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**Teaching Maths with Confidence: Insights
for Change, a Policy Document**

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Learns and The Maths Anxiety Trust

Overview

This report examines the experiences and attitudes of teachers and trainee teachers of mathematics in England, revealing key challenges and opportunities for policy reform. This research shows that trainee teachers' confidence is closely tied to prior qualifications, and many experience maths anxiety to differing degrees. Practising teachers report structural issues, such as excessive focus on assessment and compliance, as factors that contribute to burnout and hinder effective teaching. Despite these, teachers consistently valued subject-specific continuing professional development (CPD), wise mentorship, and leadership that supports professional autonomy and values conceptual understanding of mathematics. They emphasise their need for better pedagogical understanding to improve pupil engagement and outcomes. Policy recommendations to strengthen the quality of maths education include investing in specialist CPD and mentoring, addressing systemic school pressures, and improving recruitment and retention strategies.

Rationale

In 2022, the Learning Skills Research Foundation commissioned a YouGov poll to investigate a range of attitudes among teachers of mathematics. The online poll (YouGov 2022) included 283 teaching assistants, 608 primary teachers and 569 secondary teachers currently teaching mathematics. It found that significant numbers of teachers felt insufficiently trained to teach maths (44% of secondary, 17% of primary and 37% of teaching assistants), leading to over 20% in all groups confessing to experiencing maths anxiety in lessons, at least sometimes. In particular, many secondary teachers felt under-confident about their ability to explain maths (38%). (Detailed results are included in the Appendix.)

In response, two research projects were commissioned by the **Learning Skills Research Foundation**, working through the **Maths Anxiety Trust**, to explore possible reasons for the poll's findings. One project (by Fay Cosgrove and Zebedee Friedman) involved semi-structured interviews with six qualified teachers, selected so as to have a variety of teaching experience, all currently teaching maths in a variety of English secondary schools. The second project (by Rosalyn Hyde, Elizabeth Parr and Rachel Stenhouse) involved a survey of 295 pre-service (trainee) teachers, of whom a third were on undergraduate primary or early years courses, a third were on one year postgraduate (PGCE) primary/early years courses, and the final third were secondary (mathematics specialists on PGCE courses). All courses were leading to Qualified Teacher Status (QTS). The survey included some open response comment questions as well as multiple choice and short answer items, with a focus on discovering factors that might contribute to maths anxiety or maths teaching anxiety. It is the results of these two projects that this paper reports, alongside relevant evidence from other published sources.

Findings and Recommended Action

The following sections present a synthesis of findings from these two research projects, structured around the framework of the YouGov poll (YouGov, 2022). The poll explored key areas relevant to maths education policy, including teachers' personal histories with mathematics (maths qualifications), their preparedness to teach the subject, confidence in explaining maths, experiences of maths anxiety and maths teaching anxiety, and the impact of external pressures on their professional practice.

Personal History

We always come up against earlier events in later ones, not as matter that has been fully formed and pushed aside, but absolutely present and alive (Schlink, 1998 p.215).

Background

Attitudes to maths are heavily informed by personal history with maths. Emotion and learning are deeply interwoven in everyday maths classrooms where, from an early age, the process of being deemed correct or incorrect is rendered –a conspicuously public experience, and one which stays with learners throughout their lives (Ingleton and O'Regan 2002).

Some teachers begin their teaching career with a passion for maths, or gain it during training. Whiteford et al. (2021) found that among Australian undergraduates who expressed interest in becoming teachers, making a contribution to society and the love of maths were the top motivators for becoming a teacher. Andrews and Hatch (2010) agreed that people become teachers for mostly intrinsic reasons, for example, because of prior maths experiences, a desire to teach, or a happenstance life-event, adding that relatively few people become teachers for either entirely altruistic or extrinsic materialistic reasons. Indeed, Kandemir and Gur (2009) concluded that intrinsic motivation is more powerful than extrinsic motivation, listing attitudes towards maths and maths-beliefs as two of the four categories of strong intrinsic motivators.

Many of Hunt and Maloney's (2022) participants described negative associations with maths rooted in poor childhood experiences. Common themes included confusing instructional methods, negative teacher attitudes, unrealistic expectations, and male-favouring gender bias. Several participants recalled feeling pressured or humiliated at school, compounded by a lack of support at home. While Hunt and Maloney acknowledge the potential bias in retrospective accounts, their findings are echoed in other studies. For instance, Hobden and Mitchell (2011) found that pre-service primary teachers often viewed mathematics as hostile and adversarial, and described teachers as lacking subject knowledge, empathy, and professionalism. They also reported confusion in maths content and discontinuity in learning, further reinforcing the long-term emotional and cognitive impact of early maths experiences.

For some teachers, their negative maths-affect motivated them to become teachers of maths so that they could provide better experiences for their pupils. Those with a passion for maths were motivated to teach in order to pass that passion to others. These intrinsic factors are considered strongly motivational while extrinsic factors (such as job security or the needs of the school) are less effective, raising doubts about co-opting teachers of other subjects to teach maths. Reporting on out-of-field teaching, Ingersoll (2002), lays the blame with school management for too readily assigning teachers to out-of-field subjects, even in schools without teacher recruitment problems. Acknowledging the lack of new maths recruits which persists today, Cockcroft (1982) asserted that improvements in maths teaching would have to be as a result of the efforts of those already in post and that they must therefore be given all support possible. Sani (2019) addresses the complexities of retraining out-of-field teachers to teach maths, noting that when retrained, even experienced and senior teachers exhibit similar behaviours to novice teachers; thus highly qualified teachers may become highly *unqualified* if not well trained and supported. Regardless, Ofsted makes it clear that in schools that struggle to recruit or retain specialist maths teachers, there are weaknesses in the continuity of curriculum planning and in the teaching of problem solving (Ofsted 2023).

Findings

Responses from participants in the studies drawn upon here supported the findings of the above literature. One of the in-service teachers, George, gained his passion for maths while training as a primary teacher. Having been taught purely procedurally, he said that he was not even aware that maths was underpinned by meaningful concepts; "I didn't know that this sphere of knowledge was out there". Alan also demonstrated intrinsic motivation; "I just wanted people to have a better experience than what I had. Because I didn't enjoy it". Sukhy began with extrinsic motivations, saying she was attracted to maths because, "I knew it was a shortage subject; there was a bit of job security because of that", but she found intrinsic motivation for maths

after joining a working-group with local colleagues. Another of the interviewees, Teddy, described attending an interview for a PE teaching job in which he was asked about his second subject. Teddy felt that saying maths would give him the best chance of success because the job interviewer knew he was tutoring a child in the subject. During the research interview, Teddy added that he was disappointed by the level of support he had received, given that he was not trained to teach maths.

Likewise, the qualitative data from the pre-service teacher survey suggested prospective teachers have had similar experiences, adversely impacting their maths-affect. Participants commented;

“The reason I did not take A-Level maths was due to a bad experience with a teacher, otherwise, I would have taken it and was predicted to achieve highly,”

and,

“I hadn’t been taught maths properly in years 3-4 because we didn’t have a proper class teacher and this effected [sic] my confidence and ability”.

One pre-service teacher said,

“I flew through primary and secondary mathematics. It was only when I got to A-level that the struggles started due to lack of teaching. Teachers wanted to teach the lower years and left the sixth formers to teach themselves from the text book”.

These contributions further underscore, not only maths’ lasting emotional-cognitive impacts, but the importance of teacher availability and teaching quality.

To recap, many in-service and pre-service teachers reported negative personal experiences with mathematics which heavily impacted their attitudes to maths. Some of these as a result felt motivated to provide better experiences for their pupils. Some participants exhibited intrinsic motivation for teaching maths because of a passion for the subject. In contrast, some practising teachers said they taught maths mainly for extrinsic reasons, such as the needs of the school or because of perceived job security; when these teachers were ~~are~~ non-specialists, they felt they needed specific support and retraining.

Recommended Actions



- ACTION: Promote positive maths experiences across all age groups to foster greater enthusiasm for maths, build confidence, improve well being, and thus increase the availability of intrinsically motivated new teachers.
- ACTION: Using non-specialists at secondary level is sub-optimal, but thoughtful school-based recruitment, support, investment and retraining can create effective new specialists for both secondary and primary phases.

Preparedness

‘Some people I’ve encountered in various phases of my career seem more certain about everything than I am about anything.’ (Rubin and Weisburg, 2003).

Background

Effective teaching is a complex process, and, while routes to qualification are diversifying, many teachers still obtain qualified status in a relatively short time-frame, compared with other similarly complex professions (Lester 2009). The justification is that these applicants are graduates and are presumed to have a solid foundation in mathematics or the capacity to quickly develop one (Norton 2010). In fact, the learning curve for new teachers is steep. Since the 1980s, it has been recognised that teachers must understand, not just the subject (content knowledge) and how to teach (pedagogical knowledge), but also the intricacies of how to

teach a specific subject (pedagogical content knowledge) (Shulman 1986). It is well-established that teachers must also become self-improving professionals (Schon 1983). All teachers must present learning opportunities appropriate to a learner's level of cognitive development and teachers of maths have an additional element of complexity; maths is a highly hierarchical (and networked) domain, so the sequencing of learning is of considerable importance (Rowland et al. 2008). Frameworks for effective teaching of maths, such as The Knowledge Quartet (Rowland et al. 2008), incorporate the challenge of sequencing (part of the 'Connection' dimension) as well as 'Contingency' (the ability of a teacher to respond dynamically and capitalise on unexpected contributions). For all these reasons, preparing new maths teachers (through ITE and CPD) is not a trivial task. It is not surprising that some teachers do not always feel adequately prepared, but this uncertainty is not always given the attention it deserves.

According to Boyland et al. (2024), teachers are dissatisfied with management's insufficient prioritisation of maths-specific CPD, with leaders emphasising generic pedagogy and initiatives rather than subject-specific input, especially for Early Career Teachers (ECTs). They claim there are notable gaps in availability of maths CPD, particularly collaborative types and those concerning subject-focused coaching and maths metacognition. Regarding pedagogy, they found an absence of CPD opportunities for the teaching of problem solving and the use of representations. ECTs in particular, bemoan the lack of support and mentorship opportunities within the CPD they are offered, making coping with classroom and subject matter challenges difficult (Hobson et al., 2009).

Joubert et al. (2008) investigated CPD that maths teachers find effective: direct classroom relevance, inspirational leaders, opportunities for collaboration and a level of challenge were all considered important for teacher learning. Increased confidence and acquisition of new skills were linked to change in teacher attitudes and classroom practice. Evans et al. (2014) compared the usefulness of feedback given to maths teachers following lesson observations performed by specialists and non-specialists. They found that feedback from specialists was considerably more useful than that from non-specialists.

Findings

The pre-service teacher survey (conducted at the mid-point of ITE courses) showed that those preparing to teach secondary maths rated themselves more prepared to teach than those training to teach in the primary phase (where teachers teach all subjects), perhaps due to secondary pre-service teachers' higher maths qualifications. It also found pre-service teachers were generally positive about their training, aware of the need to learn more, and confident they would do so. Those who had had negative past experiences with maths were more aware of the impact poor teaching has on learners, and felt less prepared. These results were not consistent with those in the YouGov survey which was the trigger for this research, where among a large sample, secondary teachers were less satisfied with their preparation for teaching maths than primary teachers. It is not clear why this inconsistency arises, possibly because all the pre-service secondary teachers in this sample were on specialist courses to teach maths.

Views varied among the in-service interviewees, on how well ITE had prepared them. Alan and George felt quite well-prepared for teaching maths due to the quality of their ITE (particularly maths-specific philosophy and pedagogy, and inspiring educators) and self-sourced CPD. Although Alan added that generic skills were prioritised over maths-specific skills, such as identifying misconceptions. Sarah and Sukhy were less positive about their ITE/CPD. While finding her ITE supportive, Sarah did not believe it had adequately prepared her with the right content for teaching secondary maths; she believed that CPD should prioritise effective pedagogical strategies for deeper understanding of maths concepts, echoing some of Alan and George's observations. Like Sarah, Sukhy felt too much time was given to procedural A-Level content. She advocated for longer periods of training, having found her own training to be rather a "sink or swim" experience which had not prepared her for the complexities of teaching maths. All four had spent considerable time sourcing their own maths-focused CPD, and it was these experiences that they felt were most influential in making them better teachers.

Despite struggling with behaviour management as an Early Career Teacher (ECT), Hannah felt that she was at least somewhat prepared to teach maths as long as it was in her Teach First school where pupil attainment in

maths was limited to lower GCSE grades. Having previously benefited from consistent, high-quality in-school support, she felt abandoned when her mentor left and was not replaced by someone of the same calibre. Teddy, who undertook a non-maths PGCE and who received no maths-CPD, rated himself quite well prepared to teach KS3 due to his own knowledge of maths. Teddy was seeking more access to a maths-teaching mentor, though finding that time poverty was a barrier to this type of CPD. The mentorship both of the ECTs were seeking, would have bi-directional benefit, provided the most appropriate teachers were involved, increasing the effectiveness of both mentor and mentee (Coates 2012).

To summarise, in contrast to the earlier YouGov poll of practising teachers, secondary pre-service teachers felt more prepared than their primary counterparts. Teachers from both projects wanted to feel well-prepared and sought high quality, subject-specific ITE and CPD, including some self-sourcing their CPD, despite their time poverty.

Recommended Actions



- ACTION: Provide Early Career Teachers (ECTs) with effective mentoring from high quality role models
- ACTION: A high proportion of primary ITE and both primary and secondary CPD to be maths specific, including monitoring and scrutiny conducted by subject specialists.
- ACTION: Recognise and support teachers who pursue and implement their own subject-specific CPD

Explaining Maths

‘Learning is more a reaching out than a taking in. It is participation... Activity and identity are inseparable from ... knowledge’ (Davis et al., (2000).

Background

Mathematics teaching has already been acknowledged to be a complex process, largely because learners do not simply receive and store information (the ‘Banking Model’ of education, Freire 1978), they actively reconstruct it for themselves (Piaget 1962, Bruner 1974, Freire 1978, Vygotsky 1978). Sequencing learning correctly is so important because as learners reconstruct knowledge, they build on what they already know. Piaget and Cook (1952) use the concept of ‘schemas’ (or ‘schemata’); mental structures into which new information may be assimilated. Vygotsky suggested the notion of a ‘Zone of Proximal Development’ (ZPD) as:

“The distance between the actual developmental level [of a learner] as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers.” (Vygotsky 1978 p. 86)

Bruner (1974) suggested that this active reconstruction of knowledge takes place through three, “hierarchical but complementary modes of representation” (Rowland 2009, p. 42); enactive, iconic, and symbolic. His work inspired the pedagogical approach known as Concrete-Pictorial-Abstract (CPA, Leong et al. 2015) in which mathematical concepts are learned through physical, manipulable objects (e.g. counters, teddy bears, beads, toy cars, etc.). As the concept is refined and internalised, a pictorial representation (e.g. photograph or simplified diagram) suffices for further learning until eventually abstract symbols, numerals or letters can be understood and used (e.g. 5, 0, =, x).

Understanding and using learners’ misconceptions is also crucial to being able to explain maths. Given that learners actively reconstruct understanding as they learn, it is of no surprise that they sometimes build misconceptions into their knowledge: a misconception is not an error but a concept in embryo or a partial truth, a logical natural step in conceptual development (Swan 2002). For example, a learner might erroneously think that 0.625 is greater than 0.9 because they see three digits, and know that among whole numbers, a three digit integer digits guarantee the number is greater than a single digit number. When a misconception

like this comes to light, the teacher may judge that it is within the learner's ZPD to adjust (and improve) their schema, thus misconceptions can be exploited, rather than avoided, to build new learning (Vygotsky, 1978, EEF 2017). Since misconceptions are often common to multiple learners, they should be discussed in teaching (Askew and Wiliam, 1995). Indeed, children need to know that misconceptions are a normal part of learning (Dowker and Kaufmann 2009);

"... teachers must work hard to break the myth of effortless achievement, pointing out that all high achievers have worked hard and failed often, even those thought of as geniuses," (Boaler, 2016 in Hansen, 2020).

This is another aspect of the teaching of maths in which teachers need to make contingency decisions; deviating from the lesson plan or prepared resources in order to respond to the learners' contribution.

Findings

Whilst not specifically asked, some pre-service teachers expressed frustration about explaining maths by describing a perceived gap between theoretical training and classroom application. They said, "we have been taught theory behind the subject knowledge, but not how to apply this in real teaching practice," and, "as someone who is not maths-confident, it's difficult to transfer the skills we've been taught to a real lesson". More specifically, one pre-service teacher commented, "we had some initial training on ... concrete, pictorial and abstract methods however more ... real-life examples [were needed]". They also reflected on the challenge of preparedness in contingency moments, saying, "all classes are different and different pupils bring different challenges so you can never prepare for all situations," and another, "there could always be misconceptions you haven't thought about". One participant thought,

"each learner ... has unique existing schema - I feel I am getting prepared for adapting my teaching to that uniqueness, but there always remain "unknown unknowns" where you can't anticipate the ... misconceptions that they will hold".

Teachers evaluated their ability to explain maths against a background of (a greater or lesser degree of) understanding how challenging it is. The four mid- and late-career in-service teachers (Sukhy, George, Alan and Sarah) emphasised the need for teachers to have deep conceptual understanding of maths in order to explain it to others. Sukhy suggested that both published resources and ITE should emphasise conceptual understanding rather than procedural knowledge. When mentoring other maths teachers, George said his focus was, "Can they actually articulate the concept?" He suggested that ITE should focus on developing strong communication skills and conceptual understanding, claiming, "Even the most abstract maths can be put into a concrete example". He also noted the importance of understanding and addressing misconceptions. George speculated that, in his experience, the current ITE courses often lack maths specialists, which results in a delivery of broad skills rather than specific, maths-focused training. Sarah commented that many teachers, particularly those in their 20s, can demonstrate procedures but struggle to explain them conceptually. She expressed concerns about newer pedagogical approaches, particularly criticising the "silent teacher" approach, which she felt hindered student and pupil engagement and understanding.

Alan, a primary-trained teacher employed in secondary education, valued the power of Assessment for Learning (AfL) in understanding how a pupil is actively constructing their understanding. He referenced Bruner's (1974) work asserting that teachers need to be able to move in both directions through the stages (enactive, iconic, and symbolic) within individual maths concepts. He also mentioned Skemp's (1976) theory about relational and instrumental understanding. (Skemp defined relational understanding as 'knowing what to do and why' and instrumental understanding 'rules without reasons'). For Alan, this was why conceptual teaching is so important. He also referenced Freire's philosophy of education as dialogue, which promotes the elimination of hierarchy between teachers and students and emphasising reciprocal teaching and learning, in stark contrast to the silent teacher approach condemned by Sarah. Alan's views were in agreement with those of the other interviewees that CPD should focus on these conceptual issues, in order to improve teachers' ability to explain maths.

Both of the early career interviewees felt they lacked mastery in some aspects of maths. They expressed a need for CPD that was focused on maths pedagogy. They gave examples of engaging more with maths-specific content and pedagogy, being able to experiment with different approaches in class and having time to observe more experienced colleagues.

To summarise, some pre-service teachers reported a lack of mastery of specific areas (especially multiplication in the case of primary trainees), difficulty in applying theory to practice, and a lack of confidence dealing with unexpected questions or misconceptions. Some reflected thoughtfully on the challenges and complexities of teaching maths well. Some experienced practising teachers emphasised the importance of conceptual understanding (as opposed to procedural knowledge) and effective explanation of maths, valuing insights from theory and empirical research relating to teaching and learning maths.

Recommended Actions



- ACTION: Promote conceptual understanding of maths in published resources, as well as in ITE and CPD.
- ACTION: Subject specialists within schools or groups of schools should be empowered to promote thoughtful experimentation and school-based research, using exploration, active learning, articulation, careful sequencing, and using misconceptions for learning.

Maths Anxiety & Maths Teaching Anxiety

“The first advice most teachers are given is to establish good relationships with students but establishing a good relationship with maths is vital to be an effective maths teacher.” (Hackett, 2023).

Background

Maths anxiety (MA) is an “uncontrollable feeling of tension and anxiety which affects cognition and disables people from being able to manipulate numbers or solve mathematical problems,” while they are doing maths for their own purposes (Skyrme and Hunt 2022, p.3). Much more than a dislike of maths, MA prevents those who experience it from demonstrating what they know (Beilock et al. 2010) because it consumes cognitive resources needed for doing maths (Hembree 1990, Ashcraft 2002), such as working memory (Van der Ven et al. 2023). Sloan (2010) found that negative school experience, low achievement in mathematics, test anxiety, lack of confidence, negative attitudes, and an inadequate mathematics background due to maths-avoidance all contribute to increasing the average risk of MA. MA can take the form of a stable aspect of self-image, not changing much over time (trait MA) or be fleeting and highly context-dependent (state MA) (Miller and Bichsel 2004). Trait MA leads to avoidance of maths which can then impact fluency and learning of new mathematical skills (Buckley et al. 2016).

MA in pupils may be unintentionally reinforced in the classroom, particularly if the teacher experiences MA themselves. This can form a cycle in which maths-anxious pupils become teachers and reinforce MA in their own pupils (Bekdemir 2010; Brady & Bowd 2005). MA is common among primary teachers and pre-service teachers where it can hinder pupils’ mathematical development (Schaeffer et al. 2020). It is often rooted in negative learning experiences (Skyrme & Hunt, 2022) such as competitive environments, traditional teaching methods, and pressured assessment practices (Whyte & Anthony, 2012). With higher teacher MA linked to reduced student achievement, maths-anxious teachers may lower their expectations, emphasise rote learning over understanding (Ramirez et al., 2018), miss spontaneous teaching opportunities (Skyrme & Hunt, 2022), and spend less time on maths instruction (Galeano et al., 2024) than their non-anxious counterparts. Thus, students may internalise teachers’ implicit attitudes toward maths (Ramirez et al., 2018). Additionally, maths-anxious pre-service teachers may not see the merit in developing conceptual mathematical understanding (Stoehr and Olson 2023).

Maths teaching anxiety (MTA) is a related but distinct construct defined by Peker (2009) as tension and anxiety surrounding the teaching of maths to others. MTA can be split into ‘self-directed’ and ‘pupil-directed’ MTA and an individual can experience MA only, MTA only or both types together (Hunt and Sari 2019). Bosica (2022) identified a significant correlation between MA and MTA, though earlier studies (Brown et al., 2011; Hadley & Dorward, 2011) suggest this link is not consistent. MTA can have both physical and cognitive effects on trainee teachers (Peker, 2009), with concerning implications for pupils: higher MTA is associated with lower achievement and reliance on traditional teaching methods (Hadley & Dorward, 2011). Syuhada and Retnawati (2020) found that MTA in novice teachers stems from internal factors, such as insufficient pedagogical competence, and external challenges such as strategy selection and classroom management.

Teacher beliefs about ability also impact pupil achievement. According to Dweck’s (2008) influential work on maths and science mind-sets, pupils with a growth mind-set (believing that ability can be developed) are more likely to outperform those with a fixed mind-set (believing that ability is innate and fixed). Dweck says teachers play a key role in forming pupil mind-sets and interventions to change pupil mind-sets can increase achievement and reduce disparities for women and minorities. She adds that teachers who have a growth mind-set are most likely to produce well-attaining pupils with growth mind-sets compared with teachers with fixed mind-sets. It follows logically that teachers with growth mind-sets are more likely to self-improve and capitalise on contingency moments, encouraging growth mind-sets in pupils. Maths-specific CPD and peer support can encourage this.

Findings

Figures 1 and 2 show pre-service teachers’ results for MA (single-item 10 point scale) and MTA (Mathematics Teaching Anxiety Scale, Hunt and Sari, 2019).

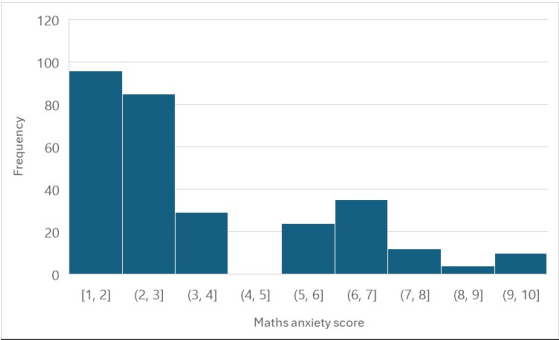


Figure 1: Distribution of MA scores for all pre-service teacherspre-service teachers

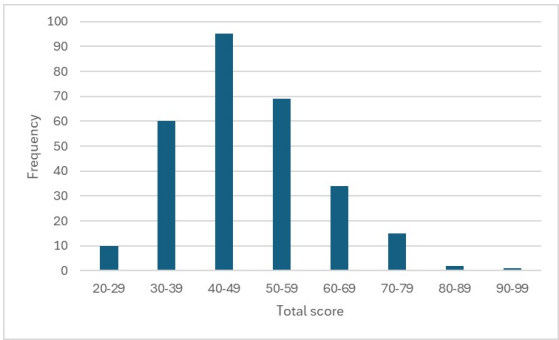


Figure 2: Distribution of total MTA scores for pre-service teachers

Hyde et al. (2025, p.8) (Higher scores indicate higher levels of anxiety)

Overall, primary pre-service teachers had higher levels of both MA and MTA than secondary pre-service teachers, though the latter did commonly express concerns on some pupil-centred MTA variables. Female pre-service teachers reported significantly more MA and MTA compared to their male counterparts. Age was not found to be correlated with MA or MTA. Having an A-Level in maths was associated with lower levels of MTA compared with GCSE maths only but qualifications above A-Level were not associated with any further reduction.

Some pre-service teachers indicated that they held fixed mind-sets about maths, commenting, “I find mathematics naturally just makes sense to me,” and,

“I was a growing boy with lots of other interests and occupations that came before studying. I relied on my natural mathematics acumen to get me by,”

Not all respondents felt this way though; one who ascribed the view to teachers in general (but not to themselves), said,

“I am not entirely bad at mathematics but I believe had I been given more support, and there was a better attitude surrounding [giving support], instead of favouring those who had natural ability in the subject, [I would have done better]”.

The in-service teachers of maths, Alan and Hannah, reflected that one type of anxiety can eclipse another, asserting that until behaviour management skills are well established, some teachers do not notice maths-related anxieties. Hannah was also aware that her explanations of maths concepts could easily ‘unravel’ when she felt her pedagogical content knowledge to be lacking. Similarly, Teddy, while confident about his own ability to ‘do’ maths (content knowledge), was somewhat anxious about the performative element of teaching. He was aware that pupils expect him not to make mistakes, expressing concerns about making more mistakes than could be dealt with light-heartedly. Alan commented that departments need to establish a culture of peer support but that teacher time poverty was sometimes a barrier to teacher peer discussion.

To summarise, amongst pre-service teachers, higher-level maths qualifications were linked to lower MA, which in turn correlated positively with MTA. Primary pre-service teachers and female pre-service teachers reported more of both types of anxiety than their secondary and male counterparts, though even secondary maths specialists were not immune to MA or MTA. Some pre-service teachers held fixed mind-sets, believing maths ability is innate. Some less experienced in-service teachers seemed to focus more on their own role than on the pupils, which may be indicative of underlying MTA. Peer support, formal or informal, was widely valued, especially by those seeking to address MA or MTA. Given the impact on pupil attitudes to maths that teachers with high MA or MTA can have, the following actions are recommended.

Recommended Actions



- ACTION: Ensure that maths subject-specialists and ITE providers are aware of MA, MTA, and mind-set research and promote an open and supportive culture in which such issues can be discussed.
- ACTION: Encourage and protect time for peer interactions amongst teachers.
- ACTION: Since maths specialists are hard to recruit, prioritise investment in maths-specific CPD, both at school level and more generally, including using peer discussions.
- ACTION: Offer targeted intervention at an early stage to pre-service teachers who experience MA or MTA to address their anxiety, especially those training to teach at primary level.

External Pressures

‘Teaching is not what it used to be ... The curriculum may have a reassuring familiarity, but its value is now measured less in intrinsic terms than as a proxy for a school’s or a teacher’s effectiveness’ (Galton, 2008 p. 39).

Background

As with other professions, teaching is subject to a range of pressures imposed from outside the classroom. Goldstein (2007) termed pressures imposed by powers within the education sector, ‘shovedown’. Teacher perception is that policy makers no longer trust their ability to make professional judgements (Galton 2008). Yet governments respond with, “greater containment, stricter testing regimes, and ever increasing pressure on teachers to ‘raise standards’ (Galton 2008 p.40). Thus, reforms tend to be mandated rather than consulted on and piloted before they are imposed (Galton 2008). Goddard (2000) asserted that teachers feel ‘under siege’ and that outsiders do not understand their professional lives. Mortimore (2013) cites preparation for high-stakes testing, the mistrust and de-professionalisation of teachers, and the focus on politically motivated accountability as diverting precious time and effort from holistic, child-centred, and authentic equitable education. Galton (2008) lists reform agendas, inclusion policies, accountability procedures and parental pressure as additional pressures on teachers. Even teachers whose pupils are too young for standardised tests; feel pressure to teach in ways which are conducive to the school’s targeted test achievement rather than use developmentally appropriate practices (Tran 2024).

These pressures take a toll:

“The more teachers perceive that school administration thwarts their autonomy by imposing pressures on them, the less [they have intrinsic] motivation for teaching, the more they become controlling in their [pedagogy], and the more students demonstrate a controlled motivation orientation” (Pelletier and Sharp 2009 p.174).

In addition to this impact on motivation and pedagogy, teachers begin to reluctantly set boundaries in efforts to limit the invasive effects of external pressures, yet they feel unable to separate themselves entirely from the expectations set by others (Tran 2024). Similarly, Galton (2008) reports teachers as outspokenly complaining about policy, pressure and de-professionalisation yet dutifully accepting the inevitability of the situation. Living under intensified pressures leads to stress, not only because of an unsustainable workload, but also due to the frustration of feeling depleted, with too few resources left to teach well after meeting external demands. Policy makers and managers should not rest easy though, Galton adds that this shoveldown, “often expresses itself simply in resentful resignation” (Galton 2008 p.41).

Pre-service teachers experience this academic shoveldown too. Rose and Rogers’ (2011) participants, who were on their final ITE teaching practice, identified a range of influences pressuring them to teach a more formalised curriculum than that which they prepared for in university. They reported that, even in early years settings, pre-service teachers experienced cognitive dissonance between the play-based, developmentally appropriate approach they felt they should use (which is demanded in legislation) and the reality of pedagogic practice in real classrooms.

Findings

In-service teachers discussed the negative impact of time poverty on teaching maths. Alan lamented the balance of teaching time and preparation time and his unsustainable teaching load. George also reflected on workload, accusing schools of a ‘factory mentality’ in which teachers are worked to the point of burn-out and then moved on. Hannah (an ECT) also suffered from departmental disruption due to staff turnover, resulting in a stream of new initiatives introduced by new managers, leading to a lack of ‘buy in’ from teachers. She also found that her school lacked commitment to mentor her effectively as staff resigned. Sarah observed a disparity between the English department, which was better provided with both teachers and pupil contact time, compared with the maths department. Sukhy explained that time poverty, combined with management’s expectation of over-adherence to schemes of work, led to a discrepancy between the intended curriculum and the enacted curriculum. For Teddy, the time demands of teaching in two different departments may have met the needs of the school, but led to problems with expectations and communication between departments. According to Teddy, the absence of maths CPD meant that his maths teaching was not developing.

George, Sarah, and Sukhy all commented on structural barriers created by school management. George and Sukhy both complained that expectations regarding compliance and consistency were over inflated and counterproductive, with George asserting, “I’m a massive believer in consistency but I don’t believe in uniformity”. Sukhy felt that there is an assumption in the field of education that only pupils, not teachers, might be neurodiverse obstructed her ability to teach well. Hannah and Teddy were both cognisant that management pressure to improve GCSE grades was not always conducive to increasing the quality of teaching. Sarah noted that similar pressure put on primary colleagues had led to the over-use of traditional approaches to calculation, evident to her as pupils joined secondary education. She also lamented the disparity she had experienced between management attitudes to the whole school responsibility for literacy (a frequent whole school focus) compared with the whole school responsibility for numeracy, which was never mentioned. Finally, Teddy and Sukhy pointed to the acceptance of poor maths skills in wider society, manifesting in unhelpfully low pupil expectations and comments from parents and even some teachers.

Data regarding external pressures was not collected as part of the pre-service teacher survey.

In summary, all of the external pressures reported by in-service teachers were considered detrimental to effective teaching.¹ The pressures discussed were: time poverty, influence of management, staff turnover, preferential resourcing of some departments over others, and expectations regarding working across multiple departments. They considered the quality and generalist focus of ITE, ECT support and CPD to be a negative external pressure. They also cited structural barriers such as over-insistence on compliance and consistency and societal attitudes to maths. Some pre-service and in-service teachers also reported that misunderstood neurodiversity impacted on their experiences of maths and their ability to teach it.

Recommended Actions



- ACTION: In order to avoid superficiality, ITE and CPD needs expert delivery from subject-specialists.
- ACTION: Allow more non-structured time for teachers, to improve teaching, to improve retention and recruitment, and to support personal well-being.
- ACTION: Cut the number of generic school-based initiatives to allow teachers to focus their time on subject teaching improvement.
- ACTION: Resource subject departments (in both primary and secondary) equitably.
- ACTION: Offer neurodiverse teachers the flexibility which is increasingly offered to neurodiverse pupils.

Conclusion

These findings underscore the critical interdependence of teacher confidence, subject-focus and quality in training, and systemic support structures in fostering effective mathematics education. Issues such as maths anxiety and maths teaching anxiety, and systemic barriers such as excessive compliance and workload pressures, significantly impede pedagogical efficacy and teacher job satisfaction. To address these challenges, targeted policy interventions are needed. These should encompass: enhancement of subject-specific training, cultivation of supportive classroom cultures, and the reform of recruitment and retention strategies to prioritise subject-specific pedagogical expertise and ongoing support. Only through an holistic and sustained strategy, including at societal level, can the educational system effectively bolster teachers' confidence and capacity, thereby advancing the quality of mathematics education and fostering positive attitudes towards the subject among both educators and pupils.

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Appendix A

Summary of data from Survey of Maths Anxiety among 1593 teachers conducted for the Maths Anxiety Trust by YouGov, June 2022

‘For the following questions, by "**Maths Anxiety**", we mean a negative emotional reaction to mathematics, leading to varying degrees of helplessness, panic and mental disorganisation that arises among some people. when faced with a mathematical problem.’

	Primary	Sec math	TAs
<i>No in sample (including small numbers not teaching maths)</i>	617	676	300
TEACHING QUALIFICATIONS (whole sample only)			
TA 1-4 quals (only) *	4 (1%)	4 (1%)	141 (50%)
BEd*	197 (32%)	50 (7%)	17 (6%)
PGCE*	284 (46%)	499 (74%)	21 (7%)
Teach First*	3 (0.5%)	8 (1%)	0 (0%)
Other*	121 (20%)	108 (16%)	79 (26%)
<i>Nos in sample (removing those not teaching math)</i>	608	569	283
EXPERIENCE MATH ANXIETY IN LESSONS			
<i>Always</i>	6 (1%)	16 (3%)	9 (3%)
<i>Always/Often</i>	28 (5%)	40 (7%)	21 (7%)
<i>Always/Often/Sometimes</i>	143 (24%)	116 (20%)	91 (32%)
Rarely/Never	458 (75%)	451 (79%)	188 (67%)
CONFIDENT IN MATH KNOWLEDGE&UNDERSTANDING**			
Not at all confident**	9 (0%)	45 (0%)	15 (0%)
Not very/Not at all confident**	63 (9%)	187 (14%)	81 (23%)
Very/Fairly confident **	548 (90%)	478 (84%)	213 (75%)
CONFIDENT IN ABILITY TO EXPLAIN MATHS			
Not at all confident	9 (1%)	69 (12%)	13 (5%)
Not very/Not at all confident	57 (9%)	218 (38%)	81 (29%)
Very/Fairly confident	545 (90%)	338 (59%)	195 (69%)

	Primary	Sec math	TAs
SUFFICIENTLY TRAINED TO TEACH MATHS?			
Strongly disagree	22 (4%)	129 (23%)	18 (6%)
Disagree/Strongly disagree	101 (17%)	250 (44%)	91 (32%)
Agree/Strongly agree	402 (66%)	208 (37%)	105 (37%)
EXTERNAL PRESSURES IMPACT MY ABILITY TO TEACH MATHS EFFECTIVELY			
Strongly agree	110 (18)	38 (7%)	25 (9%)
Agree/Strongly agree	327 (54%)	127 (22%)	106 (37%)
Disagree/Strongly disagree	127 (21%)	203 (36%)	68 (24%)

*Calculated for whole sample as not possible to divide into primary and secondary in sample of only those teaching maths

** Data available for whole sample only, not just those who teach maths. 'Best case' percentage data quoted eg assume that all of those in poll but not teaching maths are among the least confident. This is likely to slightly understate the percentages who are less confident among those teaching maths.

*Summary of data on degree of agreement as to whether training on teaching maths was sufficient, by type of teaching qualification**

<i>Teaching qualification</i>	<i>Strongly disagree</i>	<i>Disagree/strongly disagree</i>	<i>Agree/strongly agree</i>
TA 1-4 quals (only) *	7 (5%)	45 (31%)	56 (38%)
BEd*	7 (3%)	43 (17%)	158 (64%)
PGCE*	117 (16%)	245 (34%)	357 (50%)
Other*	31 (11%)	90 (31%)	126 (44%)

(Numbers were too small to report data for Teach First, though of the small number there was a very high degree of disagreement/strong disagreement that training was sufficient)