DEVELOPING TEACHING FOR MATHEMATICAL RESILIENCE IN FURTHER EDUCATION

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Abstract

The construct 'Mathematical Resilience' [1] has been developed to describe a positive stance towards mathematics; resilient learners develop approaches to mathematical learning which help them to overcome the affective barriers and setbacks that can be part of learning mathematics for many people. A resilient stance towards mathematics can be engineered by a strategic and explicit focus on the culture of learning mathematics within both formal and informal learning environments. As part of that engineering, we have developed the notion of 'Teaching for Mathematical Resilience'. The work described here is focused on developing teachers who know how explicitly to develop resilient learners of mathematics.

Teachers for Mathematical Resilience develop a group culture of 'can do' mathematics which works to counter the prevalent culture of mathematics helplessness and mathematics anxiety in the general population when faced with mathematical ideas.

This paper discusses the changes in awareness brought about by a one-day course designed to develop 'teaching for mathematical resilience'. The course presentations ran between November 2015 and July 2016 and recruited participants who work as teachers of numeracy or mathematics in Further Education (FE) institutions in England – predominantly in the Midlands. Many of these teachers were being required to teach beyond their own level of mathematical confidence.

The data shows that it is possible within a one day course to increase teachers' awareness of negative past experiences as a possible cause of difficulty with mathematics; teachers become aware of how patterns of behaviour such as avoidance and disruption may have developed as safe-preservation habits and how mathematics anxiety can be transmitted from teacher to student in a vicious cycle. Teachers are supported to work through personal anxieties towards mathematics in a safe and collaborative environment and to develop elements of personal mathematical resilience and awareness of the affective domain. Thus we have sought to break the cycle of mathematics anxiety by educating teacher awareness. However, we have also found that many UK FE teachers request and would likely benefit from further courses.

Keywords: Mathematical resilience, growth zone model, mathematics anxiety, teacher as coach

1 THE CONTEXT

A significant proportion of the population in UK suffers from maths anxiety and maths exclusion and UK has a long tail of underachievement in maths [2]. The UK government's response to this has been to require all young people to continue to study maths until the age of 19 - or until they achieve a GCSE A*-C grade. Furthermore, since September 2015, all students who had attained a grade D have been required to re-sit the GCSE repeatedly, rather than be examined in a more practically based Functional Skills qualification. Sadly, the government does not appear to recognise the scale of the affective barriers and the psychological harm involved. The situation has been further exacerbated by a shortage of qualified maths teachers.

Around 50% of young people starting FE courses in England previously been entered for a Maths GCSE examination in which they experienced failure. Many of these students have experienced repeated failures [3]. Typical responses regarding expectation include: "*I have done it so many times*", "*I will never get it*" and tears, hopelessness, anger or in some cases outright refusal. Some can give no examples of good experiences in school mathematics and have experienced exclusion from mathematics since primary school. As a result, self-preservation strategies such as avoidance and passive non-compliance abound; student attendance in FE mathematics is often low, student expectations are low and anxiety levels are high.

Mathematics specialists often lack awareness of the impact of the affective domain on progress in mathematics. Consequently students unconsciously preserve their well-being by only attempting work they have already mastered and not engaging with mathematical challenge resulting in them making little progress beyond basic skills acquisition. For many students, this results in a grade profile that is stuck at grade D, or in some cases even deterioration to lower grades.

2 THE AFFECTIVE DOMAIN

'Maths, more than any other subject has the power to crush children's confidence and to deter them from learning important methods and tools for many years to come' [4, p. 1].

The affective domain is widely acknowledged as relating to beliefs, attitudes and emotions. Attitude can be defined as *'a liking or disliking of mathematics, a tendency to engage in or avoid mathematical activities, a belief that one is good or bad at mathematics, and a belief that mathematics is useful or useless' (p. 632). In the United Kingdom, girls in particular do not enjoy mathematics, are anxious when asked to solve mathematical problems and underperform compared with boys'* [2, p.1].

Anxiety and stress are reactions often evoked by teaching methods – including an emphasis on speed, accuracy and avoiding mistakes [5]. Maths anxiety is prevalent amongst students [6 and teachers, and maths anxiety spreads [7]. In addition, maths is typically viewed as a largely abstract subject, dependent on symbolic language, with scant regard to Bruner's enactive and iconic stages (in marked contrast to the mathematically high-achieving nations of SE Asia) or to practical application. Other factors include: a focus on acquisition of isolated skills, as opposed to development of deeper understanding and connections between topics [1]; a lack of emphasis on the need to struggle and persevere with maths [8]; and the absence of agency on behalf of students. Nardi and Steward [9] have described this as 'TIRED' maths (tedious, rote, isolated, elitist and de-personalised); students respond with avoidance, and if that isn't possible, helplessness and anxiety. The situation is further exacerbated by teaching systems which emphasise results to secure a high position in performance tables, and the prevalence of setting in UK schools [10]

It has been widely reported that attitudes are formed as a consequence of emotional reaction to situations [11]. Thus individuals who experience stress and anxiety towards mathematics, or repeated failure to achieve desired solutions, or who develop feelings of being of inferior intelligence when engaging with mathematics, will form negative attitudes towards mathematics. These negative attitudes lead to avoidance [12,13] or lack of motivation to engage with mathematics [14]. The inability to achieve success in solving mathematics problems has resulted in individuals actively avoiding interactions with mathematics in any way they can. Avoidance can take many forms: total non-engagement, rushing to complete work and thus having less time engaging with the mathematics, not taking optional mathematics courses and choosing careers that have the least amount of mathematics in them. Learners who feel that they have no agency in their learning are also likely to lack motivation to engage [15].

Ashcraft and Moore [16] reported that anxiety depressed an individual's ability to process cognitively. This creates a cycle of failure [17] reinforcing the negativity surrounding mathematics. Maths anxiety is acquired, and disabling, but it is treatable. By reducing the amount of anxiety an individual experiences while engaging with mathematics we have encouraged more positive attitudes towards mathematics and more sustained engagement with mathematics. In the long term, it is hoped, personal beliefs that everyone "can do" mathematics and that everyone has ability to grow their skills in mathematics will become the popular societal view.

2.1 Mathematical resilience – a framework for change

Many learners need to develop a more positive stance towards mathematics. As Dylan Wiliam [18] describes it, "*when a child is given something challenging to do the first reaction is to say 'Can I [already] do this or not?' Most students go down one of two pathways - one is the well-being pathway ... to preserve your sense of self and well-being. If you think you can do the task, you will do the task because you will get some approbation from the teacher. If you think you can't do the task, you will switch off and disengage on the grounds that it's better to be thought lazy than stupid. And you see a lot of that in schools - students actually deciding not to try*."

This behaviour leads to attitudes of self-exclusion from mathematics and a self-depriving focus on personal inability to engage with mathematics. "*Other students faced with a challenging task choose to activate what you might call the growth pathway - they choose to use that situation as a chance to*

improve their ability to get smarter ... the important thing is that ... [teachers learn] to help the students manage their emotions so that they engage in the growth pathway and engage in the task in order to improve their capability - rather than just focusing on preserving their sense of well-being."

With the growth zone model [19], we have a structure to build an effective intervention. The safe zone or 'comfort zone' (green) encompasses everything the learner can already do independently. Cruising in the 'comfort zone' can build self-confidence, practise for automaticity, provide reassurance and allow for recovery.

Figure 1: The growth zone model

The 'growth zone' (orange) is that zone immediately beyond what a person is able to do reliably, without aid or support. When in the growth zone, new learning happens. Here it should be safe to make mistakes, go down dead-ends, experience some failure, require support, get stuck and find activity somewhat, but not overly, challenging and tiring. The learner needs to know in advance that being in the growth zone may trigger productive levels of adrenalin: not too much but just right. The learning environment needed is one of trust, courage, articulation, collaboration and persistence. Ideally, students will find themselves motivated – and having opportunity – to enter their growth zone often, being encouraged to take mathematical risks while being appropriately supported

The danger zone or 'anxiety zone' is where what is being asked of the learner is not within their reach, even with support; with increasing exposure, the learner's stress increases and the brain begins 'fight, flight or freeze' routines. There is less or, in extremes, no useful learning taking place, and learners experience increased use of coping strategies (avoidance, helplessness) or even paralysis.

Mathematical resilience can be thought of as what it takes to be safely challenged while being in the growth zone, where the learner develops confidence, persistence and perseverance [20]. Mathematical resilience was originally theorised as having 4 factors:

1. belief that brain capability can be grown (mindset);
2. understanding of the personal value of mathematics (value);
3. understanding of how to work at mathematics (struggle);
4. awareness of the support available from peers, other adults, ICT, internet, etc. (support).

This is not new theory. It is a model rooted in the work of Vygotsky, Dweck, Swann, Wiliam, Freudenthal, Bruner, Bandura and Mason. It is an effective and pragmatic structure for raising awareness and thereby effectiveness.

3 PLANNING THE ONE DAY COURSE

With funding from the Education & Training Foundation, a one day CPD intervention was planned to address the needs of maths teachers in the FE and skills sector. The aim of the day was to introduce FE teachers to the ideas of mathematical resilience and their application in overcoming affective barriers to learning mathematics. The learning outcomes were that the delegates would be able to understand and apply key ideas of 'mathematical resilience', and use these in order to support learners to overcome emotional barriers to learning mathematics, using activities which make mathematics ALIVE (accessible, linked, inclusive, valuable, engaging) and enable them to support the development of mathematical resilience in learners.

The course content was developed, amended and updated throughout the delivery period in response to feedback from teacher-participants and from the professional development leads delivering the CPD. There were, however, several constant features in the structure of the programme:

- **Sharing & discussing experiences of mathematics learning:** teacher-participants were encouraged to reflect on and share their experiences of mathematics as a learner – both positive and negative – in order to raise awareness of affective factors in mathematics learning and, in

particular, how the behaviour of teachers can impact on learners' attitudes, beliefs and behaviours. This was developed to discuss notions of 'TIRED' and 'ALIVE' mathematics – with exemplar activities to illustrate these.

- **Mathematical mindsets:** participants were introduced to the ideas, research and implications of Dweck's growth & fixed mindsets, and Boaler's strategies to promote growth mindsets through 'positive classroom norms.'
- **Growth zone model:** this was presented to participants as a framework for viewing responses to different kinds of learning situation, and to encourage reflection on the feelings and emotions associated with each zone. Participants were asked to work in groups on a complex problem-solving activity (the 'Zin obelisk'), while simultaneously monitoring their 'zones' through the use of red/amber/green cards. This lead to a discussion about what helped them stay in the growth zones and avoid the red zone.
- **Accessible activities**: participants were presented with a range of 'accessible' activities – defined by the following characteristics:
    - 'low floor-high ceiling' open problems that allow a variety of approaches at different levels
    - using visual representations to develop understanding, rather than reliance on symbolic language
    - using meaningful contexts which encourage more intuitive approaches, rather than standard algorithms.
- **Exploratory questioning:** participants evaluated different ways of reacting to learners when they got 'stuck', and the use of coaching questions as an approach to support learners' perseverance with mathematical problem solving.
- **Reflections & action planning:** in the closing stages of each day, participants were encouraged to reflect on the ideas and approaches they had been introduced to, and highlight aspects they could take forward in their own practice.

4 SHORT TERM EVALUATION

The ideas in the course are framed in such a way as to focus on solving a problem in FE which manifests in learner absenteeism, defiance and lack of progress in mathematics. This short-term evaluation is based on two sets of data: feedback forms completed by participants at the end of the day and interviews with team members. Four key themes emerged from the data: increasing teacher awareness of the role of affect in learning mathematics; a new structure for addressing the affective domain; the role of coaching strategies; and transformation of teachers from helpless to positive and agentic. In the following sub-sections, the key themes are discussed in more detail.

4.1 Increasing awareness of the affective domain in learning maths

Most participants were already aware of some affective barriers to learning mathematics, although, for others, it was something that they had not previously considered. One experienced practitioner had considered the affective domain to a great extent; nevertheless, she stated: "*One of the things I haven't taken sufficient account of was the impact of maths anxiety on working memory*."

The course provided a forum and a framework for discussing the affective domain explicitly. This was in contrast to participants' usual experience of CPD, which tends to focus on the cognitive domain; the affective domain is effectively '*brushed under the carpet'*.

The traditional (Western) view of learning is that sense-making precedes emotional response. Recent work by Damasio [21] and others has shown that, in fact, the emotional reaction precedes the sense-making. This is a fundamental feature of the brain that is rooted in the role of the amygdala in safe-guarding animals [22]. If an environment is perceived as threatening, the emotional reaction overrides the reasoning process. The affective domain then effectively plays the role of an '*emotional handbrake'* on mathematical progress. In effect, teachers have to push a metaphorical car with the handbrake on. As one of the team members said, "*You might have some great cognitive activities but they're not going to be effective until you've addressed the affective barriers; their [lack of] confidence and the mindsets that people have [leave] some believing that they cannot achieve in maths*".

During the course, participants were asked to share past experiences, both positive and negative, to help colleagues increase their awareness of the impact the affective domain can have on learning mathematics. Many participants expressed lack of confidence in their mathematical abilities, or had TIRED experiences of maths:

- *I wish I was more confident with x and y*
- *Sometimes I did not understand something, the teacher just moved on and I never understood it as a result (elitist)*
- *Feeling stupid for not understanding (elitist)*
- *Working as individuals - no group work (isolated)*
- *Not seeing relevance or value of certain topics such as algebra (de-personalised)*
- *Felt like we hit a ceiling in terms of ability/complexity and structure (elitist)*
- *Lack of support (isolated)*
- *Teacher saying I would never pass (elitist)*
- *Fear of failure/speed causes you not to be able to answer*

For some participants, it was a revelation that '*it's not just me'* and that many other people have affective barriers. *"I was in some cases quite shocked by what bad experiences some of them have had from maths. I can remember one woman saying how badly her maths teacher put her down at school, told her 'you're rubbish at maths, you'll never be any good, you'll be down to the lowest set, you're not in this set anymore'. At a young age obviously, a lot of that could have killed her confidence for good.* Certainly [the course] made me aware that most teachers focus exclusively on the cognitive domain and about thinking and reasoning and we have not really thought much about the affective domain."

Thus participants came to realise that it is very important for mathematics teachers to discuss affective issues and the management of these with learners. If teachers and learners don't address affective barriers explicitly, learners won't learn; learners need to feel safe enough to learn; they need to stop using avoidance as a strategy for self-preservation when they experience symptoms of being 'in the red zone'.

The course helped the participants to overcome personal affective barriers and also helped them to realise how they had previously passed negativity on to their students. Experienced practitioners have noticed that "*teachers who are confident in their own maths skills tend unwittingly to encourage the development of mathematical helplessness. And those teachers who are more anxious about their maths skills tend to pass on their negativity and maths anxiety.*" One participant expressed this for themself, saying "*I realise now that I am a big part of the problem because of my attitude to maths that I pass on directly to the students. So I'm going to make sure I don't do that anymore, but I'm going to adopt a positive approach and look for the positive effects of learning maths.*"

Many of the prior positive experiences of maths were experienced as ALIVE; these were shared and the ALIVE concept was well-understood. Examples included:

- Maths linked with chemical formulas (linked)
- Any maths related to finance/budget management - making life easier (valued)
- Shifting perspective in 'doing' maths because I could see the point, treating maths problems as puzzles (engaging)
- Always learning new techniques from my team (inclusive)
- Working as part of a group to solve problems (inclusive)
- Activities were inclusive and innovative (inclusive, engaging)

Other people engaged fully with the need for using narrative for some learners: "*I now fully understand the narratives behind maths concepts are as important as the maths problem (accessible*)."

4.2 Growth zone model

Participants found the Growth Zone Model helpful in their quest to help learners manage their emotions when mathematically challenged. Participants came to appreciate that the balance between challenge, struggle and support is vital. The Growth Zone Model provides a helpful framework to think about that balance. Participants reported that in the past they had been keen to help learners at the first sign of trouble, anxious to remove the anxiety to ease the passage for learners; their attitude had

been "*Right let me show you. I can tell you. I can do this for you. This is how you should do it. If you start from here, this is the way*".

As one participant explained their new insight, "*[being too helpful] might remove temporary anxiety but what it's done is to encourage maths helplessness. So instead of building resilience in the learners by encouraging them to think about what they're doing to move forward themselves ... it has been much more tutor led*."

Participants commented that they found it helpful to have a vocabulary to discuss issues with staff and students. They reported finding the RAG cards really helpful to identify feeling about activities. They reported being more aware of the zones that individuals might be in at any moment, and of the need to become aware of how they manage the affective domain.

For example, one participant stated *"after being in the program, the thing that was really helpful ... was the growth zone diagram".* Another explained further *"... the other thing that I really liked about it is that, it's not an individual thing which growth zone model can be but also that learning is a kind of apprentice activity so you get support from others, having the advantage of better people at maths. So the students know that maths is not something they do on solitary basis, but it is something they do in collaboration with other people so they can get support and help, but also giving them outside help if [they] need support. Part of being a good learner is to know where to get support when you need it."*

4.3 Introduce coaching strategies and challenge

All the participants reported that the course was useful in terms of becoming aware of and acquiring new, inclusion-promoting teaching techniques, such as visual tasks and methods, promoting discussion by using open questions, different ways of solving problems, new resources, and helping learners to manage anxiety. They also responded very positively to using the suggested expression 'not yet' when a learner complains that they can't understand a topic or complete a question [23].

Participants who were accustomed to repeating an explanation very much appreciated considering an alternative approach. One said "*I think the biggest thing is the coaching bit".* Another described the process as: "*the tutor stepping back and being less directive and letting the students support each other and take more responsibility for their own learning and feel empowered."* Participants highlighted several elements of the coaching approach as most constructive, including: learning to use more effective coaching questions; learning to ask and listen (and draw out), rather than telling again; the notion of giving their learners more agency and opportunity to take initiative; and having a language that allows learners to "*struggle safely and recruit minimal support rather than over-helping"*.

Several participants mentioned that developing questioning techniques was important to them ... *"trying to encourage people to listen more and ask questions rather than traditionally [when] somebody did not understand then the teacher explained it again"* and building learner resilience through "*the use of exploratory questions and so on, encouraging the learners to talk and explain where they are and moving from that point rather than jumping in too soon through good intentions*." Several mentioned the notion of the coaching approach enabling teachers to give learners more challenge "*with things they have to think about themselves. So, rather than pushing information into them, it is pulling from students what they know*."

Participants felt that they needed more skills (specific to maths and resilience) in coaching and in helping learners to become mathematically resilient; some participants would like more training in becoming able to generalise the benefits to other areas, such as: English teaching, developing resources, and developing support across the college.

4.4 Transformation

The course included a focus on strategies for addressing affective barriers. The theme 'transformation' emerged from the experience of team members and from participants moving from relative helplessness in the face of maths anxiety and avoidance to awareness, positivity, agency and intention. There was some evidence of a transformative effect on some learners, however this was only anecdotal and will be the subject of a later paper.

A few participants described themselves as previously "*attempting to remove ... maths anxiety but without a sort of strategic plan of how to do so as is now ... represented with [the] maths resilience structure and the growth zone model*". For other participants, helplessness manifested as a '*that's life'* acceptance that maths anxiety is a problem but not knowing what to do about it. Most of the people involved were aware that there are many people who hate the subject and get really anxious about maths, but that the frequent response tends to be "*oh yes that is just life get on with it and do what we do"*.

The team members and participants experienced the course as something that made them rethink and reflect upon their perspectives on, and stances towards, mathematics teaching and learning: *"it opened my eyes"*. What came out from the course was the idea that "*we need to do something about this; we need to approach it in a different way and be aware of this, and take steps to address these issues*". In the experience of the team members, the affective domain has never previously been addressed so explicitly in CPD. Participants increased their understanding of the role of a growth mindset, sense-making, collaboration, inclusion, and personal resilience; they went away believing they could do things differently, for example, not saying 'I don't want to do this any more than you do' or 'I don't see the point of doing this either' but, instead, encouraging the attitude of 'let's find out'. The participants talked about the course being transformational in terms of what they were going to do with their own students. In particular, many said they were going to work at linking maths to values and experience because they had understood "*the importance of making maths meaningful; maths is not just abstract symbols on the board".*

Participants became aware of how patterns of behaviour such as avoidance and disruption may have developed as self-preservation habits and how mathematics anxiety can be transmitted in a vicious cycle from teacher to student [7, 11]. By the end of the training day, some of the participants were planning to talk explicitly with learners; *'I think acknowledging with learners that too often it is just pushed under the carpet and ignored but there might be ways that they are anxious or they don't like maths but they don't discuss it. I [now see] the importance of discussing with learners "why do you hate maths?", "what is it about it?", "what may make it better?" And giving the learner more say in it*." Other participants recognised the importance of teachers changing their own mindset and having a belief in their students, rather than hating maths and thinking 'I'm not going to be able to teach them'. Others were planning to adjust their teaching style: to ask more questions, and to invite learners to do the thinking for themselves with some support.

Some team members reported participants experiencing less anxiety and having changed their opinion about maths. *"I spoke to some people ... the ones teaching functional skills, the teachers who did not like teaching maths, the changes were noticeable with them".* For some participants, the transformation involved learning not to be scared of maths; participants experienced being supported to work through personal anxieties towards mathematics in a safe and collaborative environment and to develop elements of personal mathematical resilience and awareness of how to change their own affective response to mathematics. Others came to feel more confident, even more able in maths, and some began to enjoy maths for the first time.

4.5 Reflections

For the members of the team, the main emphasis in the work on mathematics resilience is on seeking a balance between using coaching approaches to challenge learners, allowing them to make mistakes, and explaining what they were doing, getting them to think things through but also to support that process and make learners aware that support is available.

Team members have agreed that working to support teachers who have weaker personal maths skills and who may suffer from maths anxiety themselves is in some ways easier to manage than teachers who have stronger maths skills and see themselves as good at maths, yet do not necessarily understand the need for alternative ways of helping learners to make progress in maths; *"getting more confident maths teachers to change from a tutor centred approach to a learner centred approach is the thing that I find most difficult to bring about*."

Team members have given development of mathematical resilience a high priority in their wider lives as CPD providers: "*For me ... it does not matter what maths CPD I am delivering, building maths resilience is going to be part of that course*."

5 THE WAY AHEAD

In this paper, we have identified that, while some FE teachers of mathematics are aware of the impact of the affective domain, many do not know how to respond effectively to learners' expressions of negativity in the classroom. The teachers feel helpless and negative when they encounter learner negativity towards maths and continue to 'carry on as before' or worse, they find themselves saying *"I don't like this any more than you do*." They persist with their role without a clear strategy for change, daily facing students' maths anxiety, avoidance, defiance and absenteeism from maths lessons.

Once teachers are given a way of reframing the problem, in terms that are within their control, most become more positive and agentic, at least in intention. Participants stated that they value and will implement strategies from the course such as using the expression 'not yet' in response to students saying 'I can't'. Other popular strategies include RAG rating tasks, developing learner agency, doing more listening and less telling, not jumping in too quickly to help learners, thinking in terms of previous harm, and understanding 'why people are anxious about the topic'. Some participants planned to make more opportunities to allow learners to develop and practice intuitive methods before introducing standard methods.

Many participants also stated that they would like to develop further coaching skills. We will develop a course to address this need.

We conclude that, in a one-day course:

- Teachers can develop awareness and understanding that mathematics anxiety is acquired, disabling and treatable.
- Teachers can begin to develop a new mindset about learners, the barriers they face and their potential.
- Teachers can develop knowledge and understanding about the impact of mathematics anxiety and student habits of self-preservation on progress with maths.
- Teachers can acquire tools and strategies which lead them from helplessness to positivity and agency in addressing negativity towards mathematics.

This is a preliminary evaluation of an intervention for teachers. We seek to know more about the extent to which the short-term impact and the intentions of the participants are carried forward into practice and what is the impact on learners. We are in the process of evaluating the longer term impact on both teachers and learners. We also seek to consider how best to advise leaders about change at institutional level in order to facilitate further transformation in developing understanding of how the affective domain influences learning.

We will continue to work towards developing a policy that enables any person who has been historically excluded from mathematics, mathematically shamed, or who has developed mathematical anxiety or avoidance in an attempt to protect themselves from further mathematical harm, to be entitled to re-inclusion, as either a teacher, a student or a member of the wider community who is involved in supporting learners. They should feel allowed to experience mathematics as ALIVE: accessible, linked to what is already known and understood, inclusive, valuable (personally as well as culturally) and engaging.

6 EPILOGUE: "WE HAVEN'T GOT TIME"

We think of developing mathematical resilience as releasing the *emotional handbrake* on mathematical progress for some learners. If that handbrake is not released, then progress is hampered and harm is caused, sometimes serious harm.

Steve was watching a teacher working with a few students using the ALIVE approach, when one student burst into tears. What upset her, as she explained during the break, was that she never '*got*' maths before. She asked "*why were these methods never taught to me at school? So I've suffered all*

this time, been put through all this misery. If it was done this way in the first place, it would've saved it all." So the course enables participants to develop a realisation that maths does not have to be TIRED and that learners have an entitlement to mathematical self-preservation, and to experience mathematics as ALIVE, being challenged with appropriate support and agency, even if that takes time.

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