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Remembering learning mathematics – we can run but we can't hide

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ABSTRACT

The adult participants in this study range in age from 20 to 50 years. They describe their remembered experiences of learning mathematics in both primary and secondary education. None of the participants achieved the qualifications in mathematics which would allow them access to higher education. They are now studying mathematics after many years away because it is required to achieve their ambitions. Each participant has considerable mathematics anxiety, which, they reported, resulted in reactions towards mathematics ranging from avoidance to fear and distress. The research uses narrative methodologies to collect and analyse these data. Common emergent themes were unsupportive relationships with their teachers and memories of being excluded and humiliated. The data suggests their teachers did not see supporting students' well-being as part of their role, resulting in strong negative emotional reactions. The article concludes that where warm, respectful, relationships are built, barriers to learning mathematics can be overcome.

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Mathematics anxiety; adult learners; learning relationships; mathematical resilience

Introduction

Mathematics is considered a vital part of education for young people throughout the world. It is part of the curriculum offer in every developed nation. Mathematics teachers bear huge responsibility, as qualifications in mathematics act as gatekeepers (Douglas and Attewell 2017) facilitating or denying entry into many career paths. However, mathematical learning poses some unique cognitive and affective challenges which, when mathematics is taught in certain ways, can lead to apprehension and anxiety about continuing to learn mathematics (see for example PISA 2012). Mathematics anxiety interferes with learning at every level and has been detected in children in primary classrooms (Bolt, Börnert-Ringleb, and Orbach 2022). Having mathematics anxiety to any degree will usually mean that a person will avoid anything to do with mathematics to mitigate the uncomfortable and often fearful feelings the subject evokes. When making career choices, they will choose the course least likely to expose them to studying or using mathematics

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(Johnston-Wilder, Brindley, and Dent 2014). According to Else-Quest, Hyde and Linn (2010), people with mathematics anxiety, especially women, may be dissuaded from pursuing careers in the STEM (science, technology, engineering and mathematics) disciplines, which include engineering and medicine. The reported reason behind their choices was that these careers were considered to have a strong mathematical content. Therefore, the prevalence of mathematics anxiety may mean that, for example, not enough medical professionals and engineers are trained.

This study explores the genesis of mathematics anxiety from the point of view of adults who are returning to study mathematics, having previously failed to gain sufficient qualifications to study for their chosen career. The participants were 13 adults taking mathematics as part of an access to higher education course in a Further Education college which, if they gained the qualification, would enable them to go onto train as health professionals. All the participants are now adult, their ages ranging from 20 to 50 years. The participants are therefore considered to be mature learners.

The Access to Higher Education: Health and Social Care Course (access course) which the participants were studying is a focussed program for healthcare professionals looking to further their education and career prospects. This course is designed to provide a comprehensive foundation in health and social care, covering essential topics and skills required in the healthcare sector. It is designed for those who have not gained a passing grade, which in this case was a grade of C or above, in the national examinations in mathematics (GCSE) that students take in England and Wales at age 16 years. The students were required to study and pass a mathematics examination as part of this course. Access courses are designed to build a bridge between their previous low level of attainment and gaining the entry qualifications for a nursing degree in the United Kingdom (UK).

Colleges of Further Education, often referred to as 'FE colleges', play a significant role in the post-compulsory stage of education, which starts at age 17 years in the UK, providing a wide range of educational and vocational courses to individuals of any age beyond compulsory school age. FE colleges offer opportunities to gain academic qualifications, vocational training and skill development for those that choose to attend them.

The participants' level of mathematics knowledge on entry to the access course could be considered rudimentary for the most part; one student had a low-grade at GCSE, while the others had no formal school qualifications in mathematics. Access course students have usually left school at 16 and have often taken up employment with limited opportunities for any career progression. Most of the students joined this access course because they aspired to progress into nursing but had found that their lack of academic qualifications excluded them.

John, the co-author of this article, was the participants' mathematics teacher as well as researcher on a larger project of which the data presented here forms a small part. Most of the participants were schooled in the UK, and one was educated in the Philippines. In relating their experiences of learning mathematics at school, the participants show how they recall their teachers discharging their responsibilities in teaching mathematics and the effect those teachers' actions were remembered to have had on the participants' relationships with their teachers and with mathematics itself.

The data analysed in this article are made up of narratives, which arise out of participants' memories. They remembered teachers whose actions they credited as having

a negative effect on their relationship with mathematics at an impressionable time of their lives, in both primary and secondary schools. It explores memories about how their relationships to both teachers and mathematics were ruptured, to use a term from psychotherapy (see for example Walser and O'Connell 2021) and the lifelong negative effect that this ruptured relationship has had on the individuals concerned. The findings in the data are not wholly negative; relationships can be repaired (Perry 2020), and the adult participants whose experiences form the data for this article also show that when that repair is taken seriously, these same adults can and do succeed in learning mathematics. The data show the participants' teachers' actions are remembered as resulting in the participants' life-long negative stance towards mathematics which limited the participants' decisions in terms of their lives and careers.

The background

This study is a small part of a bigger study which investigates how adult learners can be helped to learn mathematics successfully when so many present with observable mathematics anxiety. The larger study uses ways of working with these learners aimed at developing their 'mathematical resilience' (Lee and Johnston-Wilder 2017, which is defined as a positive approach to mathematics that allows people to overcome any affective barriers presented when learning mathematics. As such, the ideas behind teaching for mathematical resilience as set out by Johnston-Wilder, Lee and Mackrell (2021) and Lee and Johnston-Wilder (2017) are an important part of the study. Teaching for mathematical resilience suggests that the learning environment should:

- foster the ideas of a growth mindset (Dweck 2000);
- emphasise the value of mathematics in society, the personal value of mathematics to the individual and that the individual is valued within the community of students of mathematics;
- help students understand that everyone has to struggle to some extent to progress their mathematical learning, and that challenge and making mistakes are part of learning;
- emphasise that everyone needs support and help students identify how to access the support they need.

Teaching for mathematical resilience is a challenge to teachers to think through the actions that constitute teaching mathematics with the well-being of the student in mind. It demands the kinds of teacher–student relationships that develop mutual respect and trust and consider the students' psychological well-being. Research recognises that positive relationships are fundamental to education in general and therefore mathematical education. Hattie and Yates (2013), in their review of effective education, identified teacher–student relationships as one of the most important elements in enabling successful learning. Sethi and Scales (2020) agree, suggesting effective relationships are ones that show students that they matter to the teacher, consistently challenge students to grow, offer support, allow power to be shared by offering mutual respect and expand students' possibilities. Where there are strong teacher–student relationships, McKay and Macomber (2023) argue, students are willing to work hard and have confidence in positive

outcomes accruing from their hard work. Split et al. (2012) recognised a focus on relationships as key in providing teaching that allows at-risk children to overcome adversity. They associate warmth in relationships with higher achievement and conflict in teacher–child relationships with underachievement. They found the probability of school failure increased as a function of the length of time children were exposed to relational adversity with their teachers.

Whereas strong teacher–student relationships nurture learning, negative relationships act against learning and are likely to be part of the cause of mathematics anxiety and avoidance. Where teachers are employed in contexts which result in hostile attitudes to the establishments in which they teach, Ali, Ashraf, and Shuai (2019) showed this is often reflected in teachers' relationships with students, resulting in rigid and often conflict-inducing relationships. Sava (2002) goes further, seeing rigidity and conflict-inducement as teacher misbehaviour, which he terms psychological maltreatment. He cites the use of fear and intimidation to instil discipline as an example of such maltreatment, contending use of negative control interferes with student learning most of the time. Furthermore, these acts of misbehaviour can lead to negative teacher–student interactions and students considering their teachers as the cause of their school problems. Hyman and Snook (1999) consider teacher misbehaviours cause the development of a variety of symptoms in students, including neurotic traits, behaviour extremes, withdrawal or avoidance, and anxiety. They note that these indications may be temporary or may last the child's entire life.

The participants in this study have been assessed as having mathematics anxiety, and this study explores their memories of learning mathematics in school in order to question where that anxiety may have originated. Mathematics anxiety is both a real and disabling condition: Dowker et al. (2016) suggest mathematics anxiety may be more severe and will have a greater effect on performance because of the gatekeeper (Douglas and Attewell 2017) nature of mathematics qualifications. Ashcraft and Krause (2007) have shown that the more anxious someone becomes, the less able they are to pay attention to mathematical ideas and the more they avoid taking any qualifications they know may use mathematics. They may also avoid career paths that they fear will involve mathematics (Roberts 2002). Ashcraft and Krause (2007) further suggest mathematics anxiety is learned in the classroom, citing unsupportive teachers. They give as an example of a risk factor for developing mathematics anxiety the practice of singling out a student to give an answer.

There is an ongoing debate about whether and to what extent mathematics anxiety causes underachievement in mathematics or whether that anxiety is caused by underachievement. Ashcraft and Ridley (2005) are clear about the relationship between mathematics anxiety and mathematical performance, arguing that mathematics anxiety interferes with the cognitive processes necessary for mathematical problem-solving (Ashcraft and Krause 2007), which in turn inevitably leads to underachievement. Beilock and Carr (2005) add more in their discussions of the cognitive interference hypothesis. They show that the performance of students with high working-memory capacity declined more under pressure than the performance of students with low working-memory capacity. They referred to this as 'choking under pressure'. It is likely then that those with mathematics anxiety will experience this 'choking', which will weaken their performance in mathematics, as the pressure from anxiety will prevent their use of the working memory capacity on which they rely. Young, Wu and

Menon (2012) found the negative effects experienced by those with mathematics anxiety were specific to mathematics and unrelated to general anxiety, intelligence, working memory or reading ability and were convinced that it was the mathematics anxiety that caused underachievement, not underachievement that caused the anxiety.

Mathematics anxiety may result from being taught by a teacher who themselves suffers from mathematics anxiety. Beilock et al. (2010) found that mathematical anxiety was catching, and that girls in particular seem to absorb any anxiety their teachers are feeling and make it their own. Children can also 'catch' anxiety from their parents (Maloney et al. 2015). Ashcraft and Krause (2007) attribute a teacher's own anxiety as fostering an unsupportive, 'cold' teaching approach in mathematics, which they argue promotes anxiety. They consider that teachers act in this way to defend their own well-being when faced with teaching a subject they have learned to dread and want to avoid.

UK teacher training programmes that result in qualified teacher status may be an undergraduate (Bachelor of Education [BEd.]) degree course or at postgraduate level via a Post-Graduate Certificate in Education course (PGCE). Primary teachers will often take the generalist BEd., which focuses on providing comprehensive pedagogical training to equip primary teachers with the skills and knowledge necessary to provide a well-rounded education. Primary teachers in the UK are required to instruct across a wide spectrum of subjects, including mathematics, and are not typically designated as mathematics specialists. In fact, as discussed above, they may have significant mathematics anxiety themselves. Secondary school teachers will usually have a first degree and will usually take a subject-specialist PGCE as they are likely to specialise in teaching one subject; some will predominantly teach Mathematics, others History and so on. It is probably true that fewer secondary level teachers of mathematics have mathematics anxiety themselves than those teaching at primary level.

In the UK, approaches to teaching mathematics have been in a process of evolution during the time the participants in this study were in school. Some would have experienced individualised learning schemes which were used from the late 1960s through to the 1980s such as Smile (STEM n.d.) and SMP (Frankland 1994). The role of the teacher in facilitating such schemes was ill-defined, and from the point of view of this study, the schemes gave an opportunity for the teacher to interact with a few students whilst keeping the rest of the class occupied. Such schemes became outdated when the National Curriculum (DfE 1988) was brought in, followed by the National Strategies in 1997 (DfE 2011). The National Strategies advocated teaching mathematics using whole-class teaching and individualised practice. These reforms also encouraged the idea that speed was part of mathematics, through national assessments which used tests of speed in answering mathematics questions. The National Curriculum assessments, which at that time were a feature of schools from primary age, also encouraged teaching to the tests (Phelps 2016). As will be seen in the participants' testimony, that the tests were used as accountability measures also seemed to encourage UK teachers to focus on those learners that seemed able to pass these assessments with a little more attention (Hutchings 2015) and disregard those for whom a pass mark seemed unattainable. Recently, there has been a move towards a 'mastery' approach (Drury 2014), which is a 'small steps' approach that emphasises conceptual comprehension and problem-solving in addition to procedural fluency and is promoted by the Department for Education (2014). The approach is

intended to ensure that all students have a strong foundation in mathematics and may have helped some of the participants in this study.

Research on adult numeracy states that a large percentage (nearly 50%) of the adult population living in the UK have numeracy skills similar to those expected from primary school children (National Numeracy 2019). Whilst not conclusive, this does seem to show that there are many people who experience difficulty in learning mathematics. The participants whose views are reported here have returned to learn mathematics as adults, and the main study, of which this is a part, is aimed at identifying the barriers they face and offering the learners opportunities to overcome them. It has seemed to both authors that for many years that the main barrier these learners have to overcome is their own levels of mathematics anxiety. There are few papers published on the barriers adult learners face when returning to mathematics. Of these, Burton (1987) seemed acutely aware of the affective barriers faced by her participants, but since then others such as FitzSimons (2019) and Brook (2017) seemed to have ignored such barriers. This article argues that ignoring the affective domain in learners is detrimental to their well-being and consequently their learning.

The extant literature shows that where students are taught by teachers who do not understand the importance of relationships or are themselves anxious about mathematics, underachievement, avoidance and anxiety are likely to be the result. Research currently glosses over what students feel resulted from their teachers' actions and how that affected their relationship with learning mathematics. This study takes limited steps to correct this and allow the participants themselves a voice to explain their previous experiences of learning mathematics and how that rationalises for them their current relationship with mathematical learning.

Context of the study and research questions

This study considers a small part of the data generated as part of a three-year study seeking to understand how to support the mathematical learning of adults returning to study after a significant break. The data analysed here was generated from discussions in several small-group interviews with the participants. The adult participants had the resilience and motivation to study the course which John taught, as they saw that they no longer wanted their career choices to be dictated by their lack of mathematical qualifications. The study draws together the participants' stories of how they remember the mathematical learning environment whilst they were at school and to consider what those narratives can offer in terms of helping more people have a better relationship with mathematics.

The questions we seek to address are:

- What experiences of learning in school do self-identifying mathematics-anxious adults relate?
- What outcomes do mathematics-anxious adults attribute to their in-school learning experiences?
- What commonalities can be drawn from the stories related by mathematics-anxious adults?

Methodology

This study is situated within a narrative methodology. 'Narrative research is not only the stories or accounts contributed by the participant, it is the evaluating and analysing of those accounts' (Overcash 2003, 108). Here we present the participants' experiences of learning mathematics in school and evaluate and analyse those accounts in order to learn from them and make that learning available to a wider audience. For most people, as Moen (2006) attests, storytelling is a natural way of reporting an experience. It is pragmatic in answering the need to create reasonable order out of experience, whether traumatic or positive. Narrative is part of the regular discourse of daily life.

Small-group interviews were used in this study to capture the participants' lived experiences of learning mathematics. The narratives conveyed to John, who conducted the interviews, capture both the individual and the context in which those individuals act. The process of articulating a narrative is an interaction between the individual's current beliefs and values and their experiences in the past and in the present.

The question of truth is a recurring theme within narrative research on educational practice. Phillips (1997) claimed that a narrative must be true to be considered acceptable. He asks us to consider that the participants in this survey may not always be aware of, or be honest about, the reasons underlying their narrative. We see this may be particularly true for this study. The participants are recalling experiences from a long time ago that seem to them to have had a lasting effect on the trajectory of their lives. They may have an unconscious desire to reframe their relationship with mathematics to safeguard their own feelings of self-worth because not succeeding in mathematics led to them not being able to take desired career paths. Denzin (1989) contended that narratives that are about real lives will always be to some extent fictional statements. The process of collecting and producing narratives of lived experience always presents stories about remembered events and how these were experienced. What is produced then is a narrative that presents the realities of what the participants believe to be true of their experience. 'True stories are stories that are believed' (Moen 2006, 63). We note that the participants were unlikely to report where they felt they had had a good experience learning mathematics when others were discussing traumatic events. However, the participants had been confirmed as mathematics anxious by using the Mathematics Anxiety Scale (MAS) (Betz 1978) at the start of their course. In the MAS questionnaire, each participant reported experiencing some dread or fear when they thought of mathematics. No pressure was put on the participants to say anything about what happened to them in school; it was the participants themselves that chose to present their previous experiences. It is possible they were presenting them as a contrast with their current situation as a way to express the positive differences they saw. As will be seen in the findings, the students voiced reasons why the teachers may have acted as they did, considering whether the experiences may not have been entirely the teachers' fault.

Narrative technique can convey benefits on the participants. It allows the participant to reify and characterise a problem and convey the individual experiences (Clark and Standard 1995), which allows the participant to understand the events portrayed within their current context. In the collaborative context of this research, discussing the nature of the experiences each participant has undergone previously allowed them to understand that the experience was likely to have been shared by others but was unlikely to be repeated in their current context.

Methods

The data in this study was part of a larger study. At the start of the main study the MAS, developed by Betz (1978), was used to determine the anxiety rating of all participating students. Eighty-one per cent of students reported being anxious about mathematics across the whole group. The participants in this study were volunteers. All of them came from the 81%, showing clear anxiety. Each of the four interview groups consisted of either three or four students, and the interviews followed a semi-structured script. Open-ended questions were posed in order to understand the participants, experiences of learning mathematics. The interviews were recorded with the participants' permission, and the data were transcribed verbatim prior to analysis. The interviewees were all female, reflecting the make-up of the whole cohort in which there was just one male student. The age range of the participants was from 27 years to 52 years old (Table 1).

Table 1. Age distribution of participants.

Age distribution of participants		
Age range	Number	Identifiers
20–30 years	3	S1, S9, S10
31–40 years	4	S2, S3, S5, S6
41–50 years	5	S7, S8, S11, S12, S13
51+ years	1	S4

Analysis

In the interviews the participants discussed many aspects of their mathematical learning up to the time of the interview, which was during the second term of their college courses. Therefore, the first stage of the analysis was to comb the data to find all the comments that pertained to the research questions above in that they narrated the participants' previous experiences of learning mathematics. At this stage, all mentions of the participants' previous experiences were gathered with no assessment of whether the comments were positive or negative. No wholly positive comments are reported in the findings of this study, because the participants made no such comments.

The data analysed for this article consists of transcribed utterances, freely contributed by the participants. The two authors separately conducted a reflexive thematic analysis according to the principles advocated by Braun and Clarke (2019) and then together agreed that the findings led to the themes that are reported in this article.

Ethical considerations

Each participant gave written informed consent to be part of the extended study of which this article reports a small part. They gave further oral consent to be part of the interviews and were reminded that participation was purely voluntary. Express permission was also sought and given for their words to be recorded and anonymously transcribed and used in both the full study and in this article. Anonymity has been maintained throughout, no student is identified either in the data set or in the article, and the college they attended is not identified in any way.

A further ethical consideration for this part of the study was that we understood from our previous experience that the participants may rehearse traumatic events from their past when narrating their experiences of learning mathematics. Therefore, it was important to minimise risks to the participants' well-being. The interviews were conducted in friendship groups to ensure they could support one another, and the group facilitator knew the participants well and stayed alert for any incipient distress being shown. A further member of staff was available to help if participation in the interviews had to be terminated owing to distress being experienced. In the event no such incidents occurred.

Both researchers were teachers of mathematics; we both still work with teachers and perhaps more importantly respect teachers. We also believe that the job teachers do is both difficult and demanding and that they do it because they want the best for the students they teach. This must be stated because much of what is reported may seem to be an indictment of teachers, particularly mathematics teachers. It is not. What it is, is the remembered truth related by the participants in this study. It is their voice that is presented here, and the narrative methodology used is designed to allow that voice to be heard and considered.

Findings and discussion

Analysing these data using reflexive thematic analysis (Braun and Clarke 2019) yielded six themes from the participants' narrations:

(1) *You can run but you can't hide*; in this theme we saw data that showed the students would have liked to avoid mathematics completely, but they now realise that they need to engage with mathematics if they are to fulfil their life-plans.
(2) *Don't put us on the spot*; the data in this theme shows the depth of feeling experienced by students when they are singled out to provide answers in a mathematics lesson, especially when they are unable to provide the answer required in the time allowed.
(3) *Just one incident*; here the data indicates that the participants feel that just one incident may be sufficient to create the anxiety that leads to avoidance.
(4) *Don't throw me out – support me*; the data here pleads for support and help to understand mathematics rather than for teachers to assume that a failure to understand is attributable to bad behaviour on the pupil's part.
(5) *Teachers have to have more knowledge of how to help*; the data here shows that some teachers may not have sufficient understanding of how to help students who have gaps in their knowledge or understanding.
(6) *Is it the teachers' fault?* the data in this theme was the participants' discussion of how far their own attitudes and behaviour contributed to the events reported and show a willingness to share responsibility.

Examples of data within each theme will now be presented and discussed. The numbers of quotes used in each theme do not indicate the importance of a given theme but rather are intended to present the nuances of meaning represented in the data.

You can run but you can't hide

There seems to have been little willingness on the part of these participants to engage with mathematics whilst at school, which has changed now they are in college.

> S1 When I was in school, I really couldn't wait to get away from the maths lessons I felt that stressed about being in there. I feel that we can run but we can't hide!
>
> S4 I really am the type where if I see some stress coming towards me, I just want to run I want to get out of that situation.
>
> S3 I feel that I need all this to get into my social work qualification and I feel there's nowhere to hide . . . . This gives me a motivation now to achieve, which I didn't really have when I was in school.

Despite the remembered stress and lack of motivation experienced when being in a mathematics lesson in school, the participants recognise both that they would like to continue to hide from mathematics, but they cannot if they want to pursue their career goals. Having faced up to the challenge they are now able to look forward to their studies even though that means more mathematics.

Don't put us on the spot

Being put 'on the spot' is the participants' way of expressing being publicly singled out to give an answer in mathematics, which is sometimes termed cold-calling (Dallimore, Hertenstein, and Platt 2013). This pedagogical choice seems to have been remembered by the participants as damaging the teacher–pupil relationship more than any other. Feelings of humiliation and of inescapable stress are reported because of being singled out. To put this in Ryan and Deci's (2018) terms, the students felt both incompetent and that they lacked any control in the situation. Not meeting these basic human needs suggests students may suffer anxiety.

> S11 The teacher had me up in front of the class knowing full well that I didn't understand it and that I had repeatedly asked for help, she got me to do the sum she knew I couldn't do in front of everybody, and I was ridiculed, it was awful.

The participants commonly used strongly emotional expressions such as 'hate' or 'killing' in discussing their memories of this teacher action.

> S5 I hate being put on the spot in maths.
>
> S2 I just have felt really bad when I was put on the spot, and I felt like killing him.
>
> S3 Well I found it intimidating . . . you know stand up and give an answer. It was very humiliating; I just didn't like how the lesson was taught as a whole basically.

That the teacher–pupil relationship was ruptured is further elucidated by the lack of respect shown to the teachers who put them 'on the spot'.

> S3 My maths teacher asked me which was the heaviest one kilogramme of stones or one kilogramme of cotton balls? Because I didn't like the teacher, I had a game with him, and I said of course the one kilogramme of stones is the heaviest . . . I didn't like him because he put me on the spot.

> S2 When my teacher would ask me questions, I would just look at him as if he was a 'prat' and just ignore him . . . I really didn't like being put on the spot, so that was just the outcome, and it wasn't very good really.

The pedagogical device of singling out pupils and asking them to quickly answer questions seems to neither help learning nor have the potential to give a true reflection of what a student knows or understands. Instead, these actions seem to both engender strong emotions and rupture the learning relationship. One student expressed how this device both excluded and humiliated her:

> S3 Stand in front of the class and make you do something they know you can't do so everyone could laugh at you. Honestly there was nothing I liked about Maths. I used to dread my maths lessons.

Just one incident

Often the participants pointed to just one vividly remembered incident as the time that they began to dislike being part of mathematics lessons to the extent that they wanted to take steps such as avoidance to safeguard themselves from what they saw as damaging to their well-being.

> S12 Because I didn't understand, I got upset and they kicked me out. A horrible experience and I have hated maths ever since. . . . I don't think maths really bothered me before that point, and after that point it stopped me from doing well.

> S13 He actually used those words, so yes, he said you are on table seven, you are thick, you won't pass. So, I just took that attitude then, didn't have a clue and just hated maths from then. . . . I just hated maths, the thought of it just literally made me sick.

It seems that the way mathematical learning was experienced was sufficiently humiliating or emotionally upsetting to colour each participant's attitude to mathematics for the rest of their learning career and severely affect the life choices they made. In these incidents trust was reported to be lost on both sides of the teacher–student relationship, affecting the student's ability to engage in mathematical learning. The reporting of single incidents here may have an element of a convenient narrative shorthand, a pragmatic way to answer the need to create reasonable order out of their experiences (Moen 2006). The incidents could be a subconscious encapsulation of several incidents into one memory that can be used to explain to themselves and others the negative feelings the participants now report as they remember their learning in school.

Don't throw me out – support me

The participants perceived a lack of access to support. Many of the students reported that they lacked access to anything that they saw as helping them to understand mathematics, to the extent that in one case asking for help is reported as prompting the teacher to remove that student from the classroom.

> S12 my teacher used to chuck me out all the time. I didn't find they were supportive. They would just give you the work and say just get on with it.

> S4 our teacher used to chuck a chalkboard rubber at you, yes, they had a rubber, and they would chuck it at you. . . . they never tried to learn us, the ones that were stupid were put in a corner. Yes, they never tried, they just used to put me in a corner and then that was it.
>
> S5 they just don't explain, they go through it and then just don't help you. You are just expected to do it.
>
> S7 I don't know, maybe she had other things to do. Every time I asked, she used to give me these booklets. She just used to say work through them and go through them on your own. She wouldn't actually go through things with me and explain how to work things out.

Being able to access the support that they need when they need it is vital if students are to become mathematically resilient (Lee and Johnston-Wilder 2017). That these participants could not access support would further convince them that they had no place in the community of those that learned mathematics; they were excluded from some notional elite (Nardi and Steward 2003) that had a right to be supported to learn. The participants who reported being thrown out of class, or who were otherwise excluded were, considerably later in their lives, back in the classroom, learning successfully.

Teachers have to have more knowledge of how to help

The participants were adults, and their perspective may have made them more willing to look for reasons as to why their teachers were unable to help them to progress with mathematics. One attributed their teacher's lack of support to a lack of experience:

> S7 He could see that I was struggling, and you could see that he just didn't know what to do, he wasn't experienced enough to help me.

However, some participants felt that it was their fault that the teacher was unable to help.

> S8 It's not all about the teacher being at fault . . . I had a mental block, and I just knew I wasn't going to be able to do this.
>
> S9 The teacher seemed to be so much concentrating on all the rest of the students that were struggling . . . I just thought there was no need for me joining in . . . and asking questions as well so I just left it.

Whilst at this distance it is difficult to tell what happened in these classrooms, it seems likely that the 'mental block' was a way the student explained to themselves why they were unable to access mathematical learning at school and to protect their well-being. It also seems from these comments that many students in these classes were struggling. It is interesting that participant S9 felt they had no right to join in and try to understand.

One of the participants advised:

> S10 Could the maths teaching be presented using different techniques so that we could do the same problem but in different ways? So, if you could see a student that wasn't getting it when you were teaching one way then you would switch to another method so that would enable them to be able to understand it that way.

Teachers who understand that mathematics anxiety may cause students to feel that they have a mental block also know that with the right support such feelings can be overcome

(Lee and Johnston-Wilder 2017). Whilst it is impossible to know the exact circumstances behind these accounts, the present-day reflections of the participants are certainly resonant with calls in the literature (see for example Walshaw 2012) for teachers to attend to their pedagogical subject knowledge. Assuring all students that they have the right to support may be a first step in building the kind of relationship that nurtures high achievement, as well as recognising that students can and should ask questions until they do understand. It seems self-evident that they should never feel that they have to protect those who are charged with teaching them by not 'joining in' with asking questions.

Is it the teachers' fault?

The participants in this study were adults, and perhaps one of the most convincing aspects of the trustworthiness of their reports is that they wanted to talk through the extent to which they felt they should hold their teachers responsible for the trauma they reported experiencing. The data in this theme shows contradictory views but also shows the thoughtfulness of the participants. Some held their teachers responsible, when asked 'was it your teacher's fault?' one commented:

> S12 Yes I think so definitely. I don't think they intend to do it, but I think the more naturally able ones just tend to have that better relationship with the maths teacher because they understand it. I do get that. Teachers must get frustrated with people that don't try but if you are trying, they sometimes, because you can't do it and are trying your best, they kind of push you aside with the rest of the students.

Others agreed:

> S10 I think it's because the teachers know their subject and are so good at maths they think that everyone else should be good at maths as well.

> S9 I always felt in my school anyway, the teachers were more interested in the people who were naturally able to do it and they were at the front, and they got more attention and so the people at the back were, well, I felt like we were just pushed aside.

> S8 and when we thought of maths, we thought oh maths! Like the class itself was horrible. I always felt that I could understand it but then the vibe of the class always made people feel they couldn't do it.

> S6 The teacher that we had, . . . she was quite young. I just don't think she could handle it to be honest, you know? Really bad behaviour. And if I remember rightly, I think she did have a breakdown in class once. I think the teacher makes a big difference if you've got a competent teacher and you enjoy the lessons, they make you feel at ease.

But there were disagreements, several felt that any blame for the relationship not working was to be shared jointly:

> S3 I would say it's equal blame on both, because you know the teachers, a lot of time in school the classes are overcrowded so it's a lot for the teacher. They are trying their best to separate the ones that will need the extra help and the ones who can do it naturally, but it's not always going to work because of the amount of kids in the classroom and it's the motivation of kids – what child wants to go into a maths lesson to do maths as a teenager? So, I think it's both equally to blame.

The maturity of the participants is again evident in these quotes, and they raise pertinent points, discussing ideas that are prevalent in society. The idea that some people can 'naturally' do mathematics, and some cannot, is expressed here. Research (see for example, Boaler 2016; Dweck 2000) has discredited that idea and the participants in this study are testament to the idea that everyone can improve their learning in mathematics given the right support. However, when talking about previous experiences the participants accepted that the teachers would naturally form positive relationships with those who attained well in mathematics and that those that struggled were less interesting to the teacher. We find accepting this state of affairs by either teachers or adults within society to be troubling but agree with Noyes that teachers 'are part of a process of sociocultural reproduction' (Noyes 2004, 244). The habitus (Bourdieu 1984) which orchestrates teachers' actions is not overtly learned, nor directly resulting from teacher beliefs but rather 'necessity internalised and converted into a disposition that generates meaningful practices and meaning-giving perceptions' (Bourdieu 1984, 170).

Conclusion

The participants have related mainly negative experiences from when they were at school which they consider resulted in their intense dislike of mathematics lessons and poor relationships with their mathematics teachers and mathematics itself, which resulted in an inability to obtain mathematical qualifications. There were many commonalities between the accounts given of their experiences. The participants have much to say about the pedagogical choices teachers make, showing it is important to build a positive ethos. A mathematics learning environment that values the progress of each and every member enables learning, and failure to do so has a significant deleterious effect on individuals. They also ask that every mathematics teacher should be 'a competent teacher [which means] you enjoy the lessons, [and] they make you feel at ease'. They provide several ideas for accomplishing such a classroom environment and about the how the mathematics teacher can make good pedagogical choices.

A competent teacher, according to this data, creates an environment where the right support can be accessed by each student; students are helped to consider what support works for them and know for certain they have a right to that support. In a classroom of 30 or more students, support is more quickly obtained if the teacher activates the students to support one another (Wiliam 2017), something that these adult participants do as a matter of course. However, research (Lee and Johnston-Wilder 2013; Nardi and Stewart 2003) shows collaborative support is often considered to be 'not allowed' in a secondary mathematics classroom.

Teachers should also be mindful of the dangers of incautiously putting students 'on the spot'. Singling out unprepared students to answer questions led the participants in this study to feel humiliated and ridiculed. Ashcraft and Krause (2007) showed a link between this pedagogical choice and the development of mathematics anxiety. A mathematically resilient student can think and reason about and with mathematics, but any requirement for speed may result in the 'freeze, flight or fight' response that interferes with thinking and reasoning and therefore learning.

A teacher's own experience of school, first as a pupil, then as a teacher, will influence their teaching alongside any formal higher educational experience of

mathematics (Beswick 2012; Noyes 2004) and may have led to some of the actions reported in the findings, such as only really being interested in the students who were good at mathematics. Habitus (Ali, Ashraf, and Shuai 2019; Bourdieu 1977), that is, internalised contextual pressures and the resulting disposition, generates practices and perceptions which determine how teachers act in the classroom. Noyes (2004) found that teachers who have experienced mathematics taught in the way experienced by these participants are likely to continue the practice, even with intervention from teacher educators. Such teachers are also likely to suffer from some mathematics anxiety themselves, and as Beilock et al. (2010) showed, anxious teachers pass on their mathematics anxiety to their students.

The data also indicates that some mathematics teachers may know little about how to help students who have gaps in their knowledge to close those gaps. At the time the participants were in school, their teachers seemed to lack this knowledge. The reason for the teacher reactions reported here could be a lack of knowledge of how to help and therefore, rather than losing face or control in the classroom, the teachers blamed the students and assumed they were badly behaved. The reactions reported may have been a way for the teachers to safeguard themselves.

The recent effects of the COVID-19 pandemic on schooling make this aspect particularly pertinent. The COVID-19 pandemic disrupted education worldwide, leading to school closures and a shift to remote learning. A report by UNESCO (2020) provides an overview of the global disruption of education and the responses made. They assess the impact on young people's education as likely to be a lasting one. School closures and disruptions in traditional classroom learning have led to concerns about learning loss among students. Kuhfeld et al. (2020) predict the impact of COVID-19 school closures on academic achievement will be of enduring concern. Young people who have been absent from school, or have suffered teacher absences, are likely to have significant gaps in their knowledge and understanding of mathematics. It seems to us that many mathematics teachers will need to be helped to know how to respond and support their students to close those gaps. Support and understanding are what these participants were looking for when they were in school, and they felt that their teachers did not know how to offer appropriate help.

Whilst we would go along with the participants in not attributing all the blame to the teachers, we would be less willing to blame the students. They were young people who had been placed in groupings that appears to have limited both the learning experiences they received and the expectations of success from those that taught them (Francis, Taylor, and Tereshchenko 2020). The participants in this study seem to have been looking for teaching that helped them understand mathematics and made them feel valued and included. They seem to have been looking for the kind of relationship that was warm and supportive, which would help them feel competent and in control of their learning. They were seeking a relationship where they were able to safeguard their well-being. Instead, they reported the trauma of being excluded, ignored, humiliated and sometimes 'thrown out' of the classroom. They responded by 'hating' both their teacher and the mathematical learning that they were supposed to engage in. They also developed such anxiety that they 'dreaded' going to mathematics lessons and

when they were in class, they felt excluded and the need to protect their well-being.

> S6 I just don't say anything, because everybody else just seems to fly through it . . . You don't want to be left in the cold. You don't want to look stupid.

Both as researchers and educators we found some of these narratives uncomfortable to listen to and analyse. The education system and habitus in which their teachers worked seemed to encourage and validate such actions when teaching. This article allows the participants' voices to be heard so that those charged with enabling the learning of mathematics can understand the effect of certain actions that have been, and still are considered by some, to be part of learning mathematics. For example, Francis, Taylor and Tereshchenko (2020) argue that current policies continue to exclude some pupils and regard others as more valued. It seems changes are needed if mathematics is to be taught and learned more effectively.

The findings bear out that the teacher–pupil relationship is key to effective teaching. As Giles, Smythe and Spence (2012) say, 'Curricula, lesson plans and learning outcomes are long forgotten, but the impact of relationships lives on' (214). The relationships between the participants in this article and their teachers were broken, or ruptured (Tufford and Lee 2020; Walser and O'Connell 2021). Furthermore, the rupture in the relationship with their teachers also caused a rupture in their relationship to mathematics. The participants 'hated' mathematics and were shown to be anxious about mathematics by the MAS (Betz 1978) questions, many years after these incidents had occurred. The ruptured relationship had damaged these people's life prospects and expectations significantly as, according to Hayward, Hunt and Lord (2014), 'Individuals achieving five or more good GCSEs (including English and maths) as their highest qualification are estimated to have lifetime productivity gains worth around £100,000' (9). In John's experience, the majority of the people taking access courses similar to those taken by the participants, are both surprised, dismayed and in most cases apprehensive, to find that they are required to achieve mathematical qualifications as part of their course. Many say if they had realised beforehand the extent of the mathematics they were required to study, they may not have signed up for the course. The damage to these people, emotionally and economically, is significant.

However, ruptured relationships can be repaired, and the rupture and repair cycle is seen by Perry (2020) as a necessary part of life. John and Alex, the teachers of these participants, are repairing their relationship with mathematics, alongside building warm, respectful learning relationships. The students said, for example:

> S3 in this College . . . they explain everything and make sure we understand it.

> S6 Now I'll stay in the lesson I'll try and do all the things I need to do in order to complete the task and I'm a bit more confident as I do that.

> S1 now we look forward to our degree studies with maths being a part of it.

Is it more difficult to build that effective relationship when the students are involved in learning mathematics? It may be. Mathematics is cumulative, one aspect building on another. If someone is not given the time and support to

build fluency in one idea, then subsequent concepts are likely to present barriers. Nardi and Steward's (2003) assessment of students' experiences of learning mathematics shows that the traditional way of teaching mathematics makes it difficult for many students to feel involved or that mathematics is worth the effort it takes to learn.

> Foregrounding relationships in education has the potential for humanising educational praxis in the face of powerful and dominant educational discourses that have taken the teacher–student relationship for granted for the sake of the system that ought to serve it. (Giles, Smythe, and Spence 2012, 233)

This article makes clear the need to build positive teacher–pupil relationships and that making the students' well-being fundamental in mathematical learning environments will make those environments more effective for all. If teachers consider working in ways known to build resilience (Lee and Johnston-Wilder 2017), then they are less likely to cause anxiety in their students and more likely to build the supportive relationships that encourage students to grow and expand their possibilities (Sethi and Scales 2020). The students' relationship to mathematics may have been damaged by systemic demands made on the way that mathematics is assessed and therefore taught, but the relationship can be repaired.

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