Narratives of gender and maths

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This paper explores the gendered nature of the educational decision to study maths through two girls' accounts of their experiences on an advanced maths course, and through their wider views on education and gender. While both girls feel out of place in their maths group, they are very different, with Niamh being strikingly more confident than Julie. I argue that this difference can be understood by looking at how they talk about their relationships with family and friends, something that can also explain why they both do not feel that they belong in their maths class. The final section of the paper argues that these two maths students' stories can tell us a lot about why so many students, male and female, do not chose to continue with maths. It is suggested that what is needed is a pedagogy based on interaction, connection to real life, and a sharing of authority between teacher and learner combined with an epistemology that recognises that maths is a social practice not a transcendent body of knowledge.

Mathematics is a central and controversial part of the school curriculum. In the UK the New Labour government has introduced a variety of initiatives on mathematics education, with the stated aim of 'raising standards'. These include the National Numeracy Strategy, a project that dictates, not only what and how much maths should be taught to pupils in compulsory schooling, but also how it should be taught; the Numeracy Skills Test, that must be passed by all trainee teachers before they can gain Qualified Teacher Status; and the new modular A-level, from at least 25% of which graphics calculators are banned. These have served further to institutionalise maths as a high status subject that is best delivered through a transmission pedagogy. Alongside these developments there is a growing concern about the declining numbers of students electing to study maths in further and higher education. Embedded in the debates on the place of maths in the curriculum is a complex and conflicting collection of discourses that interact in creating the subject. These discourses variously frame maths, as a key skill, a source of knowledge necessary for the successful negotiation of life in a scientifically and technologically sophisticated society, and thus as a source of personal power; as a route to economic power within advanced capitalism, with maths acting as a 'critical filter' controlling entry to high status positions; as associated with forms of cultural deviance, where, particularly in the media, mathematicians are depicted as nerds or geeks, a species apart (Damarin, 2000). People studying maths must locate themselves relative to these discourses. It is this process, its operation within subject choice and the ways it is gendered, together with how it is that some people come to identify as mathematicians whilst others reject it vehemently, that are the concerns of this paper.

I begin with a brief discussion of the theory and methodology of my study of subject choice, and then tell two stories drawn from interview data. The stories are crafted around the words of Julie and Niamh (the names of the students and of the school used in this paper are pseudonyms to protect the confidentiality of those involved), two AS-level maths students as yet unsure

whether to continue with a second year of advanced maths, who told me their thoughts on maths, other subjects, educational decisions, and gender. I conclude with a discussion of the implications of these narratives of two learners of mathematics for mathematics teaching.

Theory and methodology

The empirical data used here is taken from 11 interviews (10 individual and one paired) which were conducted with 12 students at the end of the second term of an AS or A-level maths course in the sixth-form of Grafton School in London. The students were all between 16 and 18 years of age and had opted to study maths, along with 3 other subjects, in the post-compulsory phase of their education. The students were originally taught in one group but 3 weeks into term were divided into 2 groups based on their 'ability' as judged by their GCSE result in maths. As a result these groups developed different identities, although they were to come back together as a single group a few weeks after these interviews were conducted. The interviews, which form the first part of a longitudinal study exploring subject choice, mathematics and gender, were semi-structured. They explored students' experience of maths lessons, their feelings about teaching and learning styles, what they think maths is like as a subject, how they chose their subjects, their views of the transition from GCSE to A-level, and their understandings of the way gender influences subject choices and wider social issues. Grafton School is an inner city comprehensive with a multi-cultural, mainly working-class intake, and the maths cohort reflected that.

The interviews varied widely in both length, ranging from 15 minutes to 40 minutes, and in formality. Power saturates the interviews, with the inevitable inequalities of power embedded in research being exaggerated by the age difference between myself and the participants and the fact that I was a member of the teaching staff at the school where I conducted the interviews (see David et al., 2001 for a related discussion). For some of the interviewees I was their current maths teacher, and for these students the pedagogic discourses within which our dialogue is normally framed intruded, particularly on the fraught issue of homework. An example is when Rob, who had submitted very little homework, after telling me that the way he learns best is by doing exercises on his own at home, feels the need to add, "which I don't do". But Rob's willingness to disclose to me the personal information that the parents he lives with are not his biological ones, something he rarely tells teachers, does suggest that he saw the interview as a different space from the classroom.

The two stories that form the bulk of this paper are inspired by what the students I interviewed decided to share with me. These stories are interweavings of student voices, represented by interview extracts, and my own, more explicitly analytical, voice. I have chosen to use stories, rather than themes, as the structure for two reasons, one methodological and the other more theoretical. Methodologically, it became clear that when looking at all the responses on a

particular topic, for example what makes maths similar to or different from other subjects, it was possible to understand these responses on different levels. They could be looked at in isolation, so that some people in drawing parallels to or distinctions from maths spoke of the curriculum, and some of the teaching methods, while others focused on the atmosphere in the class or on the teacher. However, they became more meaningful when looked at in the context of the interview as a whole. So that for example, for Nazima, maths' similarity to English was about the teacher, but so too were, the things she selected when asked about what she had enjoyed about maths lessons and about the difference between GCSE and A-level. In fact the role of the teacher permeated her account of school maths. It thus seemed that each interview could be examined more productively as an integral whole through one or more central strands that threaded through many of the responses. This would also better capture the way students, through a complex process of negotiation and identification, were positioning themselves relative to maths. And this is the theoretical point, that subject choice is about identity (Shaw, 1995), and the mode of data analysis should be motivated by this understanding.

By choosing to do maths students are saying something about who they are, and in asking them about maths I am asking them to tell me about who they are:

> When we choose subjects we are obliged to redefine ourselves and make a public statement about what sort of person we are, or hope to be. It is perhaps the first significant choice of identity. (*ibid*., p. 113)

Subject choices establish patterns of sameness and difference to those around us, they entail the giving up of parts of ourselves, of friends, teachers and subjects with whom we have established relationships. Subjects are a source of comfort or, if the wrong choice is made, of distress, anxiety and even terror. They function like people, "they have to be related to and identified with…one has to 'get on' with" (*ibid*., p. 113) them. And, like people, academic disciplines even have different 'personalities'. Shaw (1995), drawing on the object relations school of psychoanalysis, argues that subjects are transitional objects, analogous to the comfort blankets to which children cling. Transitional objects are a way of attaining a sense of individual identity and agency as an infant moves away from the relationship with the mother and cultural artefacts, including academic disciplines, function to maintain this identity/separateness in adulthood. This idea is supported by the empirical work of Boaler et al. (2000), who found, through interviews with 14-18 year olds on both sides of the Atlantic, that there is a connection between the nature of classroom mathematics, as abstract, objective, absolute and procedural, and students inability to identify with it and "procedural presentations of mathematics do not only make the subject less enjoyable, or preclude understanding for some, they also represent a potential life-path that is uninviting for most students" (*ibid*., p.199).

The sense of identity that informs my work is a post-structuralist one:

> Poststructuralist theory argues that people are not socialised into the social world, but that they go through a process of *subjectification*. In socialisation theory, the focus is on the process of shaping the individual that is undertaken by others. In poststructuralist theory the focus is on the way each person actively takes up the discourses through which they and others speak/write the world into existence *as if it were their own*. (Davies, 1993, p.13, original emphasis)

Such selves are multiple, fragmented, contradictory, they come into being through a range of discourses, in which they are produced as, among other things, naturally able, failing, hardworking, creative, male and female.

Thus post-structuralism offers a radical re-conceptualisation of the rational, autonomous, unified subject of liberal humanism. The liberal model sits at the heart of current educational politics. Within this climate, with its valorisation of individualism and choice, it is difficult to ask why subject choices remain so marked by social inequalities. This is very evident in the students' inability to explain the gendering of the subject options within their own school. However:

> Social regulation can function, not only in a sense through overt oppression, but rather through defining the parameters and content of choice, fixing how we come to want what we want. (Henriques et al., 1984, p. 219)

While there are very few remaining differences between the attainment of male and female students in either GCSE or A-level maths examinations (Guardian, 2000; Gorard et al., 2001) the decision to continue with advanced mathematics remains a highly gendered one. There are roughly twice as many boys studying the subject post-16 as girls and a declining proportion of women continuing into undergraduate and then postgraduate study (Kitchen, 1999; Boaler, 2000). This polarisation persists despite decades of feminist intervention (see, Jones and Smart, 1995, for a discussion of such a scheme; or Willis, 1995, for a critique of an Australian programme), as Shaw (1995, p. 107) says "the most striking feature of subject choice is that the freer it is, the more gendered it is". In looking at the way Julie and Niamh relate to maths, I argue that the notion of subject choice derived from the liberal conception of subjectivity needs to be replaced by an understanding of such choices as consciously and unconsciously motivated series of identifications, which interact with other aspects of their identity such as gender, sexuality, 'race', class, age and (dis)ability in complex ways.

Introducing Julie and Niamh

I am focusing on Julie and Niamh because they were close friends who had not decided whether to continue with maths into their second year of sixth-form and who both expressed feelings of not belonging in the maths group they were in. If learning is viewed within the perspective of situated cognition, as a social activity, taking place within a community of practice, then a sense of belonging to that community is central to achievement in maths (Lave and Wenger, 1991; Wenger, 1998).

Although both girls shared an experience of not belonging in their class, there were also striking differences between them. Niamh's voice comes across more confidently in her interview than does Julie's. Typical of the contrast between them is their response to getting a grade E in their first module, the Methods exam. Julie was visibly upset, "a lot of people noticed, going 'are you alright?' and I was like 'no, not really', 'why?', 'cos I got an E'". However, Niamh contrasts her own response to a very similar mark with that of her friend's:

Niamh: I was kind of like oh, I mean 46% sounds alright, but then cos it's an E I was kind of like, I was a little bit disappointed, but I thought if I can do it again, I know I'm gonna do better and [pause] this time, I will actually revise and I will understand a lot more of it, than what I did at the time. And I'm not really that bothered about it. But I know like someone else who got the same grade as me, who was kind of like 'oh no' and was really disappointed.

While Niamh *knows* she can do much better than her current result and is able to arrive at this conclusion independently, Julie needed external validation to help her cope with her slightly higher mark of 48%:

Julie: I was quite upset cos I thought I did OK on the paper. But the thing is the last question which was 12 marks, I didn't do cos I didn't get to it so I basically lost 20 percent, and me and Tony were talking about it and that means that I got most of the paper that I did answer right...I got about 90 percent (sic) of what I did answer right, which really gutted me because if I'd done that question I wouldn't be on an E.

Tony, acknowledged by his peers and teachers as the best maths student in the year, can function as an authority on maths exams for Julie. It is Julie's trust in Tony's expert opinion of her result that enables her to begin to rebuild her confidence, something enabled for Niamh by an internal voice. It is the search for possible reasons for these differences in confidence that motivates the more detailed exploration of Julie and Niamh's interviews that follows.

Julie's story

Julie is a white working-class girl who is studying geography, psychology and art alongside maths and tells me that she has no idea what she wants to do when she leaves school, or as she puts it "I'm not mature enough to be career minded because I don't want to think about, I just want to get these A-levels and everything else before I think about the future". My story of her starts with the centrality of friendship in her life. When asked about the difference that being female makes to her life, she chooses to speak about the emotional intimacy that she experiences with her friends:

Julie: Um, I think emotionally girls are probably a lot more [pause] they're better off because they can talk to their, like it's easier for us, to say talk about sex with our friends openly. Cos like me and my friends are really open with anything we have to say. Maybe with boys, they wouldn't be able to admit it if like they were still a virgin, they'd get bullied, or they'd get stick for it, whereas a girl wouldn't. It would be like, 'oh well that's your decision'. And I think…that's why a lot of men turn out the way they do like butch and masculine, cos they can't show any emotion, cos then they look like a girl.

This answer suggests an open communication with her friends that Julie values greatly. Thus it is not surprising that when she was asked "What do you think other people who are not doing maths think about the subject?", she chose take 'others' to refer to her friends. How students answered this question about others' views of maths became central to the process of developing my narrative of them. They all gave very immediate responses that detailed the universally negative views of 'other people', who see maths as some combination of hard, boring and pointless. They then had to position themselves against these views. Julie's answer begins:

Julie: They think I'm stupid, for doing it. Because it's really hard…

Typically she is clear that her friends think maths is "really hard". However, atypically this is her second statement on the matter, and it functions as a rationale for her first. Her first instinct is to personalise the question and to see it as being about what people think of her. Here is her full response:

Julie: They think I'm stupid, for doing it. Because it's really hard and a lot of the people I know didn't do as well in their, the people that I know that did well are in the maths class, so it's, kind of like the people that I do talk to, they'll say 'oh why did you take maths I think you're really silly'. Or if they look at, say 'what the hell is that?' and 'that's too complicated for me, why did you take it?'. But I, um I used to say 'I don't know really' just because, because a lot of them take lessons that ain't so complicated, just to get an easy A-level I guess, they thought it was gonna be easy but it's not.

She vividly recaptures instances of her friends telling her she's "really silly" and asking her why she chose maths. Her answer to them is the highly equivocal "I don't know really", and contrasts with those of the other students interviewed who used the divergence of views as an opportunity to position themselves as more knowledgeable about maths, to say that while "others" think it's hard it's not because really it's about the way it's taught or about how you apply yourself. Julie's resolution of the difference through a performance of ignorance contradicts the openness she claims for her friendships, for later in the interview it becomes clear that she does know why she elected to do maths. When asked directly about this choice, her answer is suggestive both of a clearly considered decision and of a quiet determination:

Julie: It was in my, it wasn't anyone pressurising me, I just in my, in myself, I knew that if there was any lesson that I'd take that was gonna, that was gonna give me like maybe a better chance in the future and that I was quite good at it was maths…I don't know, I just, it's a challenging subject without being boring I think.

Perhaps Julie censors this information in conversations with friends in favour of "I don't know really" in order to erase the differences between herself and her friends, by positioning herself with them, also at a loss to explain why she has opted for such an impossible subject. The paradox of female friendship is that beneath the smooth surface of pretended equality there lurk suppressed differences. Val Hey captures the psychic costs of this for the girls she studied:

> One outcome of the pressure on girls to convert the wider loyalties of friendship into the exclusivities of best friendship is an implosion of individual power. It is not that girls…did not experience differential *feelings* of power through their

ability to access other dimensions: being clever; being pretty; being good at games. They did. It is more that all of these other forms of cultural capital were incessantly evaluated within the domain of their friendships. Importantly therefore, in setting their alliances girls had to position themselves very carefully, lest their success in these other dimensions was perceived as disadvantaging one's peers. (Hey, 1997, p. 65, original emphasis)

There is a sense here of how a position has to be negotiated between the individual and the collective, a process in which one of Julie's voices, one that is experienced by her as more personal, is occasionally lost or distorted. Being able to express this personal voice in public contexts is central to her building of confidence in herself.

This silencing of voice pervades the interview. For example, at its conclusion she apologises for talking too much, something she says she always does. It is also present in Julie's description of another of her subject choices, of geography. This was a subject that Julie spoke of having always enjoyed. But, as she said:

Julie: There was another reason behind me choosing it which was I was doing physics and having physics and maths wasn't a good idea. I couldn't, I couldn't cope with it. And the teacher as well, I couldn't, he, it was like I couldn't, he would not let me leave the lesson and one of the ways I could get out of physics was by doing geography. By taking up geography and I, because there wasn't a geography course available first and everyone wanted to do it. So they started up a course during like, into like the first month, and so we started doing geography and dropped physics, cos I couldn't do 5 AS levels.

The conflict here is between Julie's voice and that of the teacher, an authority figure who has taught her since she was 13, and whom she describes as being very strong-willed:

Julie: If he believes in some, if he believes in you then he will not let you disbelieve in yourself. And the way, I don't know, the way he teaches, and like you've got to do it. And he would say 'you're doing physics', not 'oh are you gonna choose physics next year?', he's 'you're doing physics next year ain't you?' and it was intimidation to say yes.

Julie was clearly in a difficult situation. She was unhappy in physics lessons, something she elaborates on later in the interview. Again it is her resolution of this that is interesting. She escapes physics by taking geography, a way that avoids confronting her teacher and that removes the responsibility for the decision from herself. This is reminiscent of Carol Gilligan's (1993, first published 1982) Amy who is given the moral dilemma of whether Hans, whose wife is dying, should steal the drug he needs to save her but cannot afford. Instead of reasoning abstractly as traditional moral philosophy demands, Amy searches for a solution based in relationships. She refuses to accept the problem as it is presented, asking whether Hans cannot persuade the druggist to give him the drug more cheaply on humanitarian grounds, and considering the possibility that should Hans steal the drug, he may be found out, and end up in prison, leaving his sick wife alone. Julie like Amy seems to be interested in solutions that preserve connection.

However, there are other ways that this silencing of voice can be interpreted. In her more recent work with Lyn Mikel Brown, Gilligan (Gilligan and Brown, 1992) describes a crossroads that girls traverse during adolescence, at which:

> Young teenage girls appear to lose the feisty, self confidence and directness of their middle childhood years and replace it with a self deprecating, assumed and false ignorance. They fear being outspoken lest the knowledge that they have of relationships, themselves and other people, which comes from their experience to date, wrecks the idealised relationships that they are beginning to want above all…Swept up in this ideal image girls lose confidence in their own bodies, and what they really know, including the evidence of their own bodies and become disconnected. (Shaw, 1995, p. 118-119)

Julie's interview offers other examples of her lack of confidence and ambivalence about her experiential knowledge, sentiments absent from Niamh's account of herself.

Niamh's story

Niamh, a working-class girl, described herself as "mixed race", her mum's parents are Jamaican and her dad's parents are Irish. She is studying psychology, geography and chemistry alongside maths. My story about her begins with family, because it is striking how she was the only person who interpreted the 'others' not doing maths, not as friends, or as generic others, but as relatives, her aunt and her mum:

Niamh: Err see, my aunt I don't think did A-level maths and she, she's always hated maths. She's just always told me 'oh it's completely pointless'. She said like 'do maths if you wanna do it cos it's a good A-level to have' but, she just says it's completely pointless and it's not really, all the things you do in like A-level maths, it's not to, it doesn't go with real life really and, I don't know she's always talking about like ah what was it? [pause] I think it was probability she said, an example of probability, what's the probability of me having 23 crackers in a packet, and I just wanna know if I've got enough money to pay for'em. That's all do you know what I mean, that's how she thinks I reckon. Um and my mum, she just looks at me, when I'm trying to explain something to her, she'll listen to me but she's not really interested in it. But like she listens to me so that if, I find it easier to understand things when I'm explaining it to somebody else, cos then it shows to myself that I'm understanding it and I know what I'm talking about. So my mum helps me with that but she's kind of like, she doesn't really like it.

Family, and her mum in particular, come across as important to Niamh. When I ask her what it was that had originally attracted her to forensic science as a career, she says:

Niamh: Um I used to watch the TV programmes like *Forensic Detectives* and *Medical Detectives* and just watching it, it's kind of like, it's just so it, my mum really got me into it as well, and it is so interesting, and just amazing at what they can do. I was kind of like, that is really interesting, I would love to do that.

Reading this it feels like she hesitates after mentioning the TV programmes, unable yet to tell me how interesting and amazing she found the job, sensing that there is some missing ingredient in the explanation of her vocational drive. It is

after mentioning this missing ingredient, her mum's enthusiasm, that she then gives free rein to her own. The influential role of mothering in young women's academic careers is highlighted by Mann's (1998) study. Niamh, like the working-class girls Mann interviewed, speaks with great pride about her mum, who "dropped out of school early" and worked in customer service administration "for ages". But "she always thought she really wanted to go back to college and like get more grades and more things, so that she'd have better job opportunities", and now she's at South London College on a computer course and next year she begins her training to become a teacher:

> Niamh: She would be a very good teacher I think. One of the teachers that people like because they're, they're, they understand. Like I think that she doesn't act her age at all, she's more on my level I reckon. A lot of the time I'm actually more, I feel like I'm older than her.

This statement echoes a finding in Mann's study that mother-daughter communication in any form, including arguments, is welcomed by girls. Such interaction helps young women develop an independent voice, communicates values and offers emotional support:

> Girls become assured that a mother is emotionally 'there' for them, when she makes time to 'talk'…One of the strongest findings in this study is that, for most girls, communication with mothers results in feelings of both 'knowing' their mothers and being 'known'. (Mann, 1998, p. 219)

In the passage quoted at the start, Niamh talked about strengthening her voice in communication with her mum about maths "she listens to me…cos then it shows to myself that I'm understanding it and I know what I'm talking about". She feels understood, in spite of her mum not liking the maths Niamh tells her about, and in spite of the exasperation she felt when she was late for maths that day "and my mum didn't wake me up and I was really upset yeah, I had an argument with her this morning about it". In her next comment, "but I don't think she was actually listening to me, I was arguing with myself", Niamh positions herself as the parent, as she does when she says that often "I feel like I'm older than her". This very equal relationship in which both mother and daughter exercise responsibility is perhaps connected to their experience of what Mann calls 'transitional' family arrangements, where marital breakdown or changing patterns of employment, have resulted in a transformation of the traditional gendered domestic roles. The fact that Niamh now has a step dad suggests that she spent some time in a female-headed household, which is likely to have had a strong influence on her current relationship with her mum and a positive affect on her confidence.

In talking about the subjects that she enjoys, Niamh shows a strong preference for teaching based on discussion. This is perhaps the theme that emerges most strongly from her account and it suggests a desire for lessons that give space to her **voice** and that get close to reproducing the easy communication and the sense of being known that she experiences in her relationship with her mother. As she expresses it, when reflecting on her

decision not to go to a college for sixth-form, "I feel more secure that I'm in a school, because I know all my teachers already and they treat, even though we're year 12, we're not treated like 'oh you have to do this all by yourself' or, like you have a lot of support from everybody all around you, that's what I like about here"; there is a sense of emotional support grounded in mutual responsibility and understanding. Her love of interaction permeates the interview. It is reflected in her preference for group over individual ways of working in all her subjects, "I always seem to be working with other people", and in the way she makes educational choices, as the following two examples illustrate. When discussing why modern history fails to inspire her, she explains "it doesn't, unless it's um interactive like, I went on a history trip a couple of years ago with the history group, and um that was really interesting cos you actually got to go around to one of the concentration camps, and I thought that was really interesting". The second example concerns her response to my enquiry as to why she chose psychology:

Niamh: Psychology um a friend of mine, she's a year above me, she did psychology, started her psychology A-level a year before me and she's telling every, like every lesson she'd have she'd ring me and say 'oh we did this we did that' and it just sounded so interesting. Well I thought it's really interesting, the mind is really interesting anyway and like powerful and very, and not a lot of people understand it, I thought that'll be really interesting to do that, so I picked it and um err it's actually a lot harder than I thought. It's so abstract.

There is a contrast here between the lively dialogue she had with a friend, and the expectation that created, and the more abstract subject she now encounters in lessons. What she means by abstract then, is perhaps the lack of discussion and of connection to real people and real life that she mentioned, when talking about teaching styles, in the following excerpt:

Niamh: But with my lesson like psychology um one of my teachers, she'll, one of my teacher's she's like really interactive and she gets you thinking about everything and the other one, she kind of just writes everything on the board in short hand, then rubs it off really quickly and everyone's like can you slow down a bit. But she doesn't really [pause] give us real life examples, she can't really put it to real life. She kind of just writes it down and you have to write it down and that's it, it's your notes. She doesn't really, she doesn't teach, if you know what I mean.

Thus abstractness is not inherent in the subject but is something that is created in the classroom through the teacher's pedagogic practices.

Discussion and conclusions

These narratives illustrate the diversity of experiences that students bring into and take out of maths classrooms and the value of exploring non-cognitive factors in building an understanding of participation and achievement in maths. Julie's story of friends and Niamh's of family, demonstrate that, students' "educational choices are a creative response to their needs and aspirations, and the perceptions of the desires and needs of those who socialise them"(Mann, 1998, p.214). It is the way these needs and desires connect with the 'personality' of maths, as students experience it, that determines who chooses to study it and

who, of those who do, is successful. While Julie and Niamh are both female I am not suggesting that boys and girls form two non-overlapping camps on these issues. Such processes are always also classed and 'raced' and my understanding of gender differences is a social one, in which psychoanalytic processes too derive from the social conditions in which they are enacted and imagined. There are, I believe, lessons here on how to improve all learners' experiences of maths and I would like to highlight one of these in the final section of the paper.

Niamh's story is a strong endorsement of interactive learning, and many echoed her in selecting this as a teaching style that they found particularly appealing. Thus it is initially confusing that they responded negatively when asked about whether they wanted to engage in more discussions in maths lessons:

Niamh: We do have as much discussion as you need in maths cos you don't really need that much as you do in geography.

Simon: Well you do the discussion, but if you know the answer you know the answer, and then there's nothing to discuss.

Tony: It's more discussion for example. There's nothing really to discuss in maths.

Heather: You don't, you wouldn't feel happy having discussions in maths then?

Tony: I'd feel happy but um I mean I talk about i and so on and things. But there's not, it's cos it's so black and white, and you have to learn rules um [pause] there's not really much scope for discussion, I think.

There is a similar pattern when students are asked about questions set in 'real life' contexts, where they see them largely as a distraction from the main task of learning maths. The explanation for this phenomenon perhaps lies in the tension it creates between pedagogy and epistemology. The dominant epistemology of maths is a neo-platonic one in which mathematics is seen as an external body of knowledge, an absolute discipline that subordinates process to outcome. Given such an understanding, a transmission pedagogy makes sense, since the task of the teacher is essentially to transmit mathematical rules and facts to the students. Conceptualised thus, discussion and context questions are a distraction tolerated only for their potential to motivate students and capture their imagination. It is only by moving to an understanding of maths as a social practice that discussion becomes an integral part of doing maths. Oral contributions are not judged in terms of whether they are right or wrong but in terms of their value in furthering the collaborative social activity of doing maths. Something which would engage not only the Niamhs in our classrooms but also the Julies, helping them develop confident voices in an equitable environment.

Acknowledgements

References

Boaler, J. (2000) So girls don't really understand mathematics? Dangerous dichotomies in gender research, ICME9 Conference, Tokyo.

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Brown, L. M., & Gilligan, C. (1992) Meeting at the crossroads: women's psychology and girls' development, Cambridge, Massachusetts, Harvard University Press.

David, M., Edwards, R., & Alldred, P. (2001) 'Children and school-based research: 'informed consent' of 'educated consent'?', British Educational Research Journal, 27(3), 347-366.

Davies, B. (1993) Shards of glass: children reading and writing beyond gendered identities, Australia, Allen and Unwin.

Gilligan, C. (1993) In a different voice: psychological theory and women's development, Cambridge, Massacheusetts, Harvard University Press.

Gorard, S., Rees, G., & Salisbury, J. (2001) 'Investigating the patterns of differential attainment of boys and girls at school' British Educational Research Journal, 27(2), 125-139.

Henriques, J., Holloway, W., Urwin, C., Venn, C., & Walkerdine, V. (Eds.). (1984) Changing the subject: psychology, social regulation and subjectivity, London, Methuen.

Hey, V. (1997) The company she keeps: an ethnography of girls' friendship, Buckingham, Open University Press.

Jones, L., & Smart, T. (1995) 'Confidence and mathematics: a gender issue' Gender and Education, 7(2), 157-166.

Kitchen, A. (1999) 'The changing profile of entrants to mathematics at A level and to mathematical subjects in higher education', British Educational Research Journal, 25(1), 57-64.

Lave, J., & Wenger, E. (1991) Situated learning: legitimate peripheral participation, Cambridge, Cambridge University Press.

Mann, C. (1998) 'The impact of working-class mothers on the educational success of their adolescent daughters at a time of social change' British Journal of Sociology of Education, 19(2), 211-226.

Shaw, J. (1995) Education, gender and anxiety, London, Taylor & Francis.

Smithers, R. (2000) 'Girls take top grades in most subjects', The Guardian, p. 9, issue date: 24 August.

Wenger, E. (1998) Communities of practice: learning, meaning and identity, Cambridge, Cambridge University Press.

Willis, S. (1995) 'Gender reform through school mathematics', in G. Kaiser & P. Rogers (Eds.), Equity in Mathematics Education: Influences of Feminism and Culture, London, Falmer, pp. 186-199.