provided a useful contrast to the general education students.

We found that there was a very high drop out rate amongst our target group students on the AS mathematics course and that the drop out rate reduced dramatically for equivalent general education students taking the AS Use of Mathematics course (TLRP, 2008).
Our qualitative work also showed that students taking the Use of Mathematics course were held in there because of its assessment methods (coursework) (see Hernandez et al, 2008, working paper) and because of a perceived slower pace of the course. In addition, we found that students taking use of Mathematics were able to demonstrate an appreciation of uses of mathematics. This awareness contrasted with the group of AS students who talked about uses of mathematics as being helpful when out shopping and showed very little awareness of how mathematics might be used in real life. Uses of Mathematics students also tended to talk about giving explanations, understanding situations or an emphasis on concepts and why the mathematics worked, and they contrasted their new course with "normal" mathematics that they had experienced hitherto.

However, despite differences in self awareness about the kind of mathematics they were doing, and the contrast in how students in Use of Mathematics were participating in learning mathematics (Wake), overall disposition to study mathematically demanding programmes decreased a little between the start and end of their A Level programmes, and was not related to Programme (Hutcheson, 2008). Thus, whilst our target group students were more likely to complete the AS Use of Mathematics programme than the established AS Mathematics programme, this doesn't in itself implicate a widening in participation in mathematically demanding degree courses. One reason for this is that the Use of Mathematics course is a terminal course and also has attracted a greater proportion of weaker students than the established course. Perhaps this is explanation enough, but our qualitative interview work tells us something more, that even when pedagogic practices influence how students articulate their experiences of participating in mathematics, i.e. that even when mathematics pedagogic culture can influence students' participatory identities and their identification with mathematics, that dominant cultural models, especially to do with the purpose of education, performativity, and already designated career trajectories, act against decisions to continue on with mathematics during their degrees, even when students say they find learning mathematics enjoyable. For students who are already transitioning into adulthood and identify with certain careers, *enjoying* learning mathematics is not enough, or is considered irrelevant to their decision-making. Decisions to continue onto a mathematically demanding degree usually require students to identify with learning mathematics in more intimate ways that they believe will impact achieving their career plans.

Thus, we start from a position of having already conducted some analysis of the data-set and a summary of some of this analysis is provided above, albeit in a rather potted format, to the extent we believe is necessary to provide context to the paper. The contribution of this paper is to consider theoretically the processes by which pedagogic culture might impact students' identities. This discussion takes place through groundings of text about students' decision-making about their future degree courses and how their learning mathematics relates to their decision.

Conceptual Framework and Methodology

Gee (1999) refers to the everyday theories (i.e. involving what others refer to as schemas, metaphors and models) that people use to make sense of their lives as cultural models. "Cultural models are not static… and they are not purely mental but are distributed in socioculturally defined groups of people and their texts and practices (Gee, ibid:23). Thus, cultural models tell us what is "typical" or "normal" and mediate our actions, not universally, but from the point of view of our experiences. According to Holland et al, 1998: 51) it is this "stuff of existence", what is real to us and which grants shape to the co-production of activities, discourses, performances and artefacts. This then connects nicely with Holland et al's notion of "figured worlds".

We see "figured worlds" as a useful concept for helping to understand how students engage in learning, whether this is learning mathematics or learning to become a university student, because it provides a way to understand how students assume orientations necessary to participate in (collectively) imagined situations. Figured worlds are simplified interpretive frames that describe characters who are inspired by a particular set of concerns to participate in a narrow range of meaningful activities ((Jurow, 2005). Thus, we can view the interviews as attempts to capture the "figured worlds" of students in relation to learning maths, historically and in the context of their current mathematics classroom, and university subject choice, but simultaneously allow that their figuring about learning mathematics is situated in their "broader" life narratives, which are nuanced by all kinds of sociocultural differences e.g. to do with ethnicity, social class, gender.

Our earlier work has confirmed that articulating decision-making is a complex process involving reflection, and that if we are to understand how pedagogic cultures can provide for connections with identity then we are best to begin by focusing on the idiosyncratic and particular experiences of individuals, starting and keeping with their point of view, before examining the data for trends, which may not be detectable given the size of the interviewed sample. In particularly, we believed that narrative inquiry had the potential to get close to students decision-making processes; indeed, we could not assume that they would arrive at the interview having already reflected upon this process, and the interview event itself sometimes provided a space for critical reflection in a dialogue between the interviewee and interviewer, who aimed to capture something of the students narratives. According to Gee narratives are the stories we tell ourselves and others about ourselves and are central aspects of culture. Narratives are also the lenses through which we understand and organise our world as individuals and collectively. Narratives then provide the externalised means to capture the students figured worlds of decision-making, to the extent that they were able externalise these during the interview event.

For the purposes of this analysis, we were interested in the discourse or discourses about university degree decision-making that emerge from student interviews, which can be seen as representing a weaving together particular cultural models, including cultural models about mathematics if these emerged in the text, and whether, or not, these can be seen as being appropriated from their AS mathematics course. When analyzing the interview text narratives we followed Bruner (Bruner, 1996) who suggested that narrative is a means for explaining the exceptional and forming a bridge to the ordinary (Rosenwald & Ochberg, 1992) and suggests that people's troubles provide a means with which to understand changes in their trajectories. We therefore asked of the texts, *how did students position themselves for or against particularly cultural models so as to afford or constrain decisions to go on to choose mathematically*

demanding degree courses? We analysed for cultural models so to understand how students' mathematical positions appear in their identity and career decision-making.

Students talking about their degree subject choice

We provide short vignettes of students' accounts of decision-making and then analyse these by addressing the questions above. These extracts were selected because they demonstrate how a culture of performativity in education impacts decision-making in different ways. They also show how beliefs about the value of mathematics in students' imagined future careers impacts decisions to continue to study mathematics e.g. I am not going to continue with mathematics, even though I enjoy maths because of x, or I am going to continue with maths, even though I don't enjoy maths because of y. In each of the extracts we show that dispositions towards mathematics not crucial to their identities as young people transitioning to become university students and future young professionals. In each case, a cultural model of performativity dominates their decisions at critical points in their trajectories.

David

When we first met David he wanted to study mathematics/engineering and had high expectations for a place in a very good university. All was going well until he obtained a grade B in AS UoM. A talk with his psychology teacher encouraged him to drop maths in favour of psychology A2 and this provided a solution he believed would maximise the likelihood of a first class A Level performance. David decided instead upon an accountancy degree which he reconciled as providing status and future rewards as well as allowing him to study at the good university he craves. He aligns with a culture of performativity, although he does also articulate some regret about having dropped maths and the opportunities this might have then afforded him.

> *" I don't know, it was just Psychology, I could get a really good grade in and I thought if I took Maths maybe I might not be able to get the grade I would get in Psychology*" and "*The choice of Nottingham Trent was something to … If I don't get the grades that I believe I can get, I've got something to fall back on so I'm still going to university. And LSE was 'cos it's LSE, which is like the best in the country for accounting. Warwick was because it is the third best in the country for accounting, plus it's nearer to home and it's cheaper housing and I thought, if I get the grades, I thought I still might not be able to go to LSE".*

We see David drawing heavily on a discourse of performativity, e.g. in his talk of the "best" and of "a fall back". Particularly we see his concern for performance signalled, by a sigh of regret about his loss in having dropped traditional AS maths in favour of "Use of Maths" (during the first few weeks of the course), because of concerns about top universities recognising his chosen maths qualification, which seemingly in contradiction, he later also describes as being "very good". We first see David's decision to move from maths to "Use of Maths" as a one of loss of confidence in his predicted future performance.

> *MP: What was the problem with Maths? I mean, you had to drop to Use of Maths, or it was your decision then?*
>
> *D: Um, it was my decision and I remember it was the first, I remember going through high school and I was top of my year, with top, some people were smarter than me in the class but*

some people weren't and I was like an average but, like, top grade student, but I never felt challenged really by the work and, like, never thought it stretched me. You'd do like algebraic expressions and stuff like that. Then I came third and stuff like that in the higher paper and then came here and my first lesson was Surds and I haven't, I didn't, for one I didn't re-do it over the summer so I didn't really know what was going on, and then I just struggled with the work and it sort of scared me in the first week, that maybe, 'cos it's your first week so you're thinking 'Oh this is going to continue straight away'

MP: 'and it's going to get worse ..'

D: 'and it's probably going to get worse.' And then a mate of mine who went to the same school, who got B overall, and I got an A [in GCSE], turned around to me and went 'You're smarter than me, I don't see why you've dropped it.' 'Cos he's getting As overall. So he said, with a bit of work you would have been, still, not having that much trouble.

Later, we see how a concern for maintaining a strong performance (we note how he chooses to give his rankings earlier) again leads to a trouble for David who is unsure about the market value of the qualification he now holds, and this overrides a sense that this was a good course: *Um, Use of Maths was very good. Use of Maths nearly swung me into doing Maths again.* However, his allowance that there may be some intrinsic value in his learning is quickly followed by a return again to a discourse of performativity*:*

I'm glad I did it 'cos at least I've got a Maths qualification; most unis will ask me for an A level in Maths but they might settle for a Use of Maths degree, 'cos it is a Further Maths qualification. Um, but I've also, it's just a big regret that I just dropped Maths. Maybe, if I had Maths, I could see it, could see a chance of a uni turning around to me and saying that I can't go to their uni just 'cos I haven't got an A level in Maths. I can see LSE, LSE asked for it, but they also say if you have got an A at GCSE you should be ok on entry. But I still see them asking for an A level in Maths 'cos they've got like a lot of people applying.

In the extract above we see how acceptance of a cultural model of performativity dominates David's decision-making process, and we see how he considers learning mathematics in relation to what counts for him, high grades, status and a career which can provide him with financial rewards and social standing. David's identifies less deeply with mathematics as he takes his decision and drops learning mathematics.

We see how this cultural model of performativity also mediates Craig's decision trajectory and although he enjoys mathematics, he doesn't perceive that it aligns with securing a place on a degree course and so he drops maths. Although Craig identifies with learning mathematics, mathematics can be seen as tangential to his goals.

Craig

We hear in Craig's third interview that he will take another year at 6th form College with the financial support of his Mum. Previously, Craig had wanted to become a vet but had adjusted his aspirations to fit with the grades he could expect on a normal 2 year "A" level study period. His resolution had been to take a degree in biology or zoology and he seemed enthusiastic about this in earlier interviews and fairly well informed about it from his mother who is a biologist. Craig sees UoM as a supportive AS level for his main science A levels, so that UoM serves its purpose in

helping him along his chosen trajectory. This view that maths is not necessary for biology (by this read to obtain a place on a biology degree) is reinforced to him by his Mother. Craig drops maths " to concentrate on his main subjects". By the third interview we find Craig ready to repeat a year determined to get the science grades he needs to become a vet. Craig seems reconciled to going to university later than his peer group. It may also be worth noting that Craig comes to take a modelling approach to problem solving and uses the graphic calculator genre of maths when discussing his problem solving. He demonstrates to us a good appreciation of uses of maths, but in spite of this does not see maths as any more than a support subject for science A levels that would lead to a then biology degree, or as of now a vetinary science degree, for which mathematics is not a stipulated requirement.

Craig, also shows something of David's loss of confidence in his ability to perform during his earlier interviews.

> *I: So it was your decision to take that course [UoM]? You didn't consider to take the Pure Maths?*
> *A: I did consider it but it was clashing with other subjects and I was told it was one of the hardest subjects to take. Because I am doing Biology, Chemistry and Physics already which is hard enough at A level. I then thought Use of Maths was the better option because its 50% course work and I enjoy course work more, I feel more comfortable with course work. I think in exams it's the pressure that you have got to finish in this time and you have to get all your answers right, whereas course work you can take your time and think about it more and there is no pressure and no-one shouting over your shoulder saying you do it in this time, "you have five minutes less" and all this. You do it in your own time, you type it up and you hand it in and you get feedback from the teacher and they will say "this is what you need to improve" and you can go away and prove it. I think that is a lot better way of teaching.*

Biology or Zoology degrees had become safer bets for Craig in earlier interviews (much as accountancy provides a perceived safer route for David than a career as a scientist, about which he was a little nervous as to whether he could be clever enough). A gain in confidence led to a readjustment in favour of a rekindled dream. Here we see how discourses of performativity and of intrinsic worth can play against one another, when in his third interview Craig talks for the first time about becoming a vet.

> *A: I always used to like animals and stuff like that and then I went into a veterinary practice and I worked there for a while ..*
> *MP: In high school?*
> *A: In high school. And I worked there for a while and then I really, really enjoyed that, absolutely loved it and then I sort of thought, ok, if I like this let's see what other sciences there are in it. So I went to an equine clinic, a horse clinic, and I worked there, at a veterinary for horses, and that was also brilliant. But I know I preferred the other one, but that doesn't matter, it's just looking at what there was out there, you know.*
> *MP: So it was always there, and these things made you ..*
> *A: Yeah, it was always there in the back of my mind and it just made me want it more, really .. want to go into that more.*
> *MP: What do your parents think about your decision? About this option you have?*
> *A: They don't mind. They think it's brilliant, yeah. I mean, going to university, my Mum obviously wants me to do that and she thinks it's a brilliant opportunity and stuff and she keeps saying to me stuff like, if you want to stay and extra year, you stay an extra year. 'Cos like I said,*

it's one year of the rest of my life, you know what I mean? If I spend one year getting the grades I want and then get onto the course I want, then it's only one year for me to get everything I want.
MP: What about your friends? Do you discuss your career?
A: Yeah, sometimes, yeah. Everyone knows that's what I want to do and I don't mind that and they all think it's a good option really. They, everyone knows it's difficult. Even my parents know it's quite a difficult thing to get into. But if I want to do it and I give it my all, yeah, I may as well go for it. And, like I say, if I have to stay an extra year it's worth it really in the end.

Punab

When we first met Punab he told us that would like to be a singer and/or an actor and hasn't had an easy ride at school. He wanted to socialise and didn't focus enough at school when in the 6th form, and this got him into various kinds of trouble, including a set of AS U grades – and one of these in AS Maths. A move to a new college and BTEC engineering offered him a fresh start on a pathway that provided a compromise between satisfying his parents aspiration for him and an alternative pathway that he could imagine taking. Punab tells us he has always liked fixing things, taking them apart and putting them back together. He also has a friend who is an electrician who he considers to be doing well. We see that Punab becomes more enculturated into the BTEC engineering group as time goes on, though he tends to distinguish himself in terms of a more colourful and varied social life than he believes the group could provide him with. Acting may be a hobby but is seen later as a bit dead end, in terms of likely financial rewards. Doing well/making money is important to Punab and we see him moving from engineering only and choosing strategically, for its exchange value and social capital, electrical engineering with computer science - he quite likes computers and is aware of good financial rewards. We can see a thread of awareness of exchange of mathematics running through his story. He moved from AS maths (in school) to UoM (as an addition to BTEC eng programme) and contrasts the two programmes, drawing on a view of AS being "normal maths" and more valuable in the market place. There is also perhaps a little more than a hint that "normal maths" is better because it is more difficult and, hence, more valuable it would seem. Punab has always considered himself good at maths, and although being disappointed by a C at GCSE identifies positively with maths as being something he is good at, and as part and parcel of being an engineer.

Punab (BTEC engineer) decided on taking computer science and engineering for similar reasons, to enhance his job prospect and future projected earnings:

P: No, I enjoy using computers already and I find it really interesting. I just didn't decide to take a computer course because this course, if you pass it and do well in it there's more money involved - in the wages involved. So, yeah I thought this one first... Before I was really into drama. Last year I took drama as well. I used to do drama. I used to go to drama school on a Saturday. So there was two branches, there was a branch to engineering or to go to drama school and doing some drama stuff.
MP: did you drop that or it's still on that.
P: I dropped it to give way to this type of course.
MP: why is that, is it your....?
P: I think that I decided that drama was more of a hobby...
MP: what made you change you mind?
P: I think it was just instinct. I think it's became a hobby, and I've heard that it's quite a dead end job also so....

And we see how he situates his original dream to become an actor/singer as being "dead end" because he perceives a high risk that he would not earn big money. His replacement safer option of engineering is then later adapted to up potential future financial rewards. Punab also shares some of David's concerns about the market value of "Use of Mathematics" and he too articulates some concerns that this qualification, which he also enjoys studying for, will not carry the same cudos.

> *I think it's quite important I think that to be honest, when I heard it was AS Maths I thought it was the real AS Maths, like the four cores, pure AS. When I heard it was Use of Maths I was quite disappointed again. I took a shot last year and missed it [Punab studied AS maths the previous year but didn't pass], so I guess it was doing half of one which is what I wanted to do then. If I took AS Maths on top of Pure Maths I would have been quite happy that I was doing that again. But because it's AS Use then it's ok. I guess I can get by with that.*

For Punab, mathematics is a tool, which he sees strategically can make him look good. Learning mathematics aligns with his sense of trajectory as an computer science engineer, but it is his sense of wanting to get ahead when in the workplace and the lifestyle he sees himself leading that is driving him, not mathematics.

Identification with mathematics

We first consider the troubles in these reasonings are about students' concerns to compete in mathematics in the short or longer term and/or to gain a good job in the future, that is, for most, a job with high financial rewards, which can confer social standing. Mathematics, if it hasn't already been discarded as unnecessary at the next step, is talked about for what it might confer on them further along their life trajectories when it comes to gaining entry to a "better" university or to high financial rewards in their careers. Decisions about which degree to take are strategic choices, and decisions about studying mathematics are taken on this basis, whether they believe they can compete in a mathematically demanding environment, or not; or, whether mathematics is seen as relevant for the job they say they want to do (see also Black et al, submitted). Mathematics can be exchanged for something else that they want – entry to their university of choice and successful careers and it is this pursuit of delayed gratification that we see taking precedence above learning for the self or for enjoyment in these extracts,. Concerns about the status of their (Use of Mathematics) mathematics course and whether, or not, it will provide them with a good enough currency for their needs appears as a concern. This "trouble" is revealing for it shows how students draw on a discourse of performivity, which is evident across the dataset, and is sometimes implicit in the use of terms such as "good", good meaning get the grades they want, or as in a subject that looks good. It is also a powerful concern, since career trajectories and learning can be changed, for some students, seemingly at a whim (note David earlier who changed to become an accountant, instead of a physicist). Yet, David's narrative tells us that he positions himself as competing in a performance culture but that fear of the unknown, of failure motivates a safer future pathway. Punab also buys into this discourse of performativity, and his one time passion to perform is discarded as deadend and his new pathway is one that he believes will allow him to succeed socially and financially. Unlike, David he believes he can succeed with the mathematical demands that will be placed upon him (even though his prior qualifications in mathematics aren't so high as David's). Craig's choices are also made on the basis of his imagined future career needs, and he drops mathematics on the basis, not that he doesn't enjoy learning mathematics, but because he

doesn't believe he will need to use mathematics in his future career, and so he is best to concentrate on the subjects that count. Thus, we see how a discourse of performativity is used predominantly when students justify decisions to continue on or not with mathematics in the future.

Bruner spoke about troubles providing a bridge to the ordinary, and in this case we argue that this "ordinary" model is "to get a good job" This "vocational" model of education is a cultural model and we see this hegemonic model (Gramsci) in the thinking of politicians, policy makers and practitioners. Sometimes when we share these stories with others, we are told, "well, that is to be expected". Yet this discourse of performativity though very much the ordinary and expected, also signals an alienation from the learning that is, perhaps, of special importance for mathematics since significant numbers of students (if our sample is typical) take mathematics because of its potential high exchange-value, rather then for any intrinsic enjoyment (see Williams, 2008).

We see performativity as double edged, for while this gives good motivator for some students to study mathematics, it is simultaneously alienating and, in line with this, we found that there was little talk that demonstrated a love of, or passion, for learning mathematics, and for many of these students little in the way of identification with mathematics. There were a few exception (see earlier), most notably, amongst this group of students , some of the would be engineers; however, this does not mean they were immune to the discourse of performativity, since for them mathematics was seen as a necessity in their line of work. This sense the exchange and use of mathematics was in alignment. We seldom heard students talk about being mathematicians, or showing a sense of the mathematics being part of who they said they were. For many of the students identification with mathematics was trivial, instead they identified, perhaps strongly, with what they could gain in other ways from learning mathematics, but not with a love of mathematics as a way of thinking or viewing the World. There were exceptions to this and they stood out in the way they identified with learning mathematics. These students, perhaps could be said to identify with mathematics in such a way that learning and doing mathematics had become part of their narrative, the story they told us about themselves – who they were and who they may want to become For example, Manjit to become an engineer, It's not something which anything else is going to do…no be what I want to do. This is something I've chosen to do and it's something I want to do as a career.

However, across the data set there was little talk about learning as a private concern, intimately for the self. Learning had become for many of these students separated from an immediate engagement, e.g. for enjoyment, to be given over to securing the next stage in their life, they were learning for their future, and often there was a sense that this was disconnected from any practical realisation in the near and now, so that Lee's declaration that "the purpose of logarithms is to pass maths" appears to make sense when we are aware of the discourse that he is operating in. Similarly, so does Louises's talk about taking maths just to get the qualification, but not to use the knowledge therein, as does the sense in David's quick decision to change to psychology to get a higher grade. If, however, we remove commitment to a discourse of performativity, and this can be a difficult belief to escape from, such is its hegemonic strangle hold in capitalist society, then these statements appear somewhat bizarre, and seems indicative of an alienated learning that so many were quick to give way too, and which the educational system seems to proffer. What then are the implications for pedagogy?

In one sense we are stating the obvious when we point out that learning is fundamentally a deeply a social process. We argue, however, that the open acceptance of this sociality within classroom culture is crucial to the ways in which students can have opportunities to identify with mathematics. Indeed, the literature suggests that dialogue might be especially important for those students whose community cultures are not well aligned with the dominant discourse of school as an institution. Hicks (2002: 2), for example, concludes that since 'the forms of action and knowledge that students embrace are strongly tied to the identities that emerge from family and community contexts, conflict can arise between an institutional system aligned with middle class practices and the life world of working class students in particular'. Alternatively, Kendrick and MacKay (2002) argue in a similar vain that when school practices do not afford 'spaces for belonging and when students are unable to place the cherished identities they live at home and outside of school in dialogue with new identities they encounter at school, they turn away to other values and practices as points of identification and connection. See Davis (2007) on young children's identification with reading.

Theories of identity can help us to understand how subjective engagement in classroom practices, through such opportunities for moments of identification, constitute learners' formation of a social identity, which may over time include a view of themselves as mathematical (e.g. as an enthusiastic learner of mathematics, or as a particular kind of maths person). For example Gee (1999) elucidated the reciprocal relationship between language and identity. Identity is not only about being recognized or passing as a certain kind of person; it is also about (re)constructing oneself that way. In this view, when students engage or disengage with mathematics they also thereby construct their 'selves' in practice. This we may refer to as identity-in practice, and is sometimes known as participatory identity (cf. Wenger, 1998, Boaler, Greeno and others). In time such participation may become realized and turn inwards to become of the self-identity kind (see Vygotsky, 1978; Williams, Davis and Black, 2007).

Crucial then for this possibility is a curriculum which encourages dialogue and mathematisation. That is, if we are to impact or transform ways that students identify with learning mathematics, the development of a peer aligned social connectionist mathematics may be needed – a way in to identifying with mathematics, that, for some, may even enable a mathematical strand to their identity to emerge.

Concluding on identity

If the upshot of the strangle-hold discourse of performativity in education is a tendency for disconnection from identification with learning then, if we work within the discourse we can capitalise on students transitioning into adulthood taking on the role of workers in society and connect with students learning. Indeed we see this in some of the classrooms, where teachers emphasised teaching and learning to pass exams (see Williams et al, 2008, ISCAR paper, Farnsworth symposium). Often teachers and students were in cahoots about this and acceptance of this hegemonic discourse led to satisfied students and college managers who were usually happy with their lot and goals. However, if paradoxically this very discourse of performativity is

considered as alienating the learner from their learning then we need to understand better how this cultural model works.

When we seek to explain why this discourse is persuasive, we can reap the rewards of narrative methodology. Narrative perspectives on learning emphasized to us how we draw on discourses and weave these into our narratives of identity as we reflect upon our becoming. We could see this happening to an extent with the Use of Mathematics discourse , whereby some students talked about the mathematics they were doing in juxtaposition to the kind of mathematics they had experienced hitherto, so that use of mathematics was "not normal" mathematics, and about understanding. But we have chosen in this paper to illustrate this for a connectionist classroom that we found unusual and revealing, and one which we have found ourselves coming back to many times during the project in discussion, and in write ups (especially Wake et al, who features this case study in the next presentation in this symposium). However, we also found that although pedagogic culture does influence how students participate and identify with mathematics, that this does not necessarily impact their critical trajectories decisions significantly.

The significance of this is that by asking students to talk to us, not only directly about their decision making but also about their histories and lives more broadly, we were able examine the relation between their identification with mathematics and their identification in other ways. What emerged as significant was the relation between identification with mathematics and identification with imagined futures, which for our sample students usually meant the relation between identification with learning mathematics and dispositions to follow certain career paths. This relation emerged early in the project and was picked up in Black et al (2007, submitted). It also emerged as crucial in a parallel project e.g. Davis and Farnsworth, 2007 and 2008 - ISCAR, which considers students identification with personal financial management practices. These papers theorise why this relation is so important for students who are at a crucial stage in their life cycles in transitioning to adulthood. We suspect this was noticeable because, in both projects, we were examining students who were transitioning into adulthood. We suggest this may be demanding of a new set of relations between themselves - their lives-in-the-making as mediated by their relation with the economic means of production (see Davis and Farnsworth, 2008 ISCAR). The dominance of their subjectivity with regard to the rewards (perhaps thought of as exchange-value) which they stand to gain as workers reminded us of Leont'ev and leading activity and in all these papers we coined the term leading identity (although we have as yet no shared agreed definition between the two projects). Developing work on students subjective understandings of this relation, how being a citizen in an industrial late Capitalist society shapes who they say they are, that is their self-identity appears significant and deserves more attention. Having the luxury to draw on two contrasting cases (research projects) with a considerable number of similarly "going-on-to-university" inclined students who were at the same stage in their transition may provide for fruitful future collaboration.

Implications for Pedagogy

We know that curriculum design impacts how students talk about mathematics and how they participate in mathematics. Numerous studies have shown this (Boaler, Boaler and Greeno, Cobb and many others, including ours). However, while performativity "rules" we operate in a system whereby we give few spaces in which students can identify with their learning, for them to

appropriate this into their identities, instead promoting a kind of industry for emptiness, with attempts at connectivity being rare. We note the high proportion of teachers in the survey data who self-classified as transmissionist teachers, emphasizing the exam and providing for more surface approaches to learning (Pampaka, Williams, Hutcheson, Davis, & Wake, under review).

We explain this first by the opportunities afforded in the pedagogic culture of concern for making connections with identity and conclude that such spaces in the A Level Mathematics curriculum are indeed rare, and that this might possibly be addressed by connectionist pedagogies, such as described in Wake et al, and Williams et al following. Secondly, we find that students of this age, in a pre-university course have usually already established strong identities about their imagined futures that are deeply nuanced socio-culturally e.g. by gender, ethnicity and social class (Davis et al, 2008, working paper a). These more trivial or surface or superficial identifications with mathematics can, for many students, coexist with their identities as young people in transition to become university students, with hopes for particular careers that may possibly make it harder for course and other contrasting narrative discourses to be appropriated once beliefs about what is really useful knowledge have become accepted. We conclude that intervention has its limitations in impacting identity, for no practices sit in isolation devoid of context!

We conclude that students draw primarily on a discourse of performativity when narrating their decision-making, and that positioning in this discourse can both afford and constrain decisions to go on to mathematically demanding degree courses, depending on students' sense of self-efficacy to succeed in mathematically demanding courses. However, this discourse emphases the exchange-value of learning and acts to alienate students from their learning, even when they choose to study mathematics further. If a discourse of performativity holds so very strongly that it is so much part of the accepted way of thinking and acting, that it is seen as normal by all around then it has become hegemonic (Gramsci). We might then expect that breaking down these apparently very accepted cultural models about the education would meet with resistance from stakeholders, including students. The cultural model of performativity is dominant in mediating how students identify with their learning and this alienation from learning that motives, paradoxically, limits the spaces that students have and allow themselves to make connections and identify.

We found that usually students' identification with mathematics was not critical to their identities. We found that students, who are at a time in their lives when they are transitioning into becoming university students and future young professionals, needed to believe that using mathematics will cross the boundary into their future professional lives, if they are to become more intimately connected with mathematics. Dispositions towards mathematics appeared in their identities

Potential for transformation seems then to lie in a curriculum intended to change identification and steering social change ultimately by changing identities. Here we speculate that this ideal of who we are, who we might want to be and ultimately what it means to be a human being is tied up with the social means of production, and we may quote Basil Bernstein here in saying that Education is no substitute for society.

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