

Against the odds: resilience in mathematics students in transition

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This paper examines “resilience” of mathematics students in transition from a sociocultural perspective, in which resilience is viewed as relational, and in particular as a function of the social and cultural capital students may bring to the new field. We draw on two students’ stories of transition, in which we recognise elements traditionally viewed as “risks” for mathematics students in transition into institutions where new demands are made. However, in each case it seems that some of their apparent background “risk factors” – coming from poorer socioeconomic backgrounds and disadvantaged “shit schools” – have come to serve to constitute capital, buttressing their particular resilience, as they provide a crucial kind of autonomy that is particularly valued in the new institution. We identify the learners’ reflexivity as having been crucial to this accumulation of capital, and we discuss some educational implications.

Keywords: resilience, transition, mathematics, capital, reflexivity, further and higher education

1. Introduction

Our two *Transmaths*¹ projects aimed to understand better how different practices during transition from School to College and later to University² impact on students’ dispositions and identity, hence influencing their choices and future success in subjects that demand high levels of mathematics.

Institutional transitions can pose new challenges and obstacles to students that can threaten their progression, and many students and teachers consider mathematics as particularly problematic during these transitions. The majority of the literature on transition in mathematics education comes from a psychological perspective where the “transitional gap” is defined as a cognitive jump: Algebra during the transition to College and Calculus and “proof” during the transition to University (Malisani and Spagnolo, 2009; Tall, 1992). However, a key feature in our work is that we take a socio-cultural perspective on transition,

where “identity” is implicated in the challenges (e.g. their sense of what a mathematician is might be challenged and their identity is developed due to these challenges) (Hernandez-Martinez et al, In press; Jooganah and Williams, 2010).

This paper builds on some of our previous results to point out how some students, in spite of many difficulties and apparently against the odds due to their disadvantaged cultural and socio-economic backgrounds, persisted and completed the transition successfully; these students would usually be regarded as “resilient”.

In our search to understand and explain the concept of resilience and the role it had in our students’ transition, we found that traditional resilience theories do not provide us with a satisfactory explanation. In the following section we make a brief review of these theories and contrast the stance that this paper adopts in relation to resilience from a socio-cultural perspective.

2. Background literature

Historically, resilience theory has its roots in the 1970s studies of children who proved resilient despite adverse childhood environments (e.g. schizophrenic mothers), and later expanded to include multiple adverse conditions such as socioeconomic disadvantage, parental maltreatment, urban poverty or catastrophic life events. Earlier definitions of resilience focused on individual characteristics, and “Individual Resilience Theory” continued to inform many research studies well into the 1990s. For example, Vaillant (1993, p. 248) defined resilience as the “self-righting tendencies” of the person, “both the capacity to be bent without breaking and the capacity, once bent, to spring back”.

As work in this area evolved, researchers acknowledged that resilience can derive from factors external to the child. Studies moved beyond the individual to consider the family and the community as sources of resilience. Children born in poverty or as part of a minority ethnic group, for example, were considered to be “at risk”. *Risk factors* are those hazardous,

adverse and threatening life circumstances that result in individual vulnerability (e.g. crime, poverty, etc.). At the same time, *protective factors* are those which enable individuals to resist life stress, such as social support (emotional support, social networks, etc.) or material support (Masten and Garmezy, 1985). Most of the research that is currently done in this area and the social inclusion programmes in community and schools in today's England are driven by what France and Utting (2005) call the "Risk and Protection Paradigm" of prevention (see Poole and Lefever, 2009, for an example of a programme aimed to support first year University students within this paradigm).

The language of risk and protection, however, presupposes that people are passive recipients of a culture. For example, Borman and Overman's (2004) study of mathematical academic resilience suggests that a communitarian model of school, with a safe and orderly environment and positive teacher-student relationships, is likely to promote resilience in poor ethnic minority students. They also suggest that students with characteristics such as strong mathematics self-efficacy, a more positive outlook toward school, higher self-esteem and those that are engaged in academic activities, are likely to show resilience. This viewpoint leads to the conclusion that resilience resides within the context and then is "transmitted" to passive individuals, or that these contextual protective factors might just be shielding or nurturing resilient characteristics that were already present in the child. To put it in the words of one of our project students: "I'm not sure whether the people are successful because they pay attention (in the classroom) or they pay attention because they're smart and successful". However, in this paper we see resilience as a dynamic process of interaction between sociocultural contexts and the agency of developing individuals (Howard, Dryden and Johnson, 1999) and, in contrast to what some other theories of resilience pose, we argue that it lies in the relationship between the individual and the sociocultural context. Edwards and Apostolov (2007), in their cultural-historical interpretation of resilience, call for a:

Need to move beyond notions of care, in order to take seriously how more vulnerable children and families are able to (a) operate as partners in adjusting and sustaining their trajectories of inclusion and (b) contribute to the shaping of the social conditions of their development. (p.71)

Thus, from this point of view, individuals are shaped by their context but, more importantly, they also act and in turn shape the context that affords them agency.

There are few studies to our knowledge that take a socio-cultural perspective on resilience. Some of these studies (e.g. Abelev, 2009) can be placed in the “Risk and protection paradigm”, although others (e.g. Bottrell, 2009) recognise the dynamic nature of resilience and the dialectical relationship between the subjects and their context. Nevertheless, there is a need for further research in this area and for theorisations that explain resilience as a dynamic, relational process. We will now explain the theoretical framework which informed our analysis of the data.

3. Theoretical framework

We take the perspective that educational “resilience” is a function of the set of relationships of the learner with other people and with the educational field. In particular, we adopt and adapt Bourdieu’s relational view of social and cultural *capital* as that capacity to exercise agency in a *field* which is (i) incorporated in the *habitus*, (ii) objectified in artifacts, or (iii) institutionalised (e.g. as credentials).

An important issue in defining resilience in sociocultural terms is that of a learner’s agency to act in the world. Adams (2006) has pointed out the debate that exists amongst scholars about the “reflexivity thesis”: On one end of the spectrum are the supporters of “self-reflexivity” such as Giddens (1991, p.14), who posits that individuals organise their ways of life through a reflective biography “in which the question ‘How shall we live?’ has to be answered in day-to-day decisions”. On the other end are those who have a deterministic view about the self and for which decisions about life are unconscious and largely pre-determined. Many authors have placed Bourdieu at the deterministic end of this spectrum, claiming that his concept of

habitus, as an embodied phenomenon, reflects a shared cultural context that becomes “a *modus operandi* of which he or she is not the producer and has no conscious mastery” (Bourdieu, 1977, p.79).

However, some authors acknowledge that “while most criticisms of habitus invoke structuralism or determinism, some of Bourdieu’s texts provide more space for agency than others” (Reay, 2004, p.437). For example, in his *Outline of a Theory of Practice*, Bourdieu (1977) discusses the necessary conditions by which someone might be able to question what is taken-for-granted (the *doxa*):

The critique which brings the undiscussed into discussion, the unformulated into formulation, has as the condition of its possibility objective crisis which, in breaking the immediate fit between the subjective structures and the objective structures, destroys self-evidence practically. It is when the social world loses its character as a natural phenomenon that the question of the natural or conventional character of social facts can be raised. (p.168)

McNay’s (2001) analysis of Bourdieu is of particular relevance to how learners might be able to exercise agency in an educational field (and therefore, contribute to building their resilience). She argues that it is also “moments of disalignment and tension between habitus and field, which may give rise to social change” (p. 146). This breakdown or lack of fit provides the space where reflexivity can emerge, particularly in times of crises (e.g. death of a loved one, loss of a job, or failure in exams). Moreover, Chapman-Hoult’s (2010) “passionate” accounts of resilience in adult learners seem to match the critical moments when the death of a loved one or a sudden serious illness provide the space to challenge their core assumptions of how the world works, and provide resilience to pursue further education. Other authors (Sayer, 2004; Archer, 2003) stress the role of our “internal conversations” in how individuals evaluate their relations with reality, therefore theorising that self-reflexivity plays for some an important role in agency.

Thus, to Bourdieu's notion of social and cultural capital, we add this note of reflexivity: that students can *develop* capital through reflection, particularly in critical moments. It is that capital that allows for agency in new fields (for example, during transition), and the possibility to exercise that agency, negotiating successfully (aligning) their habituses with the conditions of the new field (resilience).

4. Methodology

For the purpose of this paper we present the narratives of two of our apparently resilient students, Jenni³ (transiting from compulsory school to 6th form 'College') and John (transiting from school to University), who are representative of those students in our projects that could be considered "at risk" because of their socioeconomic backgrounds but that demonstrated persistence in the face of various problems through their schooling, and for which the transition could have been considered a serious risk to their progression. These narratives have been constructed from "biographical" interviews that were conducted before and after they went into College or University, respectively. We asked students to tell us their "story" of previous and present schooling and of transition, and of how their choices related to their backgrounds and aspirations, in particular about mathematics.

We use narrative analysis to explore these students' interview accounts, drawing on the work of Bruner (1996) who poses that narratives, the story of one's own life, is a reflexive construction of the human mind that reflects not only how we come to understand who we are but also the "reality" in which we live. We view these interviews as biographical narratives, made up of inter-connecting sub-stories (Gee, 1999) which can then be synthesised and (re)connected in a holistic story, involving a "plot". In the particular cases of Jenni and John, their interviews were read and relevant sub-stories were identified, meanings were negotiated among us as researchers and a plot was created following Bruner's "universals of narrative realities", most significantly: temporality (a plot has a beginning, a middle and an end),

hermeneutic composition (no story has a unique construal but it must provide a convincing and non-contradictory account of it), reasons (actions are motivated by “intentional states”) and troubles (which signals important changes in the narrative). These stories, or “narratives of resilience” as we call them here, facilitate the researcher’s work for inductive analysis and theory building. In these narratives, we argue, it is possible to understand how resilience might have been constituted.

5. Narratives of resilience

A. Jenni’s story

Jenni comes from a working class family. Neither of her parents went to University and her dad left school without qualifications. He was recently made redundant from his job at a steel manufacturer due to the economic crisis and is now working part-time packing boxes at a chemist. Her mum is an assistant nurse and her older brother is studying to be a paediatric nurse. She considers her family a big influence in her life, as she explained:

My family had an awful lot to do with it (her choice of future career), ‘cos everyone’s... my brother’s going on to help people in a medical situation, my mum’s already helping people in a medical situation. My dad’s technically in a medical situation because he’s packing boxes with medicines in, but everyone just is helping every... and I suppose that because my parents have always helped me through life, then we all try to help each other, that it makes me want to think “OK if I can help my family I can also help a lot more people”.

However, she chose “not to follow suit” in the medical area (because she “wanna be different”) by wanting to become an accountant or work in a financial based business. This, as she explained, comes from her interest in money since she was very young: “Ever since I was little I got my own bank account, I just loved watching my money mount up”. The sense of wanting to be different while still “helping others” was also expressed in gendered terms:

The world’s changing and there are men doing pretty much, there are male nurses for crying out loud, thank goodness my brother’s going to be a male nurse, so female engineers, females in the

army for crying out loud, why can't there be a female accountant just because they're men mainly? In fact it might even be better because some people, if a woman has problems and they find it hard to go their husband about it, they're not exactly going to want to go to a male accountant are they, they'll want someone feminine.

She decided to continue with mathematics at College because she enjoys the subject and because it is necessary for her future plans in the financial world. She realised that studying mathematics at College "is going to be hard", especially when none of her parents or even her brother will be able to help her because "they haven't got the knowledge, they haven't taken the subject and they don't understand themselves".

And although she "absolutely loves maths" now (at College), this was not always the case.

She told us:

I hated maths in Primary school because I couldn't do it. Got into year 7, still didn't like maths because I still couldn't really do it but then, it wasn't always because I couldn't do it, because I am quite good at maths, it was more to the fact that people in the classroom were annoying, wouldn't let me get on with my work, wouldn't let the teacher help me if I needed it, so that made me hate maths.

Crucially, she explained how "hate" transformed into "love" for maths during a moment when she reflected on her classroom and decided to hate those disrupting her studies instead:

Then I sort of like... "I've had enough now, I don't want to be bad at maths I want to get good at maths, I like maths". I only hate the people there, so I just ignored them, block it out and get on with it. So I did that for the last four years and it's been pretty good.

However, before going into College Jenni expressed some worries that could have potentially jeopardised her progression. Most of her friends at school went to a vocational institution and she was the only one to go the "harder", academic College. She expressed her worries as follows:

I was worried about going to College because I thought I'm not going to know anyone and going to be doing some difficult subjects than what I'm doing now. 'Cos I don't usually make friends easily, I find it hard approaching people and saying "Hi, my name's Jenni or my name's Jen" and just general chat.

However, she found that:

On my first day at College we had a tutorial and I actually found that someone came up to me and started talking and we made friends rather quickly and we got to know each other. So I thought that was kinda good 'cos they sort of opened me to new friends.

Now at College, she is doing well: she is an independent learner that knows how and when to access help in extra classes, she is prepared to "work her socks off" although she really is enjoying maths:

I go to the "maths zone" (for extra help) pretty much every day unless I've got a full day of college then I can't. There's someone down there that does, erm, A/S and A level maths anyway; there's the maths support upstairs and obviously if you need extra help from your other subjects I have a German oral session once a week, there's A2 mentors that can help you with A/S work.

Now maths is just, maths is just fab. You look at so many different things and like OK you looked at your basic algebra maths, there's further algebraic maths, it's fab, so I kind of never knew you could differentiate a blooming graph, how cool is that, differentiating a graph! And you can do second derivatives; you just can't do that at GCSE. You learn so much more and you get to apply it to so much every day knowledge that you'd never dream of doing it.

Therefore it seems to us that her resilience is incorporated in her disposition to work hard, not being drawn into disruption, and her distancing from disruptive peers in her past; this educational capital – constructed consciously in her past experience – serves to make her "resilient" in the new field where independence is especially valued by the staff who regard too many of the students as having been "spoon fed". This resilience, in turn, helps her negotiate the transition successfully.

B. John's story

John also comes from a working class family, where the pattern has been to “leave school at sixteen and get a job”. When he first came into university, he “was a bit like, jeez, some people have got the easy life sort of thing ‘cos they’re like, getting their fees paid for by parents and all sorts going on”, and some “they’d had such private schools and stuff like that”. Having no financial support from his family, and having missed a scholarship because he did not get three grade A’s in his A-levels, he has to work part-time to afford university and to live independently.

John went to a school in “like one of the lowest education, it’s in the lowest education borough in the UK (...) a shit school to be honest”. However, he considers himself a “fairly able student”, being “basically like the best in the school because the school was so low, in like the UK tables like the standards”. In fact, as he explains, “I was the only one to go to a red brick uni” (i.e. in the UK, a ‘prestigious’, older university).

The year in which John began his A-levels was the first year his sixth form opened, and he describes:

I was a guinea pig year (...). So like, the teachers were used to teaching us GCSE Maths, never taught at A-level (...) so like the teaching I’d say in that sense was pretty poor compared to other sixth forms, because there wasn’t a system in place, and there wasn’t teachers who were used to teaching the courses.

This however, resulted in some advantage to John, as he had to “fathom” his A-levels for himself. His interest in mathematics made him pursue an A-level in Further Mathematics, but because his school did not offer this qualification he had to rely on the Further Mathematics Network. As part of this provision, John had to travel to a nearby university for face to face sessions, and this was supported by online sessions. He explained how this experience helped him develop:

The online stuff made me like more independent though, and I reckon prepared me for uni a lot better. Some of these (he means his peers at university) are really struggling to be on their own and stuff and like, study on their own and not in class groups or whatever, but I was like, I done it all, Further Maths on my own so... But like, there wasn't really, I'd say compared to other schools not that much support because of the way, what my school was and what our sixth form was and where I'm, the area I'm from and stuff so.

He decided to study mathematics at university after considering other options:

Then I sort of just stuck with Maths on the basis that it's the thing I find easiest at A-level, compared to like doing Physics and Chemistry that you need for the others, so I'll stick with Maths and like, Maths I can like sort of do, say computer modules or something, at hopefully second or third year. They told us that, like there's a lot of free choice, when we came for interview so, I sort of stuck with, stuck with it.

John was "quite confident coming to uni and thought, like, you know, I'm one of the best at Maths in my area and stuff, so I'll be one of the better ones at uni". However, the transition was quite a shock to him. From being the best at his school, he suddenly found himself a small fish in a big pond. He described this:

Came to university and realised like I'm not the best at university, far from it. Like some of the people on our course, and in our year group that are like, things just click with them, and they're the ones that like stop lecturers and notice things straight away and like, are really sharp and like, don't really need to- like some people turn up to lectures and don't take notes because it all goes into their head as they're getting it sort of thing which...

Any sort of mathematical advantage that he thought he would have by having undertaken Further Mathematics was rapidly gone because "that stuff that you study [for] like a month [at] A Level... covering like, ten minutes in a lecture". He soon discovered a big difference between school and university, and the topic of mathematical proofs came to the surface:

It's proof, proof, proof at university, where as like, in Further Maths, I think we did proof by, erm, not contradictions, a proof by induction, which is just again, like, we just had a set way of

doing it, by just six steps to follow and then just putting in the numbers or the... prove the series, that's what we did, like, and we didn't really know why we were doing it. We just, we was doing Mechanics thing and they just spoon-fed, they just teach you what you need to know for the exam.

However, John managed to have a relatively close relationship with his personal tutor, a pure mathematician who advised him only to take "proof-based" pure mathematics courses in his second year. This tutor told him "everything else is just mechanics". This, according to John, was a major factor in helping him to understand the importance of proof at a time when he was struggling with it, indeed his whole view of himself as a mathematician had been called into question by this.

At the end of his first semester at university, however, John was finding it easier and he was finally beginning to enjoy the experience, including the social side of it (he was moving house with a group of friends). Crucially, he explained his persistence as:

But that's just part of growing up like, we've been told over and over again by many different lecturers, and even at A-level, that like it doesn't matter if you don't understand it at first, just keep trying and trying, eventually it'll click sort of thing; the best way to learn Maths is by doing problems. It doesn't matter, yeah, it just doesn't matter if you don't sort of grasp it at first. So I'd say my enthusiasm sort of dropped but it's not dropped to a sense where I'm going to leave university and get a job or something so. I don't really wake up in the morning and say, "ah yes, I've got this lecture today" or this one, it's just. I sort of half enjoy doing the MatLab out of my own sort of, I wouldn't say arrogance but like, definitely like, I was sort of understanding the flow to it like more than everybody else around me so I was a bit like, "Yeah, I'm a bit of the bees knees at Mat Lab".

Most importantly, he describes the value of his previous experience in succeeding at university:

John: I think some people, I always try to question, well, in my head whether, like, people achieve those A Levels, because of... they're well educated, they were, or whether it

was off their own back. Because some people they may have got, like, good A Levels, but then they're really sort of, erm, don't think of themselves for various sort of, erm, spoon fed still even now. Erm...

Int: Whereas you approach it quite differently, don't you?

John: Yeah, I try to. I think that's just, because of the type of education I had and, like, where literally at sixth form I would have failed if I didn't do myself out and there's really not enough support there. It wasn't really... It was there for me in a sense that they had a sixth form, but they couldn't do a lot more than, a lot much more than what they were trying to do.

Once again in John's story we see some of the same signs of resilience as in Jenni's. Having gone to a school that could do little for him, he had to develop independence that many of his peers at university do not have. This educational capital is again valued in the new, university field, and contrasts with a lack of independence of many of John's peers. Crucially for John, the personal connection with his tutor made a difference, even though he was also clear that he thought his own staying power proved critical. Traditional perspectives on resilience would simply view this as "protective factors". But we see this as a product of John's and Jenni's struggle against the odds in their previous educational cultures. More importantly, we see it as a consciously, reflected upon outcome of this. We distinguish their resilience because Jenni and John themselves recognise this resilience for what it is worth, and as capital that gives them a relative advantage over others, in contrast to other factors that disadvantage them.

Bourdieu himself – in Bourdieu and Passeron, 1977, for instance - recognised this kind of resilience in those who unexpectedly and against the odds make it in the educational field. Such people, he argued, have often better aligned their habitus within the academic field than those who take to the academic field more easily/effortlessly, and such people may even

thereby emerge at the very peaks of certain (usually less powerful) sectors of the educational establishment.

6. Discussion

Transitional moments involve a sudden change of field, in which relationships change and power is restructured: when the game changes new kinds of cultural capital become valued.

Transition into college and university mathematics poses new challenges and obstacles to students: there are new mathematical competences, new teachers and peers, new rules and there are expectations of a more adult (independent) approach to learning. We argue that resilient students are able to bring to bear particular reserves of capital that resonate with the new field.

In the case of Jenni and John – while good candidates for mismatch to the educational field according to their cultural and socio-economic backgrounds – they have acquired some capital during their schooling that became very valuable during their transition.

Jenni's disposition to study by herself, to look for help when needed, to "block everyone" and "work her socks off", supported a smooth transition because her habitus aligned with what is expected from a College student, particularly in terms of mathematics, where practices are structured for individual (some might say lonely) work. Help is available (e.g. Maths zone) but only for those who actively seek it, like Jenni.

John's disposition to be independent, to "just keep trying and trying" until eventually it "clicks", sustained his efforts through rough times, when nothing in mathematics made sense, especially in relation to "proofs". His relationship with his tutor – a pure mathematician that advise him to persist with proofs because these are essential – proved also crucial.

Mathematics lecturers might be aware that most students would have never before done a "real" proof (apart from, perhaps, by induction), but nevertheless expect students to persist and to work in an autonomous way, even though they might not grasp the concepts at first.

Jenni's disposition towards mathematics, her "mathematics habitus", was such that for her "maths is fab" and the practices of the new field, in turn, supported that habitus ("Things you just can't do at GCSE" and "How cool is that (now at college) you can differentiate a blooming graph"). In relation to her mathematics habitus, it is important to track how, from being a "hater" she became a "lover" of maths. That critical moment ("I've had enough now") when her aspirations to become an accountant and her identity as someone who is good at finances/mathematics were put in danger by a disruptive class, allowed for a reflective process in search of an adjustment of the reality of the present, a transformation of what is taken-for-granted, opening possibilities for change. The reflective development of such educational capital provided her with the necessary agency during the transition to make her habitus resonate with the new field and take full advantage of what the new institution offers (in the way of support, like the "maths zone") to such students.

At this point we think it is necessary to draw attention to other sources of capital that acted also as resources of Jenni's identity and that have been recognised by others as valuable sources of agency (Clegg, 2011). Jenni acknowledges that her aspirations stem from a caring and supportive family, and even the fact that she wants to be "different" points to the importance of community and familial capital.

John's mathematical habitus is one of an "able" and independent mathematics student, who came from a "shit school" where he had to learn by himself, even to the extent of having to take some courses at a distance, or blended online. This experience allowed John to develop a habitus that breaks with the predominant school culture of "spoon-feeding", making him very different to most of his peers at university – who struggle to be "on their own" and expect to still be spoon-fed. And although he recognises that now at university he is far from being the best, he still sees himself as being different from others in how he approaches life problems, because he has consciously reflected on his special experience of independence. We do not

recognise in John's narrative a moment of crisis per se as with Jenni, but rather a process of self-reflection in which, by facing countless risks to his progression, he made conscious decisions to develop educational capital that made him different to others and that could eventually allowed him to go to a "good" university. The online courses and the further mathematics network provided John with the possibility to develop crucial educational capital that allowed him to persist during his difficult transition and, in a similar way to Jenni, take full advantage of the support that the new institution offered to him (i.e. a personal and encouraging relationship with his tutor).

It is important to note that across the transition, both Jenni and John experienced serious risks to their progression. For instance, Jenni regarded not being able to make new friends (all her previous school friends went to a different, more vocationally oriented college) as a serious potential risk to a successful transition; this lack of particular social capital could have threatened her transition. And for John, the financial situation of his family, which meant he had to take a part-time job to support his studies, could have stopped his university aspirations. This emphasises our view that resilience does not lie only in the context or the individual but rather in the relationship that individuals are able to make with their context . We have described here resilient students as those who, in spite of their backgrounds that might put them at disadvantage in the educational field, are able to make their social and cultural capital resonate with new fields. The support of a peer group, a support programme, a special teacher, a caring family, etc., are all sources of crucial social capital, and previous literature on resilience identifies these as "protective" factors that schools and communities should aim to provide. However, this literature fails to recognise that it is exactly the "risk" factors that can play a vital role in resilience. Here we have explained how reflexivity and agency are at the core of what resilience means. Resilient students are those who actively engage with a reflective process (which can be a critical moment) in which they become

aware of their need to break with what is taken-for-granted and therefore are able to develop certain social, cultural (and specifically educational) capital that they can bring to bear in a new field, giving them certain agency to negotiate the transition successfully. Despite the poverty and other factors that put these students ‘at risk’ statistically, they show how significant social capital from their family, school or peer group can make the difference in their conscious acquisition of this educational capital.

The implication for practice, therefore, might be that mathematical educational capital is at bottom relational and therefore, we believe, processes that encourage reflexivity in students should be incorporated in school pedagogical practices. This requires spaces to discuss, argue, question, think and connect mathematical ideas, but also spaces where learners can relate appropriately with a peer group, teachers, family and community, which are the sources of valuable forms of capital. We may question ourselves if this could happen for the majority of students in an educational system that is driven by exam results, where students are trained to do procedures but where mathematics is almost never authentic, challenging, creative or has a real consequence to students’ lives. Our research does pose this important question, then: how can mathematics teaching allow for such learner reflexivity and for the construction of relevant capital and, ultimately, for the creation of such resilient students?

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² Most students in England complete their compulsory education (School) at age 16 by taking the General Certificate of Secondary Education (GCSE) qualifications. Many of the students that obtain higher grades (C to A*) in five or more GCSEs proceed to post-compulsory education (for example, in a sixth-form ‘College’), taking the traditional academic route of Advanced-Level (A-level) qualifications. A-levels are the standard awards for University entrance and students on an academic-track would normally take three or four A-levels over a period of 2 years (the first year is called AS-level). An A-level in mathematics is a prerequisite for entrance to most science, technology, engineering and mathematics (STEM) courses in Higher Education (HE), although there are vocational engineering courses that lead to university STEM programmes also.

³ Names are pseudonyms.

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