Math Ed Res J (2015) 27:83–102
DOI 10.1007/s13394-014-0120-0

ORIGINAL ARTICLE

# Recognising 'good at mathematics': using a performative lens for identity

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Received: 29 August 2013 / Revised: 6 February 2014 / Accepted: 10 February 2014 /
Published online: 4 March 2014


**Abstract** Many students do not recognise in themselves positive learner identities in mathematics and thus exclude themselves from further mathematics education, limiting their life opportunities. In this study, I use a performance metaphor for identity, drawing on G.H. Mead, Erving Goffman and Judith Butler to analyse interviews with students, taken at four time points as they make the transition from primary to secondary school. The question I focus on is 'How do you recognise someone who is "good at mathematics"?' The students' responses reveal that there is a wide variety of scripts available when enacting the role of 'good at mathematics', and these include getting high marks, knowing the answer quickly, helping others and demonstrating the confidence to put up their hand to answer questions. Despite the variety of ways in which to demonstrate 'good at mathematics', most of the students did not recognise themselves in their own descriptions. This goes some way towards explaining why students may opt out of further study in mathematics, despite high achievement in this subject.

**Keywords** Identity · Performance · Recognition · Transition · Mathematics · Education

## Introduction

> I: So can you describe for me what someone who's really good at maths would be like?
>
> J: Ah, someone that can pick up answers really fast and … can answer questions really fast, so it's just like (clicks fingers) answer that question super fast. And get excellences for their exams and tests.

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I: And … are you like that?

J: No (laughs). I would like to be, but I'm not (Jason, phase 4).

Mathematics education at the school level suffers from an image problem. Whilst it is a subject that is seen as essential for western societies' economic and technological advancement (Aydeniz and Hodge 2011; Brown et al. 2008) on a macro level, and on an individual level a prerequisite for further study, students show declining interest and motivation in mathematics as they progress through the school system (Cox and Kennedy 2008). Sometimes, despite good achievement in mathematics, students begin to opt out when it comes to time to enter post-compulsory mathematics education (Brown et al. 2008). Mathematics is often a prerequisite for entrance to higher education, and students who choose not to complete secondary qualifications are limiting their educational opportunities. Many researchers are turning to the concept of identity as a lens through which to look at students' experiences in learning mathematics (Cobb and Hodge 2009; Lerman 2012b) and perhaps gain an understanding of why some students may choose not to participate further.

Identity is a useful concept in that it allows us to attend to the process in which students *become* learners of mathematics (Boaler and Greeno 2000; Nasir 2002), rather than only looking at students' achievement or cognition in this subject. Research using identity often focuses closely on the context, whether it be considered a community of practice (Wenger 1998) or a figured world (Holland et al. 1998). Boaler et al. (2000) used the construct of identity to examine students' experiences of secondary school mathematics in order to gain an understanding of why successful mathematics students may discontinue the subject. They drew on Wenger's notion of communities of practice to understand how students' construct a sense of themselves in relation to mathematics and learn how to *be* a learner of mathematics. They found that, in some classrooms, the perceptions students developed about the subject conflicted with their notion of the type of person they wanted to be (Boaler et al. 2000).

Other research also makes sense of this process by analysing the stories students tell (Boylan and Povey 2009; Sfard and Prusak 2005) and fitting these narratives into wider societal discourses. Heather Mendick, for example, has explored the ways in which people who choose to study mathematics must position themselves in relation to various discourses of mathematics and claims that the subject choice is about identity and it is gendered (Mendick 2002). She argues that the discourses of mathematics 'socially construct "mathematical ability" as natural, individual and masculine', and this can impact on the possibilities for someone to 'occupy a position as "good at maths"' (Mendick 2005, p. 204). Bishop (2012), in contrast, used a fine grain analysis to look at students' relative positioning as 'good at math' as evidenced in the discursive patterns of their interactions during mathematics lessons (Bishop 2012). These studies, and others, demonstrate the use of identity in illuminating students' experiences of mathematics and in particular on the ways in which students sometimes position themselves negatively in relation to mathematics.

In this study, I look at the transition from primary to secondary school, which in New Zealand happens at year 9, when students are approximately 13 years old. Transition to secondary school is often framed negatively in the research literature, yet research using the lens of identity looks at this process differently. Transition can instead be seen as an opportunity (Hernandez-Martinez et al. 2011), and students often look upon the move to secondary school with pleasurable anticipation (Lucey and Reay 2000). However, other research considers this time of significant identity formation to have the potential to impact negatively on students' learning, particularly in mathematics (Tytler et al. 2008). Whether the experience be positive or negative, transition to secondary school is a relevant context in which to explore identity constructions and change (Osborn et al. 2006).

Employing a lens of identity to this important process of transition to secondary school has much to offer in helping to understand students' early experiences of secondary mathematics and sheds some light on why students begin to become disenchanted with the subject and opt out of further study. However, the concept of identity must be carefully defined in order to provide an adequate lens through which to view any data.

## Recognising identity in performance

Within the body of research literature on identity in mathematics education, it is difficult to find consistency in definitions of identity and some of the literature is criticised (Cobb and Hodge 2009) for not providing clear descriptions on which meaning of identity the writers are working from. At times, it is difficult to know whether identity is operationalised by the researcher as something you *have* or as something you *do* (Gutiérrez 2013). These differences may stem from two very different antecedents of identity. For example, psychological perspectives stem from Erikson (e.g. Erikson 1968) and sociological perspectives from Mead (in Da Silver 2011). Holland and Lachicotte, Jr. help clear the muddy waters:

> An Eriksonian "identity" is overaching. It weaves together an individual's answers to questions about who he or she is as a member of the cultural and social group(s) that make up his or her society. A Meadian identity, on the other hand, is a sense of oneself as a participant in the social roles and positions defined by a specific, historically constituted set of social activities. Meadian identities are understood to be multiple […] and they may reflect, for example, contradictory moral stances. Eriksonian approaches, in contrast, attribute psychodynamic significance to achieving a coherent and consistent identity that continues over the course of adulthood (Holland and Lachicotte 2007, p. 104).

Those authors who utilise a Meadian approach see identity as multiple, sometimes contradictory and performative (Lerman 2012a). One writer who promoted this performance view of identity was Goffman (1959), who conceptualised the self using a theatre metaphor. The work of Butler (1988) includes using a performative notion of gender. Butler describes how we become our gender through performative acts, that is, we become our gender through the stylisation of repeated acts.

I adopt a similar definition for mathematics learner identity. We become a mathematics learner in a performative manner, and it is the repetition of 'performances' in mathematics learning contexts that generates our recognition of ourselves in certain ways as learners of mathematics. For example, our performances may include putting a hand up to answer a question during a mathematics lesson, persisting to solve a problem, arguing or justifying a given solution. We may perform by working silently and individually or by giving up on a problem after a single attempt. Such performances are enabled or constrained by the stage for performance (often the classroom), the director (teacher) and by the audience—including peers. Such constraints work against a notion of complete agency in our identity performances.

There are a number of factors influencing and contributing to our mathematics (and other) identity performances. These factors include internal aspects of self, such as beliefs, attitudes and values. However, I do not intend identity to be understood here as something internal that is then performed. Rather, it is the performances and repeated performances that constitute identity, that is, a sense of self. Repeated performances of our mathematics learner identities on the stage of the classroom, and on other stages, work over time to constitute our mathematics identities.

The notion of performance identity can be found elsewhere in the mathematics education literature. Some writers have similarly drawn from Butler's conception of performative identity (Chronaki 2011; Gutiérrez 2013; Hogan 2008) or from Goffman's theatre metaphor (Chval et al. 2010). Other writers draw from Gee, who also talks about identity using language of performance (e.g. Gee 2000, 2011). Writers who take a sociopolitical stance envision identity as something you do, not something you are or have (Gutiérrez 2013) which aligns with a performative notion of identity and a 'Meadian' approach.

Such a conception of identity draws on the advantages of other, sociocultural views of identity in that it attends to the context (Esmonde 2009). A consideration of the stage is necessary to fully understand any performance, as the stage can constrain or enable performances in significant ways. To illustrate this, I will give an example from my own life. Being in the discipline of mathematics education gives me occasion to engage with both the Faculty of Education and in the Faculty of Science, Mathematics Department at my university. I find I perform very different mathematics learner identities depending on which faculty I am with. I can play a role of 'mathematics expert' within education but I am very reluctant to perform that role when I am with people in the mathematics department. This example highlights the relevance of the *audience* as an integral part of context.

It is this notion of audience that is of particular advantage in using a metaphor of performance. It is almost impossible to think about a performance without considering the audience. Looking at the possible influences of the audience in a mathematics learning situation adds another dimension to analysis. By foregrounding the audience, we can consider not only how our audience affect the type of performance we give but that they are a crucial part of the identifying process. We are simultaneously both performer and audience to others' performance. The audience role is to *recognise* the identity performance of others. Gee discusses this idea, stating that people engage in 'recognition work' when they try to make visible to others and themselves, who they are and what they are doing, when they recognise others as such and also when they reflect on these interactions later (Gee 2011, p. 37). Goffman states that the individual

> projects a definition of the situation when he appears before others, [and] others, however passive their role may seem to be, will themselves effectively project a definition of the situation by virtue of their response (Goffman 1959, p. 8).

We perform our mathematics identities and others, such as teachers, parents and peers, recognise these performances in a particular way, and while often there is much social agreement in this recognition, similar performances can also be interpreted differently by different audience members.

Furthermore, we may be performing multiple identities at any one time, upon a particular stage. We may simultaneously be performing ‘girl’ and ‘Maori’ and ‘sympathetic friend’ and ‘good at mathematics’ and more. These performances may work well together or they may be discordant and on some stages even mutually exclusive. Hird (1998) calls this ‘inner diversity’ or the conflicting narratives of self. Whilst others, in mathematics education, talk about multiple identities (e.g. Stentoft 2007); seeing this multiplicity as co-performances helps us to understand why some of these identity performances can be ‘fragile’ (Solomon 2007c) or ‘marginalised’ (Black 2004). Within the mathematics classroom, it may be our mathematical identity that is marginalised if performing ‘mathematics learner’ does not match to other identity performances in our repertoire.

Now, consider the idea that one of the audience members for any performance is always the self. Arguably, the self is the most important member of the audience, not the teacher, peers or family, especially when we reflect on our interactions at a later time (Gee 2011). Mead conceptualises the self through an ‘I-me’ split. Whilst the ‘I’ acts the ‘me’ reflects upon that action, taking on an attitude of observing oneself (Mead 1913/2011). Jenkins (1996) furthers Mead’s work as he argues for a conceptualisation of an ‘*internal-external dialectic of identification*’ (p. 40, italics in original). Drawing on these ideas, I suggest that we view our performances as if we are the other, as a member of our own audience, and in this manner, identify ourselves as being a certain type of person. In this way, the performance is generative of identity as well as being expressive of it.

By investigating students’ mathematical identity performances—including those performances on the ‘stage’ of the research interview—we can gain an understanding of the types of performances that are enabled. We can consider the impact these performances may have on any audience and question whether the students recognise their own performances in the same way they recognise others’. Furthermore, we can look at the way in which these performances change over time.

## Methods

Late in 2011, 22 students were recruited from two different intermediate[1] schools in Auckland, New Zealand. The students who volunteered were aged 12 to 13 years and nearing the end of their primary schooling. In November, the participants were observed twice in each of their mathematics classes. The students and their teachers were interviewed individually. These interviews were semi-structured; the students were asked to talk about their experiences of mathematics lessons and about their expectations for secondary school. The interviews lasted approximately 15 to 25 min each. Interviews with the teachers were about 1 h. They were asked about their

[1] In populated areas of New Zealand, it is common for students to attend a separate school, called ‘intermediate’ for their last 2 years of primary education.

impressions of the participating students in particular and their thoughts on teaching and learning mathematics in general.

The 22 students moved on to nine different secondary schools. In February 2012, the schools were contacted and permission obtained to continue the research within the schools. The students were now in 17 different year 9 mathematics classes. Early in the first term, each mathematics class was observed during a lesson, and this was followed with a second interview of each student participant. Half way through the school year, in August, the process was repeated and the year 9 mathematics teachers were also interviewed. Sixteen of these teachers consented to be interviewed. During this time, those parents who volunteered to be part of the project were also interviewed. Finally, in 2013, the students were visited one last time, observed during their year 10 mathematics class and a fourth and final interview was conducted. One student of the 22 moved schools before the final interview and access was not obtained in her new school. The following table summarises the data collected (Table 1).

At each visit, field notes of observations were made and all the interviews were audio-recorded and then transcribed. The transcripts were entered into nVivo, and a thematic analysis (Braun and Clarke 2006) was conducted with the data. Because the data set was so large, it was first segmented and re-segmented into groups according to areas of particular interest. For example, the data was segmented according to participant (year 9 teacher interviews was one group) or grouped according to each interview question. These more manageable data segments were then coded, and themes were constructed from these codes. Once themes were found related to the data segment, then the entire data set was returned to in order to elicit further evidence which either supported or contrasted with each theme.

Limitations of this methodology include the influence of the researcher on the data. The interviewer's preconceptions will have affected the ways in which questions were asked and answers interpreted. Data should be understood as having been co-constructed by researcher and participant (Kvale and Brinkmann 2009; Mishler 1986). Mitigating against this influence is the fact that impressions of students were discussed with teachers, and in some cases, parents, and this form of triangulation served to make the data more trustworthy. In analysing the data, another person may have formed different codes and generated different themes. To this end, excerpts from interview transcripts are included in order to allow the reader to see the type of comment that generated a particular code.

**Table 1** Data collected at each 'phase'

| | Time | Students | Teachers | Parents |
|---|---|---|---|---|
| Phase 1 | November 2011 (end of year 8, primary school) | Observations during mathematics lesson interviews ($n$=22) | Interviews ($n$=2) | |
| Phase 2 | March 2012 (start of year 9, secondary school) | Observations during mathematics lesson interviews ($n$=21) | | Interviews ($n$=8) |
| Phase 3 | August 2012 (mid-year 9) | Observations during mathematics lesson interviews ($n$=22) | Interviews ($n$=16) | |
| Phase 4 | March 2013 (start of year 10) | Observations during mathematics lesson interviews ($n$=21) | | |

In this paper, I will present the themes constructed from responses to a line of questioning pursued in every interview. The interview schedule for each phase of interviews was drawn from the responses and initial analysis of the set before. It also reflected my developing theories of identity. In the first phase, the students were all asked the question, 'Is there anyone in your class who stands out as being good at maths and how can you tell?' In phases 2 and 3, they were asked, 'does anyone in the class stand out for any reason?' as I was interested in also hearing about students who stood out for reasons other than being 'good' at mathematics. To give an example of the coding of themes for questions such as these, the following are two full responses from phase 1 interviews:

> I: And how … how do you know that they're good at maths?
>
> A: Well, because they always get full marks and I find that amazing. And they, um, they just always seem to know the right answer (Abby, Phase1).
>
> I: And how can you tell they're good?
>
> B: Oh, they're always doing like – A–- was the one who helped me with the algebra and […] they score the highest, yeah they just get everything and high marks (Bart, Phase 1).

The first response was coded as 'test marks', 'just knowing it/just getting it' and 'right answers' and the second was coded as 'helping', 'test marks' and 'just knowing it/just getting it'. The response quoted at the beginning of this article was coded as 'quick' and 'test results'.

In the final phase of interviews, the questions were formed in light of my theorising around the ideas of *recognition* of identity performances, as described earlier. This time, students were asked, 'Can you describe for me what someone who is good at maths would be like?' This question was followed with, 'Are you like that? Or is anyone in your class like that?' Despite the different wording, all of these questions produced data about how students recognised someone who was 'good at mathematics', whether they were talking about someone in particular or an abstract idea of a good mathematics learner. It is the responses to these questions that I present and discuss in this paper.

## Results and discussion

There was large variety in students' answers describing someone who is 'good at mathematics'. I made 35 different codes when initially analysing these responses. Some of these were repeated by a large number of students and over more than one interview. Others however were only mentioned once by one or two students. There was a lot of consistency in responses made before and after transition, with two notable exceptions. In the results that follow, I report firstly on the main responses to the question of how you can tell that a person is 'good at mathematics'. Secondly, I report on the responses made to my question in the last interview, 'are you like that?' Finally, I explore two case studies to further illustrate the variety and complexity of recognising 'good at mathematics' in oneself.

Recognising ‘good at mathematics’ in others

There were 86 opportunities to respond to a question about ‘good at mathematics’, and students were also able to answer this in more than one way. Often students mentioned two different aspects as part of their responses. The most common response for recognising ‘good at mathematics’ both before and after transitions was through test results. There were 29 responses over the four interviews that included a comment related to test marks:

> They always score really highly on the tests (Jaden[2], phase 1).
>
> She's, like, always up in the 90s in the tests, like 95 and stuff like that (Bradley, phase 3).
>
> And she actually gets really quite high marks in maths too. Yeah, she's my inspiration (Suzie, phase 3).

The next most common response recognising ‘good at mathematics’ was related to finishing work quickly; 20 such responses were made:

> Pretty much as soon as the questions up they take about ten seconds to figure it out (Bradley, phase 1).
>
> ‘Cause [he] gets through it really fast (Jaden, phase 2).
>
> […] pretty much like, whizzing through it really, like being able to go through it really fast and be done fast (Craig, Phase 4).

Another common group of responses relate to ‘just knowing’ the answer or what to do, appearing to treat this sort of performance as somehow mysterious. There were 19 responses of this type:

> And they, um, they just always seem to know the right answer (Abby, phase 1).
>
> They always just know it. Know the answer and stuff (Lianne, phase 2).
>
> She’s pretty smart at everything, like she always knows what to do (Ruby, phase 3).

There were two common responses to this question that appeared to reflect a change before and after transitions to secondary school. Ten of the 22 students told me in the first interview that they knew someone was ‘good at mathematics’ because they could explain it to them or they could give them help:

[2] All names are pseudonyms.

> Oh 'cause Aaron's always like helping other kids, all the other kids are always going up to him for help when the teacher's [busy] (Cooper, phase 1).

> Yeah, and you can ask them anything about maths when you're struggling and they'll help you out with it (Karl, phase 1).

> Um, 'cause I can go to them for advice on how to do it and stuff and they'll always know how to tell me and stuff (Phil, phase 1).

Following the move to secondary school, helping or explaining as an indicator of being 'good at mathematics' was only mentioned twice in all three other sets of interviews.

In contrast, once at secondary, eight students described putting a hand up first to ask or answer a question as an indication of being good in mathematics. No student mentioned this sort of performance before the move to secondary:

> Yeah, um, there's this girl called Mary. And she knows so much, she like, her hand is the first to be up every single time and I can remember, like, wishing I was more like her (Abby, phase 2).

> They're always asking questions or if she asks somebody to write something on the board they'll all put their hand up (Harriet, phase 2).

These common responses can be considered *performance scripts*, and it appears that there are quite a variety of scripts for 'good at mathematics'. Widely recognised indicators of this performance are, as mentioned, high test results, finishing work quickly, just knowing the answer or how to do it, being able to help or explain (before transition) and putting up a hand to offer an answer (after transition). Other performances that were recognised included having a mathematical brain or natural talent (mentioned four times), being focussed on the work (six), studying and revising or working hard (five) and a number of other performances mentioned only once or twice.

Such a variety of performances, some of which could be contradictory, suggests that there are a large number of different scripts students can call upon in their recognition of a performance of 'good at mathematics'. Some of these performances are institutionally endorsed, some are considered natural, some appear to be derived from hard work, and others are somehow mysterious—they 'just know it'.

With such a range of scripts to choose from, one might think it would be easy for students to recognise in themselves a performance of 'good at mathematics'. At this point, I should acknowledge the possible influence of the way in which I asked these questions in the first few interviews. 'Who in your class is good at maths?' is a question that perhaps assumes that the person I am talking to is *not* good at mathematics themselves. My very question may have constrained their performance, making it difficult to describe themselves in their answer. My question in the final interview allowed students to answer in a generalised way and also to talk about their own identity performance. In the second part of these results, I seek to consider the ways in which students recognise a performance of 'good at mathematics' in themselves.

Recognising 'good at mathematics' in oneself

During the research process, I was able to ascertain whether or not the student participants were good at mathematics. I could recognise 'good at mathematics', through the students' identity performances during interviews, the way they performed during lessons, their teacher's comments and self-reported test results. Nine of the 22 ended up in high stream classes at secondary school and 11 got high marks in their end of year 9 exams. It is also possible that these students were more positive about mathematics than the general population, as they volunteered for the study. I was interested therefore to see whether they recognised themselves as 'good at mathematics' in similar ways to how they described others. In the last interview (phase 4), I asked students to describe what someone who is 'good at mathematics' would *be* like, and followed this with, 'and are you like that?'

Only one student indicated that he recognised himself in his own description of 'good at mathematics,' and he did so despite not quite fitting his own criteria:

> Well, yeah, um, I could've gotten [top of the class] but, um, I got one less merit award than her (Craig, phase 4).

A second student initially described the actions of a couple of students in her class as being 'good at mathematics' but then discussed how these behaviours were not essential for performing 'good at mathematics':

> L: Which I don't really think you need to be good, they don't talk or they don't work things out together, they just sit and do it, but I don't really think you need to be like that to be good at maths, you just have to listen.
>
> […]… I don't know, everyone's sort of good at different things (Lianne, phase 4).

Although Lianne did not actually say she was like her description of 'good at mathematics', this answer, and elsewhere in her transcript, implies that she did recognise her own performances as evidence that she was 'good at mathematics'. With this response, she appeared to be adjusting her description of 'good at mathematics' to fit with the type of performance that she usually gave. Unlike the students she initially described, in mathematics lessons, Lianne talked through the mathematics with her friend and listened to the teacher and in this way she was 'good at mathematics'.

Of the rest, five students said they were partly like their description:

> Not all the time, sometimes (Bart).
>
> I'm … I'm kinda half there I think (Karl).
>
> A little bit (Mandy).
>
> Um … well, I … I think I'm good at maths, but, like, I'm not the best (Alice).
>
> I'm kinda in the middle (Zane).

All the other students said they were *not* like their description of 'good at mathematics' (Table 2).

This group included students in top stream classes and accelerated programmes for mathematics and therefore they were certainly recognised by their school as 'good at mathematics'. Of those students who said they would not fit their description of 'good at mathematics', six had received very high marks for mathematics in their end of year 9 exam. There is clearly a mismatch between the students' responses and others' recognition of their performances.

The phenomenon of students not recognising themselves as 'good at mathematics' has been noted by other researchers. Mendick (2005) found only 4 of her 43 participants self-identified as such. Bishop (2012) begins her article with the following interview extract:

"Interviewer: What do you think a good math student looks like?

Bonnie: Not like me [she laughs] …" (p.34).

This extract resonates with my data, including the laughter, which is perhaps an indication of incredulity that such an idea would be even considered.

In order to unpack these results further, I will illustrate with two case studies. I chose these students because they are students who I came to recognise (very early in the research) as being extremely able mathematics students. They were mentioned by their classmates when I asked who was good at mathematics. They were also recognised as such by their teachers and schools; they were placed in the highest mathematics groups at their intermediate schools and placed in the top stream at their secondary schools. I wanted to gain some understanding as to why they did not appear to recognise themselves in their own descriptions of 'good at mathematics', despite what appeared to be evidence to the contrary.

Finn

When I first met Finn, he told me he liked all subjects but maths 'slightly more' than the others and was thinking of pursuing a career in engineering. He performed a positive mathematics identity to me at the first interview, his first response being:

**Table 2** 'No' responses to the question, '…and are you like that [description]?'

| | | | |
|---|---|---|---|
| No (laughs), definitely not (Abby) | I don't think so. I like English more than maths (Belinda) | I spend ages on a question (Bradley) | (Shakes head) Like, I know some stuff, but some stuff I'm not very good at (Charles) |
| Kind of—not (Estelle) | [I spend] Hardly any time [Studying] really (Finn) | … No. …I need quite a bit of help (Jaden) | No (laugh). I would like to be, but I'm not (Jason) |
| Nah (laugh) (Ross) | Not really (Suzie) | No (Cooper) | Not really, no (Phil) |

Note—I did not ask the question of three students: one, because this student did not have a fourth interview due to changing schools and the other two, because the question was not appropriate in the context of the interview (one had already made clear they were not like their description of 'good at mathematics' and the other said you could not tell just by looking at someone)

"I do like maths, I've always liked maths, yeah I like maths" (Finn, Phase 1).

At secondary school, he was placed in the top stream mathematics class which he was pleased about. It is when I asked him about his classmates in this new class that he began to talk in a way that appeared to be distancing himself from mathematics and from his classmates:

F: They're nerdy. They're quite nerdy (laugh). But it's it's … kind – it's good to have everyone – they're all good at maths and the conversation doesn't ever get boring 'cause I'm always learning. […] … I don't know. They just have a nerdy sort of feel about them. Not that nerds are bad but … [… They are] smart but they kind of – their whole, their whole – I feel like their whole life kinda revolves around school and they kinda study lots. I'm not really worried about getting bad test results but I feel there's the um, … – This Chinese girl, she just studies all the time. 'Cause I'm in another class with her and she just studies all the time. […] And she got – oh we actually got joint top achievement in the class. I thought she was just going to be outright [winner] but actually I got it as well.

I: Do you study all the time?

F: No but I do want to get top marks, I'm weird about that.

I: So you'd like to get top marks but you don't want to study all the time?

F: No. […] I have soccer a lot so it is hard to fit in homework as well (Finn, phase 2).

In this interview excerpt, Finn appeared to position himself in relation to his classmate (Hannah is the 'Chinese girl' who he named only at his phase 3 interview). Yet it was a difficult position to take. Did he want to perform 'good at mathematics' alongside her or leave her to perform 'nerdy' while he performed 'soccer player'? When at the final interview I asked Finn to describe someone who was 'good at mathematics', it was this same student he referred to, again saying she studied all the time but he was not like that. Again he said he only studied for exams and he was too busy with things like soccer.

Finn related being 'good at mathematics' to studying a lot, which contrasts with other common discourses or scripts of ability in mathematics as being something that comes naturally. Such a view suggests that Finn felt in control of his mathematics learning. It was not mysterious, rather something he could do if he chose to. Although he distanced himself from a performance script of someone who studies, at other times he appeared to see a necessity for study and this was something that he would do when required.

I: So looking back on last year, what do you remember most about maths?

F: Um … probably end of year exams. They were pretty - very stressful actually. I studied a lot and … think - and obviously it paid off because I'm in the accelerate class this year as well.

[…]

F: Well I, I like to do well in tests. I'm a bit of a perfectionist like that (Finn, phase 4).

In Finn’s interview responses, we can see a linking of mathematical ability or success with hard work. Looking back on his initial year 9 experiences, he said he got good marks but ‘I wasn’t quite sure of my ability. But towards the end I felt that my work had paid off’ (Finn, phase 4). While good marks alone were not enough recognition of his ability and/or hard work in mathematics, being chosen for a special withdrawal extension group was a solid form of recognition. But perhaps an award (delivered in front of peers) was the ultimate in recognition. When I asked about the highlight of year 9, he replied:

F: Probably prize giving. I got lots of awards at prize giving.

I: Ok. What did you get?

F: Best in English, social studies, PE and Chinese.

[…]

I: But not best in maths?

F: Oh I know who's best in my class.

I: Who's best?

F: Ah, Hannah.

I: So she's - she got best in maths?

F: No! Surprisingly not. That was - I found that really weird. Everyone knows she's better than - better than everyone.

I: So who got best in maths?

F: Sarah. She's average (Finn, phase 4).

It seems that for Finn, even winning the award for best in mathematics was not the definitive word on being ‘good at mathematics’—Sarah was only ‘average’.

Clearly Finn was a student with extremely high achievement, in a large range of subject areas. Perhaps, he did not need to have ‘good at mathematics’ in his repertoire as well. If Finn felt that studying and hard work was equivalent to ‘good at mathematics’, then performing as such may have meant a co-performance of ‘nerdy’. This is the way he recognised his classmates’, such as Hannah’s, performances and it seems logical that he would turn this recognition upon himself. Whatever the reason for the change in Finn's mathematics identity performance, it was evident in this interview response from the last interview:

> Oh I think I've probably changed a bit (laughs). I mean I've - I've grown to actually - English is probably my favourite subject. [...] I find I'm just naturally good at English (Finn, Phase 4).

Finn's mention of being 'naturally good' at English is illuminating. While he did not call upon the 'natural' script when talking of mathematics ability, he did so for the subject of English. This indicates that he would rather be good at English 'naturally' than perform 'nerdy' and study lots in mathematics.

We do not have to look far to imagine where such a view of mathematics learning may come from. Popular media, for example, portrays mathematics and mathematicians as nerdy and geeky (Epstein et al. 2010). But in Finn's case, we can also look to the way in which his own mother has constructed mathematics learning:

> And all of my – none of my friends were mathsy. I think at a certain point the nerdy ones – which up until then I had been, the nerdy ones kind of keep on trying with their maths and the naughty ones don't. And maybe they were never that wicked at maths, I don't know. I was always in – they streamed at [my secondary school], so I was always in the top class but, um, yeah, there were the ones who – my friends just did arts and they were good at them, you know they would get good marks but they didn't excel at maths. So maybe I just kind of 'fell in' that way. But I could have done – I could have done it. I like maths, I like um, yeah I like puzzles and problem solving I'm kinda addicted to Sudoku. I need to do number things. So (laughs) yeah (− Interview with Finn's mother).

Family members can play a significant role in influencing the way people think about themselves in relation to mathematics (Epstein et al. 2010). Finn's mother seemed similarly conflicted in trying to co-perform 'good at mathematics'—'I like puzzles and problem solving [and] I'm kinda addicted to Sudoku' and 'naughty' (by which she may mean 'cool' or 'not nerdy').

Finn, like his mother, has constructed a discourse of working hard and being 'nerdy' as being the script for performing 'good at mathematics'. It seems that he would rather perform the role of naturally brilliant scholar and soccer player. To be able to choose to succeed in mathematics with only a little hard work is a powerful position to be in. Many other participants in this study do not seem to have such a choice or such control. But is this apparent choice necessarily a free one? Mendick et al. (2009) see choice as 'always and inseparably both active **and** passive' (Mendick et al. 2009, p. 73, emphasis in original) and discuss how we can consider people choosing a subject, such as mathematics, rationally and consciously or as 'passive consumers of meanings, subject to the undue influence of the media and other people' (*ibid, p.73*). On the one hand, Finn chose to be more of an 'English' type of student, and he had the luxury of being able to choose from a position of success in all subjects, yet he may also have been influenced by popular culture depicting mathematicians as nerdy and his mother's own similar script.

Estelle

Of all the students in my study, I most strongly recognised Estelle as performing 'mathematician'. Her responses in the first interview constituted a strong and positive mathematics learner identity.

> E: I really enjoy maths. I feel that it's quite a strong subject for me. And, … um just doing it makes – it's enjoyable for me and it's really cool learning new stuff and finding out how everything links together and stuff […] Probably because I really like numbers (laughs). I just like, I just enjoy working with numbers and seeing numbers and just playing around with numbers. I just find it, like, enjoyable.
>
> I: So, when you say, 'playing around with numbers,' what do you mean?
>
> E: Like, just making little pictures out of numbers and writing down random numbers and just seeing what different Equations I can make out of those numbers and … just … and sometimes giving like some random problems to my brothers to solve and … it's just really fun.
>
> […]
>
> E: Yes! I'm actually excited to go to secondary school next year because um, I've seen the work that my older sister's done, when I was small I used to watch her do work and I was just like, really curious about what she was doing (Estelle, phase 1).

At the next interview, soon after transition to secondary school, she appeared somewhat disenchanted with mathematics lessons, and similarly later that same year:

> E: Um, say like, in maths we like, we just learn rules. We don't really learn what it's really about. We just have to memorise rules and then write about it (Estelle, phase 2).
>
> E: Um, … … a lot of rules we have to remember. And just - a lot of problem solving. We start with like a problem, we figure that out then we … do … um, she writes some problems up on the board and we figure out as a class and then … we see what we got wrong and go from there and we just learn the proper rules and the proper procedure of working stuff out (Estelle, phase 3).

Estelle's pairing of rules and problem solving at first seem somewhat incongruous, but this is explained with her use of the word 'proper'. After the students attempted to solve a problem, they were then given the 'proper' rules and the 'proper' procedure to work it out. In this manner, their ownership of the mathematics was undermined and mathematical authority was returned to the teacher.

In the final interview, Estelle again referred to rules when she described what someone who is really 'good at mathematics' would be like, yet revealed her positioning of mathematics as more than 'just rules':

E: Well, um, I used to think it was just someone who would do really well in tests and memorise all the rules and stuff but - I mean that is good and all, but … now I find that the person that I think would be really good at maths would be someone who actually understands all the different rules and why they're there and stuff like that. Do you know what I mean? […]

I: Are you - are you like that?

E: Kind of … not. Well I try my best to be like that but … yeah. … That didn't really make sense (Estelle, phase 4).

Whilst we all know what the word 'understanding' means, we may not all have a similar way of conceiving what it means to understand mathematics. Llewellyn (2012) discusses how mathematics education research promotes a 'romantic discourse' of understanding as the 'Holy Grail' of research and pedagogy. She argues that research by authors such as Boaler (e.g. Boaler and Greeno 2000) constructs an unnecessary division between knowledge and understanding which can position events and people into conflicting, hierachical boxes (Llewellyn 2012). Llewellyn draws on Walkerdine (see for example Walkerdine 1989, 1990) to argue that 'understanding', rather than being girls' liberation, serves to discursively construct girls' mathematics performances in such a way as to be further evidence of their not being 'good at mathematics'.

It is possible that Estelle's description of 'someone who actually understands all the different rules', excludes recognition of herself as such. Possibly, she too visualised 'understanding' as being the peak of mathematical attainment but had such a stringent conception of true understanding that it always remained at the end of the rainbow, just out of reach. In this manner, despite being a very high achiever in mathematics, she could talk herself out of the identity of 'good at mathematics'. However, even in this, her answer was somewhat conflicted. 'Kind of … not' is hardly a firm answer. Furthermore, on the one hand she tries her 'best to be like that' and on the other hand her 'but …' leaves us to wonder what it was that prevented her from reaching the end of the rainbow.

I am also left wondering how much Estelle's dichotomising between rules and understanding, so perfectly mirroring discourses of the mathematics education community (e.g Skemp 1976), has to do with the fact her mother was a teacher and her older sister had recently completed an honours dissertation in education. This family situation must have played a part in her high achievement but may have also influenced her extremely high expectations of herself.

So if Estelle was not quite recognising herself as 'good at mathematics', what about her other mathematics learner identity performances? At the final interview, she again talked like a mathematician:

I: What do you think the purpose for learning maths is?

E: … Um, … it's … it relates to so much things in life. […], … like the golden ratio for example. It appears so much in nature and stuff. It's pretty amazing, it's just - wow, I never knew this, it's so amazing, I want to learn more. It's really interesting when you find out those things (Estelle, phase 4).

Estelle performed for me during interviews as a mathematician, and her performance was consistent over all the interviews. She was also a 'teacher pleaser', and I got the sense she was telling me what she thought I wanted to hear. However, at the beginning of my research project, Estelle talked about mathematics as her favourite subject, whereas by the end, it was third equal with science. I felt that her experiences of secondary school mathematics as focussed on rules over understanding and her expectations of herself regarding understanding in mathematics worked to constrain her mathematics learner identity performance and her recognition of herself as 'good at mathematics'.

## Conclusions

This study indicates that for many 13-year-old students, it may be very difficult to recognise in oneself a performance of 'good at mathematics'. I argue that performances are constrained or enabled by the stage and recognition of such performances is similarly affected. While 'helping others' may be recognised as being 'good at mathematics' on one stage, on another it may be the performance of 'putting up your hand to answer a question'. Institutions and teachers recognise 'good at mathematics' in part through assessments, and students come to recognise their peers and themselves similarly (e.g. Reay and Wiliam 1999; William et al. 2004). While there are a huge variety of performances that can be considered part of the 'good at mathematics' repertoire, some performances are well-worn scripts, called upon again and again to be enacted by different individuals upon different stages, and yet recognised nonetheless. As discussed in other literature (e.g. Solomon and Black 2008), performing 'quickly' and 'knowing the right answers' are two such scripts within mathematics learning discourses.

However, it is the way that students recognise themselves that is arguably most important for future participation and identification in mathematics. It is the students' lack of recognition of themselves in the performances of 'good at mathematics' that they described to me that is perhaps most significant for the future of mathematics education research and practice. Although this article reports on a study with a small number of students, of a specific age and in a specific context, the consistency in their 'not me' responses is worth further consideration.

The case studies I shared demonstrate that there is more than one way to *not* recognise a 'good at mathematics' performance in one self and I could have shared a variety of other stories. It is worth remembering that students perform multiple identities in the mathematics classroom, and a mathematics learner identity is just one performance—a performance that may not hold nearly the same priority as a researcher in mathematics education may wish for. In Finn and Estelle, we saw how the wider society, family and the pedagogy of the classroom may have contributed to the ways in which these able students recognised a 'good at mathematics' performance. In other students, we could have seen the same influences constraining their performances in different ways. Also other influences, such as peers and institutional practices, could similarly sway performances of identity. The way in which recognition of identity performance is endorsed by the institution of school Gee (2000) calls institutional identity. It is the very structures of schooling that impose categorisations on students as either good or not good at mathematics (Solomon 2007b) and they do this by assessment (Reay and Wiliam 1999; William et al. 2004), the lived curriculum, streaming practices (Solomon 2007a) and through the nature of teacher-student interactions (Walshaw 2011). Yet the students are constructing identities for themselves and have some agency in their performances. Perhaps, this is the very crux of the tragedy; in this example, two very able mathematics students performed '*not* good at mathematics' and the possible loss to the discipline of mathematics is a significant problem.

With so many different sources for the problem, there is no one, simple solution. We need students to feel able to co-perform 'good at mathematics' with the other identity performances they value, such as that of a 'cool' soccer player. We need to demystify mathematics so that performing 'good at mathematics' is not seen as unobtainable to all but the elite 'club members' (Bartholomew et al. 2011), with 'understanding' being an access key for which the code is hidden. We need to look at institutional practices such as streaming and consider the effect it may have on disenabling students to recognise 'good at mathematics' performances in themselves and examine the ways in which our discursive construction of confident (Darragh 2013), quick learners who just know the answer (Solomon 2007b), provide a script for performing 'good at mathematics' that works to assist other students in excluding themselves from further mathematics.

Finally, I believe we need further research that utilises the notion of identity as performance and seeks to see whether we can manipulate students' identity performances in ways that promote their recognition of themselves as people with a promising future in further mathematics education.

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