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Building Bridges, Not Barriers: A Brief Study of Developing Mathematical Resilience in FE GCSE Mathematics Resit Students

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Abstract

Mathematics anxiety remains a significant barrier for a large proportion of GCSE resit students in Further Education (FE) in UK, often leading to disengagement, low confidence, disruptive behaviour, and avoidance of challenge. Resit pass levels are also very low (Boli & Golding, 2024). This practitioner study explored the use of the Mathematical Resilience toolkit (Johnston-Wilder et al., 2020), including the Growth Zone Model, the Hand Model of the Brain, the Ladder Model, and the Relaxation Response, to address emotional barriers and support resit students in developing more positive relationships with mathematics. A small group of students also engaged in one-to-one online coaching sessions, offering safe spaces to express anxieties and practise self-regulation while doing mathematics. Findings indicate that addressing mathematics anxiety explicitly enhanced emotional awareness, attendance, attainment and classroom participation, with coaching proving particularly transformative for high-anxiety students. Challenges remained in managing large mixed-ability classes and limited access to specialist support, but overall, the study highlights the value of embedding the Mathematical Resilience toolkit as a core pedagogical approach in FE. Future research with larger and more diverse cohorts is recommended to examine the long-term impact of these interventions.

Keywords

Mathematics Anxiety, Mathematical Resilience, Further-Education Resit-Mathematics, Emotional and Psychological Barriers, Emotionally Responsive Pedagogy, Psychological Safety

1. Introduction

The first author has taught Mathematics in the Further Education (FE) sector for over fourteen years, primarily supporting 16 - 19-year-old GCSE resit students. These students often enter FE with extensive histories of negative experiences in mathematics, frequently accompanied by repeated academic setbacks. High levels of mathematics anxiety (MA) are prevalent within these students, typically manifesting as low confidence, disengagement, disruptive classroom behaviours, and limited academic progress during the year. Stress, anxiety, failure, or feelings of inferiority in mathematics can lead to negative attitudes, avoidance, and lack of motivation; building Mathematical Resilience is key to supporting progress (e.g., Trueman, 2022). Both national statistics and professional observations consistently highlight the emotional and psychological barriers such students face when re-engaging with mathematics in FE contexts (Davis, 2023; DfE, 2023).

The motivation for this reflective, practitioner study stems from a longstanding commitment to educational research and a professional concern for the emotional wellbeing of resit mathematics students. As members of the Mathematical Resilience Network, the authors have developed a particular interest in addressing the relationship between mathematics anxiety and student engagement and progress. Classroom practice over the years has increasingly incorporated tools from the Mathematical Resilience toolkit, designed to create psychologically safe learning environments (Johnston-Wilder et al., 2020; Apostolidu & Johnston-Wilder, 2023; Para & Johnston-Wilder, 2023).

The 2024-2025 academic year marked the first author's first year of teaching at a new college, presenting the additional professional challenge of adapting to a new institutional culture while striving to deliver high-quality mathematics lessons. Consistent with prior FE experience, significant behavioural challenges were experienced, often rooted in students' previous experiences of failure and high mathematics anxiety. Managing these behaviours necessitated sustained reflection, patience, and the application of multiple strategies derived from previous teaching experience.

During this period, the first author experienced moments of emotional strain, including feelings of frustration and professional self-doubt, which prompted reflection on the viability of continuing in the teaching profession. This is a common experience amongst FE teachers (ETF, 2019). Contributing factors include large class sizes, limited in-class support for students with additional needs, and persistent behavioural challenges. In this case, support from the second author provided a compassionate, solution-focused space for reflection on these professional difficulties. Guided by this mentorship, the first author shifted focus from surface-level challenges to examining the underlying causes of students' disengagement and anxiety.

2. Resit Mathematics Students at FE and Their Mathematics Anxieties

Resit mathematics students at Further Education (FE) colleges often exhibit high

levels of mathematics anxiety (MA), which significantly impedes their engagement and academic achievement (Davis, 2023). MA is defined as a feeling of tension, worry, or fear that interferes with mathematical performance (Richardson & Suinn, 1972). Research by Dowker et al. (2016) indicates that MA is particularly prevalent among students with a history of repeated failure in mathematics, such as GCSE resit students. These students frequently develop negative self-beliefs, avoidance behaviours, and a fixed mindset regarding their mathematical ability (Dweck, 2006; Boaler, 2015).

Furthermore, GCSE mathematics resit students often experience heightened anxiety, especially those with Special Educational Needs (SEN) or mental health issues. Combined with negative prior experiences in mathematics, these factors contribute to disengagement, poor behaviour, and low motivation, creating significant psychological and historical barriers to learning (Savage et al., 2023). National data indicates that only approximately 25% of FE resit students achieve a grade 4 or higher by age 19, with outcomes particularly poor for those entering with lower prior attainment (DfE, 2023). Additionally, GL Assessment (2024) report that 59% of GCSE mathematics teachers consider mathematics anxiety the most significant barrier to student progress.

Research suggests that interventions focused on developing Mathematical Resilience can substantially enhance student engagement, confidence, and persistence (Apostolidu & Johnston-Wilder, 2023; Para & Johnston-Wilder, 2023; Savage et al., 2023). Addressing mathematics anxiety through targeted emotional and pedagogical support is taken in this article as essential for improving student outcomes and supporting students' broader educational and career aspirations.

3. Mathematical Resilience

Developing Mathematical Resilience (MR) is an educational approach designed to help students overcome negative emotional experiences with mathematics and learn to persist in the face of difficulty, recruiting help when needed. Johnston-Wilder & Lee (2010) define MR as "a student's stance towards mathematics that enables them to persevere and continue learning despite challenges and setbacks" (p. 38). This approach is particularly relevant for resit mathematics students in Further Education (FE) colleges. Research indicates that addressing emotional barriers is crucial, as cognitive interventions alone can have limited impact on learning outcomes (Johnston-Wilder et al., 2013; Lee & Johnston-Wilder, 2017) and risk causing further harm (Davis, 2023).

Fostering Mathematical Resilience (MR) significantly enhances post-16 resit students' motivation, engagement, and confidence. Evidence from Savage & Norris (2021) highlights that many GCSE mathematics resit students are disengaged and anxious, with only around 21% achieving a grade 4 post-16, far below secondary school rates of 60%. Action research implementing Student Engagement Coaches demonstrated that targeted strategies—creating safe learning spaces, fostering a growth mindset, and addressing emotional barriers—can improve attend-

ance, motivation, and engagement among post-16 students. Following intervention, students were more willing to seek help, accept mistakes as part of learning, manage exam anxiety, and take proactive control of their learning, resulting in more positive experiences and improved outcomes in mathematics. Developing MR encourages students to shift from a fixed mindset to a growth-oriented perspective, viewing mistakes as integral to the learning process (Dweck, 2006; Boaler, 2015). The MR toolkit is grounded in Vygotskian social constructivism and incorporates key components such as psychological safety, the personal value of mathematics, the importance of productive struggle, recruiting support, and developing a growth mindset (Johnston-Wilder et al., 2015).

Mathematical Resilience Toolkit

Drawing on the work of (Johnston-Wilder et al., 2020) using the Mathematical Resilience toolkit in this study aimed to focus on students' emotional and behavioural responses to mathematics, examining whether making mathematics anxiety and resilience explicit could improve behaviour and increase student willingness to engage with challenging tasks. Tools within the MR toolkit include the Growth Zone Model (Johnston-Wilder et al., 2020), which enables students to identify and communicate their emotional states in relation to learning challenges; Siegel's Hand Model of the Brain (2012), which explains stress responses such as "fight, flight, or freeze" and normalises feelings of helplessness and temporary stupidity; and calming strategies such as Benson (2000)'s Relaxation Response to support anxiety regulation.

Siegel (2012)'s *Hand Model of the Brain* was used to explain the brain's response under perceived threat (**Figure 1**); the brain perceives as threat any experience that resembles prior harmful experiences. This simple, visual model illustrates how feelings of being overwhelmed occur when the "thinking brain" (prefrontal cortex) becomes suppressed due to activation of the brain's "alarm system" (amygdala). By introducing this model, students were supported to normalise their experiences of confusion, panic, or mental shutdown—not as evidence of being "bad at mathematics", but as natural protective reactions to perceived threat due to prior harm.

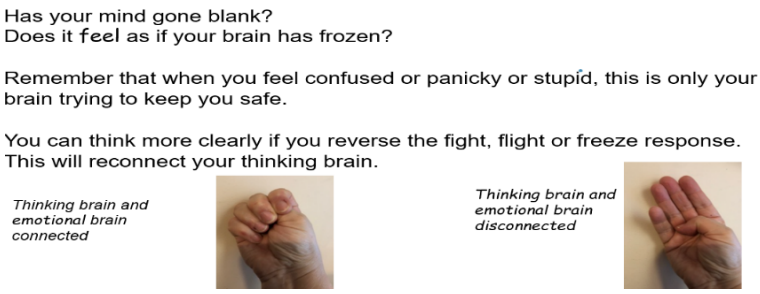

Figure 1. Hand Model of the Brain (Baker, 2023).

Building on this, the *Growth Zone Model* (Johnston-Wilder et al., 2020) was

introduced as a central tool of Mathematical Resilience pedagogy (Figure 2). This model helps students reflect on the link between their emotional state and their capacity to learn productively. It identifies three distinct zones: the **Comfort Zone**, where tasks are easy but offer little opportunity for growth; the **Growth Zone**, where learning is optimally challenging and achievable with support; and the **Anxiety Zone**, where tasks feel overwhelming, even threatening, and may lead to disengagement. To make the model more accessible, colours were assigned to each zone: green for comfort, amber for growth, and red for anxiety

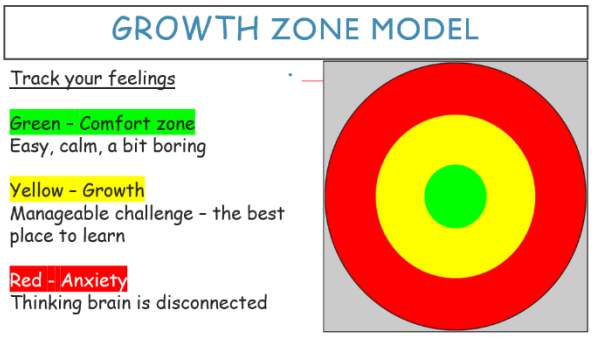

Figure 2. The Growth Zone Model (Baker, 2023).

To further support students in regulating stress and sustaining engagement, i.e. to "get out of the red zone" by triggering the Relaxation Response (Benson, 2000), relaxation strategies were embedded within the lesson structure. Scenic images were incorporated into presentation slides to prompt intentional "breathing pauses" at regular intervals. These short breaks helped to reduce cognitive overload and gave students time to regulate their stress responses before tackling new concepts. Techniques such as recovery breathing, grounding strategies, and brief mindfulness activities were also practiced. Over time, students began to associate the visual prompts with opportunities to pause, reset, and re-engage with mathematics in a calmer and more focused state.

The fourth tool introduced was the Ladder Model; if any mathematics was not understood the student was encouraged to ask for and expect more rungs to make the learning accessible for them.

Through professional dialogue and ongoing mentorship, the first author developed a heightened awareness of the emotional and psychological barriers that frequently hinder resit students in FE from engaging meaningfully with mathematics. Guided by the evidence-based framework, the study implemented the Mathematical Resilience toolkit as a structured intervention to support students in reducing anxiety and developing a more positive relationship with mathematics.

4. Research Study

The study was guided by the following reflective research questions:

- How do students respond emotionally and behaviourally when introduced to **Mathematical Resilience tools** such as the **Growth Zone Model** and **relaxa-**

tion strategies during lessons?

- In what ways does explicitly addressing **mathematics anxiety** influence student participation and willingness to engage with challenging mathematics tasks?
- How does creating a **psychologically safe learning environment** affect classroom dynamics, student confidence, and academic progress?

The intervention had 4 elements: an initial mathematics anxiety test; emotional mapping of the examination paper; incorporating the MR tools into every lesson; individual coaching for mathematical resilience. These elements are described after consideration of ethics.

5. Ethical Considerations

From the outset, ethical considerations were prioritised to ensure that the study upheld the highest standards of integrity and responsibility. Particular attention was given to safeguarding participants' personal information, protecting their well-being and safety, and ensuring their participation was voluntary and fully informed. Prior to commencing the research, managerial approval was obtained, and ethical procedures were embedded into the design of the intervention.

Student identities were protected by assigning pseudonyms in all records and reports, and any personal data was stored securely in accordance with data protection regulations. Consideration was also given to the emotional sensitivity of the research context, given that the intervention addressed mathematics anxiety and related psychological barriers. For this reason, steps were taken to establish a safe and supportive learning environment, using the Mathematical Resilience toolkit and giving regular opportunities for participants to share which zone they were in.

6. Initial Mathematics Anxiety Test

An initial mathematics anxiety test adapted from Betz (1978)'s was administered to 39 resit students, during an induction week; the results provided a foundational understanding of students' anxiety levels associated with learning and resitting GCSE mathematics at college. Responses were analysed question-by-question.

Approximately 49% of students reported that mathematics sometimes makes them feel uncomfortable or nervous, while a further 10% indicated that they always experience such feelings, highlighting a significant emotional barrier to their engagement and progress in mathematics learning.

31% of participants disagreed with the statement that they feel calm during mathematics lessons, and an additional 8% reported that they never feel calm. 56% of participants reported experiencing anxiety or difficulty when applying mathematical concepts in real-life situations, highlighting the broader impact of mathematics anxiety beyond the classroom. The statement "Maths makes me feel uneasy and confused" elicited the highest level of agreement among participants, with 72% agreeing. Regarding the statement "My mind goes blank and I am unable to think clearly while doing maths", 41% of participants sometimes agreed and

33% always agreed, totalling 74%. These findings underscore the pervasive emotional and psychological barriers that hinder typical resit students' engagement, progress and achievement in mathematics.

Responses were given a number on a Likert scale from 1 - 5 with 5 representing high mathematics anxiety in each case. Individual scores were added up; according to Baker (2023), overall "MA scores above 32 are likely to represent a tendency towards visibly high anxiety; MA scores above 27 but below 33 are recognised as likely to represent a tendency to be anxious without necessarily demonstrating visible effects; lower scores represent a low level of mathematics anxiety" (p. 121). In this cohort, only 3 students scored a low level of mathematics anxiety overall; a worryingly high proportion, 27 of the 39 participants, scored a high level of mathematics anxiety.

7. Emotional Mapping of Exam Paper

An emotional mapping activity was conducted using a past AQA GCSE mathematics exam paper: rather than attempting to solve the questions, 65 students fully registered for the resit course were asked to evaluate each question based on their emotional response using a colour-coded system: **Red** (high anxiety/"this makes me panic"), **Amber** (uncertainty/"I can try"), and **Green** (confidence/"I know this").

This activity aimed to help students recognise and label their emotional reactions to different types of mathematical problems, thereby increasing metacognitive awareness and normalising emotional responses to mathematics challenges. The exam paper was divided into topic categories: Number, Algebra, Shape, Graphs, and Probability.

- Probability emerged as the most emotionally challenging, with 65% Red responses and only 9% Green, reflecting widespread conceptual insecurity and triggering of stress responses.
- Shape questions also caused high anxiety (54% Red).
- Algebra and Number also saw high Red responses (47% and 45% respectively), indicating persistent negative associations even in foundational areas.
- Graphs, however, showed relatively positive engagement, with 41% Green responses—the highest of all categories—suggesting that visual representation and real-world context may ease cognitive load and support emotional accessibility.

Overall, 48% of responses were marked **Red**. This suggested for nearly half the questions students were operating in the *high anxiety zone*, where emotional distress blocks learning.

The activity functioned not only as a diagnostic tool but also as a **metacognitive intervention**, enabling students to identify and reflect on their emotional responses. This supported the principles of **Mathematical Resilience** by normalising anxiety and promoting self-regulation and help-seeking behaviours through the concept of accessible "rungs on the learning ladder". These findings highlight

the importance of integrating emotionally responsive teaching strategies in resit contexts to shift students from anxiety-driven disengagement toward sustained growth and confidence.

8. Incorporating MR Tools within Every Lesson

Following the results of the initial mathematics anxiety questionnaire and the emotional mapping exercise (which was done during the 3rd and 4th teaching week), it became evident that a significant proportion of GCSE resit students were experiencing emotional barriers, and literature has established this would hinder confidence, cognitive functioning, and engagement in learning (Davis, 2023; Savage et al., 2023). This level of distress highlighted the need for a targeted, psychologically informed pedagogical response.

To address this, Mathematical Resilience tools were embedded into every lesson from the 4th teaching week until the end of the year. A Red-Amber-Green (RAG) self-assessment system was incorporated into classroom routines particularly while learning new topic, doing class tests and exam practice, allowing students to identify whether they were in the comfort, growth, or anxiety zone for each question or activity. This encouraged greater emotional literacy and self-advocacy, as students became more willing to communicate their needs and seek appropriate support. Lesson content was then differentiated in response to students' self-assessments. Students identifying in the comfort zone were provided with extension tasks, those in the growth zone were offered scaffolding, and those in the anxiety zone were supported with breaks, reminders of how to trigger the relaxation response, and modified tasks.

Over time, these interventions, grounded in the Mathematical Resilience toolkit, contributed to a noticeable shift in classroom climate. It took some students more time than others to gain benefit from the intervention. However, for few students, mindsets and attitudes played an on-going barrier role. Students reported their emotional states, and most stated that they felt more comfortable in seeking help, and became less likely to disengage or respond defensively when faced with challenge. This proactive approach reframed the learning environment from one focused on managing poor behaviour and disengagement to one centred on recognising and addressing the emotional dimensions of learning mathematics.

Following the integration of Mathematical Resilience toolkit into classroom practice, improvements were observed in student attendance, engagement, and emotional wellbeing. Students reported feeling more valued and supported through these strategies, complemented by regular formative check-ins. This was reinforced in a formal observation by the college's Quality Team, who noted the strong sense of care and positive classroom culture described by students.

9. Individual Coaching Sessions

Despite these positive outcomes, based on their feedback from using the Growth Zone Model, four students continued to experience high levels of anxiety and oc-

casional panic; these four students with lower prior attainment reported stress when working alongside higher-achieving peers. The demands of managing a large mixed-ability class made personalised support difficult to deliver in real time. To address this, weekly 30-minute one-to-one online coaching sessions were introduced, providing a more tailored environment where these four students could learn to manage anxiety, build confidence, and develop self-regulation strategies.

In these coaching sessions, students brought specific topics or exam questions they found overwhelming. While initial participation was hesitant, with students reluctant to switch on cameras or share work, by the second or third session a noticeable shift had occurred: students prepared in advance, showed curiosity, and began taking greater ownership of their learning.

The sessions, facilitated by the second author, observed by the first author, employed Mathematical Resilience tools whilst the students were working on mathematics problems. Students were encouraged to recognise their emotional state, use calming techniques such as breathing exercises, and request "more rungs" (scaffolding) when facing difficulty. Learning was paced individually, reinforcing the principle that understanding develops gradually with persistence and support.

Transformative moments emerged; over time, all four participants showed greater confidence and engagement in classroom mathematics, with one student—who had previously avoided sitting with higher-attaining peers—participating more actively and even helping others.

These four students explained that the classroom environment often made it difficult to admit when they were struggling for fear of embarrassment. The coaching space, by contrast, enabled them to explore emotions around mathematics and normalise mistakes as part of learning, experiencing patience and self-compassion, reinforcing that errors are a natural part of growth.

The sessions also influenced the teaching practice of the first author, equipping her with more strategies to support anxious students more effectively and to scaffold complex problems in simpler steps to build confidence. Although running sessions outside college hours posed logistical challenges, and some students expressed a preference for face-to-face support, the positive impact on student confidence and resilience strongly affirmed the value of personalised coaching as a complement to classroom teaching.

Coaching Case Study

At the beginning of the GCSE mathematics resit course, one student we call Maria struggled significantly with mathematics anxiety. Maria often found it difficult to concentrate during lessons and felt embarrassed about asking even basic questions, especially in comparison to peers who had previously achieved up to 3 grades higher than her. She frequently expressed feelings of inadequacy, stating that she was trying but simply could not grasp the concepts. Administering a mathematics anxiety test and RAG rating of an exam paper confirmed that Maria

was experiencing high levels of mathematics anxiety.

In the first coaching session, Maria shared that she struggled particularly with angles and often felt overwhelmed when she did not understand the topic. Drawing on the Ladder Model, coaching questions identified that analogue time was in Maria's green zone; the session built up the concept of angles using a clock as a visual aid, and some physical standing up and turning, which Maria responded to positively. However, she still did not feel comfortable turning on her camera to share her work.

In the second session, the angles concept was revisited, reinforcing the understanding from the previous week. Maria brought some specific exam questions to the sessions, and worked on these. The second author used the Growth Zone Model (GZM) and learning ladder techniques, along with relaxation breathing strategies to help Maria to manage anxiety. By the end of the session, Maria seemed more engaged, and there was a noticeable shift in her confidence as she started to answer questions independently.

By the third session, Maria was noticeably more relaxed and engaged. She willingly shared her work via camera and expressed excitement when she solved a question, exclaiming, "Oh my God, I understand the question! I never knew I could do it!" This breakthrough moment marked a significant shift in her approach to learning. She started participating more actively in the lessons, tackling increasingly complex exam-style questions and eagerly looking forward to each new lesson.

As the teaching weeks progressed, the transformation became increasingly evident. Maria was confident, engaged, and participating fully in the resit lessons. She began sitting with her peers and, on occasion, was even able to point out errors in their work and help them solve problems. Her attendance and punctuality improved, and she started actively seeking additional practice to complete at home.

By the end of the course, Maria achieved 3 grades higher in her GCSE mathematics resit from Ungraded to 3, a remarkable improvement in a short time. Her achievement was a testament to the effectiveness of the tailored intervention and the use of Mathematical Resilience tools. No longer overwhelmed by anxiety, she now enjoys mathematics and continues to show signs of further growth, with the realistic prospect of achieving a pass grade in the near future.

10. Observations

Observations revealed several significant insights into the emotional and behavioural responses of GCSE resit students to the integration of Mathematical Resilience tools:

1) Emergence of Student Voice and Emotional Awareness:

Students increasingly demonstrated self-awareness and confidence in articulating their emotional responses to mathematics. They showed a growing ability to identify and express when they felt anxious, overwhelmed, or disengaged, and began actively seeking differentiated support or challenge based on their individual

needs.

2) Impact of a Safe and Supportive Environment:

Regular attendance and sustained student-teacher relationships helped foster a classroom climate where emotional safety and wellbeing was prioritised. Students reported feeling valued, listened to, and cared for, which contributed to increased engagement and a willingness to take risks in their learning.

3) Differentiation and Group Dynamics in Mixed-Ability Classes:

Differentiated worksheets and scaffolded support empowered lower-attaining students to participate more actively. However, large class sizes and wide variations in prior attainment posed persistent challenges. Lower-attaining students often took less part, while higher-attaining students at times became disengaged and complained about repetition or lack of challenge.

4) One-to-One Coaching and High-Anxiety Students:

Targeted one-to-one coaching sessions proved transformative for students with acute mathematics anxiety. Students who initially avoided engagement began to look forward to the sessions, expressed joy upon grasping difficult concepts, and displayed increased confidence and participation in classroom learning. The Growth Zone Model, the Ladder Model, and relaxation strategies were pivotal in enabling students to regulate their emotions and develop resilience.

5) Structural and Specialist Capacity Limitations:

The study also highlighted systemic barriers—particularly the shortage of teachers trained to support students with high levels of mathematics anxiety and SEN needs. The lack of in-class support and trauma-informed teaching practices made it difficult to fully address the complex needs of all students, especially within large, mixed-ability cohorts.

11. Limitations of the Study

This brief study, while offering valuable insights into supporting GCSE resit students through Mathematical Resilience tools, has several limitations that must be acknowledged.

Firstly, it was a study with small sample size—particularly in the one-to-one coaching sessions involving only four students— which limits the generalisability of findings. The study's short duration and focus on a single academic year restricted the opportunity to assess longer-term impact or sustained behavioural change. Additionally, logistical challenges, such as scheduling coaching sessions outside normal college hours, affected consistency and student participation.

Secondly, the study's scope was confined to a single institutional context with specific constraints, including large mixed-ability classes, high numbers of students with special educational needs (SEN), and limited access to specialist in-class support. These factors influenced the extent to which personalised interventions could be fully embedded across all lessons.

A further limitation lies in the dual role of the researcher as both teacher and coaching observer. While this provided rich insight into student progress, it may

have introduced bias in observation, interpretation, and student responses due to established teacher-student dynamics. This bias is acknowledged.

Lastly, the absence of longitudinal follow-up data also prevents conclusions about the long-term efficacy of the intervention.

Despite these limitations, the study lays an important foundation for further research into targeted emotional support for mathematics-anxious students.

12. Conclusion

This study represents a significant turning point in professional practice, facilitating a shift from frustration and emotional fatigue towards renewed motivation and evidence-based action. By exploring the impact of integrating Mathematical Resilience tools into resit GCSE mathematics teaching, the research aimed to reduce mathematics anxiety and improve student engagement. Over the academic year, notable improvements were observed in students' emotional readiness, confidence, and participation in lessons. The findings highlight how emotionally responsive pedagogy can transform students' relationships with mathematics, strengthen confidence in creating supportive learning environments, and address the emotional barriers that often hinder progress. Positioned as an ongoing journey, this work emphasises the importance of fostering mathematically resilient students and building bridges rather than barriers within educational practice.

In response to the first research question, students showed positive **emotional and behavioural shifts** when introduced to tools such as the **Growth Zone Model (Johnston-Wilder et al., 2020)** and **Siegel (2012)'s Hand Model of the Brain**. Students became more self-aware, increasingly able to identify when they were in the "red zone", and began using self-regulation strategies such as recovery breathing or seeking appropriate support. The visual metaphors helped demystify stress responses, promoting metacognitive reflection and a language for emotional self-expression in mathematics contexts.

To address the second research question, an **emotional mapping task using the RAG method** provided deep insight into students' internal responses to an AQA past paper. Students highlighted exam questions based on how they *felt* rather than what they *knew*. This activity not only revealed areas of emotional blockage but also gave students permission to name their anxiety without shame. Explicitly addressing these feelings created a more open classroom culture, where students were more likely to ask for "rungs on the learning ladder" and engage with tasks they previously avoided.

In response to the third question, the creation of a **psychologically safe learning environment** led to notable changes in classroom dynamics. Attendance improved, students showed greater persistence, and several who were previously disengaged began contributing in class. Some students, previously reluctant to speak or make eye contact, began to voice their thinking more confidently. Students also began requesting both **more support and more challenge**, signalling a shift from avoidance to ownership.

Further emotional scaffolding was provided through **online one-to-one coaching** for four students experiencing acute mathematics anxiety. These personalised sessions offered a low-pressure space to explore coping strategies, build confidence, and develop a more constructive self-narrative. The students involved reported reduced anxiety and increased participation during lessons.

In addition, the initial **mathematics anxiety diagnostic survey** confirmed that many students entered the course with deeply rooted fear and disengagement. Embedding resilience language and emotional prompts in lesson delivery helped to normalise these experiences, offering reassurance and a framework for growth.

Overall, the study found that **explicitly addressing mathematics anxiety through Mathematical Resilience tools** had a powerful impact on student engagement, participation, and confidence. By fostering emotional safety, students became more open to challenge, more willing to persist through difficulty, and more aware of their own learning processes. While structural challenges remain—particularly in large mixed-ability classes—this study reinforces the value of trauma-informed, emotionally grounded teaching in post-16 mathematics education. The findings suggest that embedding Mathematical Resilience is not a peripheral add-on, but a core pedagogical approach essential for transforming students' attitudes and outcomes in GCSE resit contexts.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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