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Teachers' perceptions and experiences of Maths Anxiety. The impact of engaging with Maths Recovery CPD on Teachers Maths Anxiety and confidence in teaching maths.

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Abstract

The purpose of this research paper was to look at Teachers' perceptions and experiences of Maths Anxiety. Whilst also looking at the impact of engaging with Maths Recovery CPD on Teachers Maths Anxiety and confidence in teaching Maths.

Maths Anxiety is described as a negative emotional responses to mathematics, with individuals' responses varying from mild to debilitating effects.

Much research has been undertaken on pupils who experience Maths Anxiety. However, in my role as an advisory teacher, it became apparent that there is little research to draw upon in terms of teachers who experience Maths Anxiety.

This was investigated using qualitative, action research focusing on exploring views and practices, collecting, and analysing data, providing a better understanding of the research question. Methods used to investigate this consisted of pre and post questionnaires including a Maths Anxiety scale, undertaken with seventy participants. Additionally, semi-structured interviews were conducted with ten of these participants looking more in depth at their experiences of Maths Anxiety.

The Maths Anxiety scale showed that in all areas of Mathematics, every participant experienced some level of Maths Anxiety. Higher levels of Maths Anxiety were found in relation to money, time, algebra and mental addition. Regarding the Maths Recovery CPD a positive impact was shown. Post course evaluations showed the percentage had rose of teachers that were now extremely confident in planning and delivering effective learning and teaching in Numeracy and mathematics. Confidence in delivering all Maths Domains covered in the CPD rose, specifically in Number Words & Numerals, Structuring numbers 1 to 20 and Conceptual Place Value.

A six-phase thematic analytic process was followed when analysing data from the semi- structured interviews. Identifying five themes: Emotions, Maths Anxiety, Relationships, Training & Resources and Settings that influenced the participants experiences of Maths Anxiety.

In conclusion, accessing effective teacher CPD, such as Maths Recovery, alongside supportive Maths communities need to be available for teachers experiencing Maths Anxiety and developing their confidence in teaching Mathematics. As an advisory teacher, this research has helped me to understand what support and training needs to be developed and offered to all schools.

Chapter 1 The research context

Current roles

My current role is an advisory teacher within a central support service for a local authority in the Northwest of England. This service is available to both maintained and academy schools who buy our services to support pupils with SEND. As part of our current package, we offer support on general learning; literacy, numeracy & social, emotional, mental health (SEMH) provision for primary & secondary pupils. Part of my role is to lead on and coordinate maths training, including Maths Recovery, and intervention to schools that have referred into our service. As well as teaching this also includes planning & delivering training courses, both central & bespoke, for teachers and teaching assistants as well as developing maths projects within individual schools. This is in order to support schools in fulfilling the rights of all children and young people allowing them to receive an education making the progress needed so that they can reach their potential, developing confident individuals that lead fulfilling lives. (NASEN Summary COP). In addition to this I am also a trustee for a charitable, non-profit organisation, Maths Recovery UK and Ireland. Providing professional development for teachers to help them prepare and approach maths instruction with confidence. Emphasising assessment, observation, pedagogy as well as increasing pupils' knowledge, attainment and self-confidence in maths.

Maths Recovery

Maths Recovery is a well-established, ongoing, research-based training programme and intervention course. It was developed by Professor Robert Wright at Southern Cross University, New South Wales in Australia in the 1990s. It uses a constructivist approach which is inquiry-based teaching. Construction is about building something. Inquiry based teaching is a constructivist approach to learning, a view that believes learning occurs when participants are able to take ownership of the ideas they are building. Constructivist approaches to learning consider the learner to be an active builder of ideas. They are not passive, in terms of being given information to be recalled, but the learners are encouraged to reflect on their own learning by being given problems to solve. In this process mistakes and reflections made develop stronger connections and new learning occurs. In new learning situations the learner can use what they already know, adapt and reuse skills developing a new understanding.

Maths Recovery provides a series of specialist courses to develop teachers' confidence and skills in teaching maths either as an intervention or whole class approaches. The courses give guidance and support using Maths Recovery strategies and resources, developing a high level of expertise in Pedagogy. Further research has been completed on the effectiveness of this training in terms of developing teacher constructs and the positive outcome of changing their teaching practices, Ruth Willey (2009). Other research has also been completed in terms of

the positive impact of the Maths Recovery 1 to 1 teaching programme, Joanna Gibbs (2015).

National and Local Guidance

However, despite national and local guidance schools are increasingly asking for support. From the work that I have undertaken within my role, working with both teachers and pupils it is becoming more apparent that there may be other factors at play that are affecting pupils' acquisition of numeracy skills. In order to fully understand barriers to learning such as maths difficulties and dyscalculia, I undertook a post graduate certificate and diploma with the view to developing the package of support offered to schools. During the course of my study and being reflective on my own practice and that which had been observed in schools has supported the view that there are other factors at play such as Maths Anxiety. Alongside pupils' engagement in numeracy intervention and progress, I began to realise that Maths Anxiety can play a huge part and want to research the understanding of teachers in individual settings of Maths Anxiety and how this affects their choice and delivery of different maths interventions.

Local Authority Audit

From an initial audit undertaken of staff knowledge in schools last year around dyscalculia & Maths difficulties it was found that the majority of staff in schools did not feel confident in this area. As a result of this, training has been devised and rolled out to schools. This included identifying programs of support, resources and technology that could be used to aid pupil progress. Now that this is in place and there is more understanding in this area it can be built upon to address other barriers to learning such as Maths Anxiety.

Maths Anxiety

Maths Anxiety was first referred to as 'Mathemaphobia' (Gough, 1954) and this was the beginning of the research into Maths Anxiety, further research followed which resulted in the first Maths Anxiety scale being developed by Richardson and Suinn (1972). This has been developed further by research into Maths Anxiety definitions, its effect and general strategies that can be used to alleviate this in the classroom such as mindfulness, deep breathing exercises and reappraisal of emotions. There has been a range of research undertaken to suggest that Maths Anxiety is a 'phenomenon that is a highly prevalent problem among students from elementary schools to universities' as cited by (Betz, 1978; Ma and Xu, 2004; Rodarte-Luna and Sherry, 2008; Jain and Dowson, 2009; Gunderson et al., 2018). These studies either looked at maths anxiety or maths performance but not directly focused on the Maths Anxiety and performance link.

However, with this in mind, it is imperative to conduct further research in exploring the understanding and experience of teachers in individual settings, of Maths

Anxiety. The transmission of anxiety from teachers to pupils and looking at whether particular maths interventions can be used to support teachers and pupils alike.

Rationale

The rationale for this research project was to analyse the qualitive data collected from my research, to inform future collective CPD so that the central team that I am employed by, can deliver for whole school settings and individuals. This research will address an understanding of Maths Anxiety, useful strategies, and identification of research-based maths interventions, such as Maths Recovery, that can be used to support teaching and learning. Reflecting on the evidence presented will help me understand, coordinate and plan effective support that can be accessed by all schools within my local authority.

Chapter 2 Literature Review

As a starting point to this research project and looking at, Teachers' perceptions and experiences of Maths anxiety. The impact of engaging with Maths Recovery CPD on Teachers Maths Anxiety and confidence in teaching Maths. It was essential to initially start with looking at definitions of Maths Anxiety in order to provide an understanding before then looking at policy and some of the different facets that Maths Anxiety can affect. This Literature review encompasses looking at Maths Anxiety in children and how this links with performance, this will then be built upon to consider the teachers' perspective and the impact of the Maths Recovery CPD.

Definitions of Maths Anxiety

The subject of Maths Anxiety has been widely researched over recent years. The definition that I will be using is that Maths Anxiety is a negative emotional response to Mathematics and individuals, responses can vary from mild to debilitating effects, (Centre for Neuroscience in Education). Maths Anxiety is also described as 'a feeling of tension and anxiety that interferes with the manipulation of numbers and the solving of mathematical problem, (Richardson and Suinn 1972). Maths Anxiety is not the same as general anxiety that occurs when taking tests and it does not only occur in the classroom but also in real life contexts. It can manifest to the point that some individuals will actively avoid any situations where they may encounter any kind of maths, including avoiding careers that may contain elements of maths.

Nathan Lau (2022) undertook research at the University of Western Ontario, which concluded that 'the strongest predictor of maths anxiety' was that there could be a higher level of Maths Anxiety in the pupil, which correlated to their confidence in the maths teachers' skills & knowledge.

Policy and Organisational Trusts

The background information that informed my research project is based initially upon the mathematics curriculum in England and my understanding from this about what Maths Anxiety is. Looking at how this manifests in pupils and then focusing upon the research aims as to understanding teachers' experiences and knowledge of Maths Anxiety, and how this may transfer to pupils they teach through choice of maths intervention.

The National Curriculum for Mathematics in England came into force in 2016 and was updated in January 2021. It sets out statutory programmes of study and attainment that cross four key stages, covering primary and secondary settings, in local authority-maintained schools. The purpose of these programmes of study is to provide a high-quality Mathematics education that will provide a foundation for understanding the world. Mathematic skills are essential for everyday life. Maths is multifaceted and critical in particular to subjects and industries such as technology, engineering and science. Having the necessary skills in place so that you can

navigate the world through financial literacy and is needed in most forms of employment.

The expectation is that most pupils will progress through these programmes of study generally at the same pace. However, progression should be based on 'The security of pupils' understanding and their readiness to progress to the next stage (DFE, 2021).

The Education Endowment Foundation (EEF) was established in 2011 with the aim to improve educational outcomes for the poorest pupils by raising standards in challenging schools in England. Over the years the EEF have published the outcomes from many funded projects and supplied evidence-based resources to support teachers and senior leaders within schools to improve practice and promote learning. One guidance report in particular, published in 2018, focuses on eight main recommendations designed to 'make a significant difference to pupils learning', for 7 -14-year-olds in maths (EEF, 2017). Whilst not all areas of maths are covered it is based on research, focusing on improving the quality of teaching. The eight areas are using assessment, using manipulatives and representations, strategies for solving problems, developing a rich network of mathematical knowledge, independence and motivation, challenging and supporting pupils' mathematics, using structured interventions and successful transitions between primary & secondary school in maths teaching.

However, despite having statutory programmes of study in place as laid out by the government and also initiatives to improve educational outcomes by raising standards, there is still a huge concern for educators that the area of Maths Anxiety is having a significant impact (Hembree, 1990). Why is this and is there a cause to look at the wider picture in terms of not just the pupils but looking at their teachers who may also have Maths Anxiety?

Maths Anxiety in children

Research undertaken by Petronzi, in 2019 focused on looking at numeracy apprehension in young children and described as the stage that occurs prior to Maths Anxiety. He found that numeracy apprehension could be identified in children as young as four. This is a result of negative experiences from teachers, other pupils, as well as parents, especially when they underperform in maths. The impact of this is that they start to develop negative attitudes towards maths which in turn affects their self-esteem and a self-perpetuating belief that they can't do maths. He discusses the importance of further research looking at the origins of numeracy apprehension and early intervention strategies to be implemented.

These origins could be linked to and described by three causes of Maths Anxiety according to Hadfield and McNeil (1994).

Environmental factors, these include negative experiences in the classroom, parental pressure, insensitive teachers, mathematics presented as rigid sets of rules, and non-participatory classrooms (Dossel, 1993; Tobias, 1978).

Intellectual factors, these include being taught with mismatched learning styles, student attitude and lack of persistence, self-doubt, lack of confidence in mathematical ability, and lack of perceived usefulness of mathematics (Cemen, 1987; Miller & Mitchell, 1994).

Personality factors, these include reluctance to ask questions due to shyness, low self-esteem, and viewing mathematics as a male domain (Cemen, 1987; Gutezahl 1995; Levine, 1995; Miller et al., 1994).

Gabriel and Barthakur (2006) looked at the impact of Maths Anxiety on self-regulated learning and mathematical literacy, investigating motivational, emotional and cognitive factors involved in self-regulated learning and their role in mathematics learning. Furthermore, looking at how often Maths Anxiety occurs is key to identifying its prominence within our schools which is linked to my research question in terms of the teachers' perceptions and experiences.

A study of Understanding Mathematics Anxiety investigating the experiences of UK primary and secondary school students has been undertaken by Carey (2019), this looked at the prevalence of Maths Anxiety in UK primary and secondary schools as a result of what they described as a 'Mathematics crisis' in the UK. The project looked at individual pupils' attitudes towards maths and the correlation with the decrease in the number of pupils gaining functional maths skills. The data showed that there was a drop in 2003 from 26% achieving equivalents to grade C GCSE to 22% in 2011 (National Numeracy, 2014). In comparison with 57% who achieved the equivalent Grade C GCSE in Literacy. (National Numeracy, 2014).

Research is starting to take into consideration that teachers can accidentally be compliant in escalating symptoms, from mild to severe, even further (Furner & Burnam 2003) through transferring their own feelings and behaviour on the subject of Maths. The style of teaching with over reliance on rote methods and lack of confidence can further impact the negative school experience and outcomes of pupils (Scarpello 2007).

Maths anxiety and performance

Whilst this is not an area that this research paper is focusing on, it is important to briefly acknowledge the impact of Maths Anxiety on performance. A study conducted in 2019 (Zhang, Zhao and Kong), looked at the 'Relationship Between Math Anxiety and Math Performance: A Meta-Analytic Investigation'. This research paper focused on the link between these two areas but also considered other factors such as gender, grade level and geographical regions. The conclusion of the research indicated a robust negative Math-Anxiety correlation.

An article by Cosgrove in 2021 explores the impact online platforms may have had on pupils learning and the impact on Maths Anxiety. Remote learning reduced the pupils' access to teachers in terms of giving support and encouragement as well as increasing stress levels in terms of answering questions and not allowing enough thinking time. Engagement of pupils in these lessons was affected, resulting in some pupils becoming further withdrawn.

Post Covid when pupils returned to being taught back in school the focus was on wellbeing. However, despite this teachers were not given training on identifying hidden anxieties, such as Maths Anxiety, strategies to address this or a way to measure the level of Maths Anxiety. This could ultimately have impacted pupils' potential and progress. However, Cosgrove does discuss the fact that a return to school may also have a positive impact in terms of pupils being able to have reassurance in those renewed relationships with their teachers and peers, therefore alleviating some of those anxieties.

Teachers Understanding of Maths Anxiety

To address pupils Maths Anxiety there needs to be a drive towards developing teachers understanding, identification and effective strategies that can be used in order to alleviate Maths Anxiety symptoms and therefore developing a positive experience, confidence and enthusiasm for maths so that pupils can make progress. In Kirkland's (2020) research article, exploring teachers understanding of Maths Anxiety, the questionnaire results from teachers' responses showed that 58 % described Maths Anxiety of feelings of fear or avoidance. 22% of responses described it as test avoidance, 8 % as a dislike for maths with 7% as a poor attitude to maths. She reflects that from the outcomes of her research more questions have been raised and further investigation is needed in terms of developing teachers' awareness of what Maths Anxiety might look like in their own classrooms if they aren't aware of it, how can Maths Anxiety be addressed and how can the profile of Maths Anxiety can be raised in primary schools in the UK?

The suggestion is made that firstly this can be addressed in initial teacher training courses looking at causes, symptoms & intervention. Secondly, involving the senior leadership team in schools in observing whether the correct response and support is in place, or whether there is a further unidentified issue that may be impacting on the pupil's progress. Using a Maths Anxiety scale would be beneficial to help track and identifying the effectiveness of personalised support and interventions put in place for individual pupils, (Kirkland 2020).

Teachers' experiences of Maths Anxiety

I believe that professional development is needed in order to reduce teachers' Maths Anxiety. Whilst there has been a worldwide push on providing developments in STEM subjects and therefore STEM education, it has been realised that both pupil and teacher attitudes have been overlooked in terms of Maths Anxiety and engagement with STEM (Foley et al 2017). As already stated, teachers' Maths

Anxiety can negatively affect pupils' outcomes in maths, but it is rarely addressed in terms of addressing subject specific issues such as this through intervention.

Research undertaken by the University of Cambridge has shown that when presented with a maths problem many adults and children display anxiety, apprehension, tension or discomfort, (Dr Thomas Hunt 2020). Dr Thomas Hunt, a Psychologist from Derby University states that at some point most adults will experience some form of Maths Anxiety, girls & women appear to experience it more so.

In 2018 a study was conducted with three teachers using a video assisted and theoretic reflection framework, in order to study the effects on teachers' Maths Anxiety. Whilst it was a very small-scale study undertaken over three months using four occasions, the results were very promising. The Theoretical framework that the teachers referred to when making their reflections was the 'knowledge quartet' which allowed for both planning and reflection on maths teaching (Rowl et al, 2009). They also used adapted teaching efficacy scales pre intervention and again after the intervention had been delivered. Two out of the three teachers with the highest levels of Maths Anxiety expressed that even after a brief period of time of using reflection as an intervention they did feel their Maths Anxiety had reduced. Given that the scales were not validated and the sample very small, and therefore cannot be generalised. The result of the study suggests that reflection by the teachers involved may reduce Maths Anxiety, this could be confirmed with more research in this area. Ultimately if the reduction of teacher Maths Anxiety can be brought about then there could possibly be improved outcomes for pupil attitudes, retention of teachers as well as a positive and enthusiastic outlook from both pupils and teachers towards maths.

Teachers range of expertise in maths varies, dependant on experiences. Teachers want to be seen as experts, particularly trainee teachers, and therefore are reluctant to share that they themselves have Maths Anxiety. Dr Thomas Hunt from Derby University mentions that when speaking to other professionals, particularly in teacher training programmes, it has become apparent that there is a high level of Maths Anxiety among some trainee teachers, (2020). In most cases this goes overlooked as the teachers don't have systems or strategies in place to deal with it. This can have a detrimental effect in terms of applications for teacher training as well as the impact on student outcomes once they are teaching in school. He goes on to say that it seems to be more prevalent in those trainee teachers wanting to specialise in primary rather than secondary teaching. In addition to this he also suggests that teachers with more experience have less Maths Anxiety whereas those new to the role were more likely to exhibit high levels of Maths Anxiety.

A collaboration research project undertaken at Sheffield University, between the Maths and Statistics help centre (MASH) and the Specialist Learning Difference Centre (SpLD) indicated positive results following workshops and resources developed for staff training. The workshops entailed using a constructivist approach building upon previous experiences and knowledge within a small group discussion

scenario. Initially participants reflected on their Maths Anxieties and its impact, physically and emotionally. Followed by compiling a list of symptoms that fell into three areas, physical, cognitive, and emotional.

As part of the workshop a series of Maths Anxiety definitions were studied. A crucial aspect was to then share an explanation of the impact of Maths Anxiety on the brain based on three neuroscience papers published, one of which was Young et al, (2012). Images were used to show the connection of brain events and experiences to learning maths. Then an explanation of how this affects number manipulation and the development of maths skills therefore legitimising and acknowledging feelings of Maths Anxiety as a specific learning difference. The workshop allowed the participants to then reflect on any negative experiences they had encountered as well as how this may have then further impacted on developing their own negative feelings about maths, thus creating an initial starting point to then be able to address their anxieties. Alongside this, prevalence figures where shared with the group which helped to show that the feelings they experienced, and their Maths Anxiety, was fairly common. It was discussed in the workshop that there are many misconceptions and incorrect thoughts about maths in the sense that only a certain type of person has a ‘mathematical mind’, (Furner and Duffy 2002). During the workshop these incorrect beliefs was looked at and participants encouraged to question them. Three main strategies were identified as useful when addressing Maths Anxiety, ‘encouraging self-efficacy, use of 1:1 support and encouragement of peer learning. This study established that many students at the University had Maths Anxiety as a result of early negative experiences of maths affecting the development of maths skills and causing avoidance of maths subjects later on in life. The findings suggest that use of workshops and the understanding of Maths Anxiety, its effects and subsequent strategies can be used to reduce Maths Anxiety, installing a sense of self efficacy, and helping students to effectively make progress in maths.

Dr Julie Whyte, (2022), completed her Thesis on Maths Anxiety and Primary School Teachers. In her studies she acknowledges that there is a lot of research on Maths Anxiety but not on teachers with Maths Anxiety. Her study was based on the experiences of 12 primary teachers who expressed they had Maths Anxiety around the teaching of maths. As with many of the other research cited in this literature review, she established that these teachers had all undergone negative experiences that had contributed to their feelings of Maths Anxiety. For some of the contributors this was due to a fast pace of learning, little reflection or discussion time and using negative language, such as sarcasm, confusion, ridicule to describe their feelings.

As a result of this a common thread was found, that these teachers where nervous, lacked belief in themselves which affected their confidence in their ability to teach maths and respond to students. They had difficulty in explaining concepts and felt mathematically disadvantaged to their students and had a fixed teaching style that didn’t encourage flexibility or a growth mindset. They may also have deliberately timetabled maths lessons to when it would be a shorter session or allowed other subjects to overrun or even just focused on strands that they were more comfortable

with. All the teachers in the research expressed concern as to how their feelings about maths and Maths Anxiety would impact the outcomes of their students. Some of the teachers had remained as teachers of pupils in the early years and lower down in school so that any Maths Anxiety they were feeling was reduced.

It was suggested that a way forward was to support teachers in allowing them to be upfront about anxieties they have and not to keep it hidden. Then they can seek appropriate support and work together with their peers and build a supportive maths culture and community. Starting with teacher training to not only providing a strong pedagogical content for maths but also a focus on Maths Anxiety. Also, to ensure that it is the responsibility of all and not just the individual, building upon each other's strengths. Next was sharing positive and negative experiences, learning from them to provide useful teaching practices within maths. This includes sharing knowledge, expertise, and resources together with role modelling good practice.

Dr Flavio H Santos at the University College in Dublin has also developed a programme for teachers around Maths Anxiety, (2022). It is remarkably similar in terms of the previous study mentioned in that it looks at evidence-based information, including the definitions of Maths Anxiety, its symptoms and neurobiological markers, global data and effects on cognitive related areas such as working memory overload. In relation to this it goes on further to look at the impact of Maths Anxiety on performance, grades, and career choices. The latter part of the programme considers what needs to be accounted for in terms of pupils, classroom environments, approaches, and teachers as well as interventions. Sabnani, an educational consultant echoes in her research that Maths Anxiety has a physical and emotional response, (2021). Students that have often experienced maths trauma go onto having unresolved issues later in life unless an intervention has taken place. These unresolved issues can be passed down to their children and in effect continuing the cycle. Sabnani mentions that the subject of Maths Anxiety is now well researched. However, it persists, and we need to look at why and ways to address it. She suggests that it is a lack of professional development and a lack of understanding pedagogical content that contributes to teachers' Maths Anxiety. When teachers have a strong conceptual understanding of maths, belief in themselves and the confidence to deliver maths teaching then the impact on student outcome will be successful.

The National Numeracy & the Maths anxiety trust (summit 2022)

In November 2022, an online symposium was organised which was attended by teachers & teaching assistants looking at the area of Maths Anxiety. Several professionals spoke about their own experiences of suffering from Maths Anxiety as pupils right up to becoming teachers. One teacher in particular described how her Maths Anxiety became paramount in secondary school when she was put into a lower set for maths. On reflection the question is raised as to whether that affected her confidence and/or also becoming a teenager contributed to feeling 'lost' in maths lessons. With the additional pressure of needing to pass the standard grade to get

into university to undertake a course in primary teaching. A vital course of action for this particular person to succeed was to undertake a series of 1:1 maths sessions that enabled her to pass and embark on the teaching course. With the realisation that she could do it, she reflected on the fact that maybe it was the classroom environment that impacted her learning and the manifestation of her Maths Anxiety.

On starting a teaching role in a school, the Maths Anxiety returned causing a lack of confidence and resulted in the necessity of revising for each maths lesson the night before. A 'Numbers talk' approach was used in school which enabled the teacher to gain more confidence, filling the gaps in their own knowledge as well as that of the pupils. However, the Maths Anxiety resurfaced when the teacher received a promotion becoming maths lead in the school. The teacher in question remembers being terrified even though they agreed and cried when they went home. To combat the fear, they realised that the key was to undertake professional development in not just maths skills but also Maths Anxiety itself. In response to this the Maths Anxiety trust has produced 'A guide for Teachers with Maths Anxiety' which gives expert guidance also including strategies that can be used. One chapter in particular looks at how a teachers Maths Anxiety may affect their planning and teaching of maths lessons, for example, unintentionally using negative verbal & non-verbal language portraying their feelings about maths and transferring this to the pupils they are teaching.

Conclusion

The focus for my research is on Maths Anxiety that teachers experience, the implications of this and drawing upon the research in this area as stated in this literature review. In looking at the guidance and research already undertaken in improving maths standards and Maths Anxiety, the key themes that I have drawn out is that Maths Anxiety does exist, its effect can be debilitating, it is commonplace in all education settings and age ranges. Maths Anxiety can be experienced by both pupils and teachers. In light of this, researchers are becomingly increasingly more interested in studying the link between teachers understanding and personal experience of Maths Anxiety. Across the studies looked at in this literature review there is consistent evidence to suggest that Maths Anxiety is a phenomenon that may be influenced by other factors such as environmental, intellectual and personality. As such Maths Anxiety, and its impact on teachers needed to be studied in further detail. I decided to use qualitative research with the focus on exploring views and practices of teachers, collecting, and analysing non-numerical data to provide a better understanding of my research question. This will be discussed in more depth in the next chapter, looking at Teachers experiences of Maths Anxiety so that solutions can be found to address the issue. Identifying new areas for research and a more flexible approach, so that methods could be adjusted as necessary to develop new knowledge and conducted with smaller samples (Scribbr, 2022).

Chapter 3 Methodology – designing the research.

This is my Research question, what are Teachers' perceptions and experiences of Maths anxiety, and the impact of engaging with Maths Recovery CPD on Teachers Maths Anxiety and confidence in teaching Maths**.**

Central to this research is the focus on teachers' experiences both past and present in terms of being able to answer the research question. I will discuss the methodological choices made and methods chosen to support this. In undertaking this research, the ethical requirements of Edge Hill University were followed, and approval sought before collecting data and permissions obtained from my employer and that of Maths Recovery UK & Ireland to undertake this research (See appendix 1 – completed ethics consent form).

Reference was made when conducting the research to BERA (2018) on ethical guidelines. Within this framework respect was shown for individuals, including the researcher, that were involved in the research undertaken. For the researcher to be 'mindful of the ways structural inequalities affect social relationships' (Ethical Guidelines in Educational Research, p6) which are formed during the research. Consideration was given to the 'rights and interests of those indirectly affected by the research', gaining voluntarily informed consent as appropriate. Participants were informed of the outcomes of the research and took into consideration subsequent use of the research. Finally considering maximising the benefits of the research whilst minimising any risk to the participants and establishments involved (BERA, 2018).

An iterative, reflective approach was taken in order to inform planning as well as the choices made throughout the research. I took a duty of care to ensure ethical research standards were upheld with the wellbeing of all participants involved paramount, encompassing the schools, teachers, local authorities and employers. I have strived to give this great consideration at every step so that the five ethical principles are adhered to, 'minimising harm, respecting autonomy, protecting privacy, offering reciprocity, and treating people equitably', (p117 Research Methods in Education). The research topic chosen is relevant to my current role and beneficial in improving outcomes for CPD for future teachers.

Research Approach - Qualitative Research

I decided to use qualitative, action research where the focus was on exploring views and practices, collecting, and analysing non-numerical data to provide a better understanding of the research question. This enabled a greater depth of investigation, looking at teachers experiences of Maths Anxiety so that solutions can be found to address the issue. Identifying new areas for research and a more flexible approach, so that methods could be adjusted as necessary to develop new knowledge and conducted with smaller samples (Scribbr, 2022).

Action Research

The main aim of action research is to improve understanding, practices and outcomes. It is a widely used research methodology, particularly in Education and used to inform education practices, therefore bridging research and practice.

In terms of my research question and wanting to inform future practices within my current role & setting in terms of developing CPD and giving advice to educational settings it was the most appropriate. Working together with both teachers and facilitators of staff development in order to bring about change based on the analysis of the research undertaken. As a tool, action research is advantageous as it supports the move for reflection, improvement and change, initially in terms of my research, within a Local Authority setting. With the intention of improving outcomes for both teachers and in turn their pupils by having a better understanding of what Maths Anxiety is and using a specific programme of development to improve outcomes, (Tegan George revised 2023).

A collaborative approach between myself as the researcher and the participants, alongside the incorporation of rigorous data collection and analysis with reflection would encourage positive changes to be made alongside providing practical outcomes. With my research in mind this would be by using the data to inform and develop future CPD programmes to help teachers address not only Maths Anxiety within themselves but also that of their pupils as well as identifying the benefits of using Maths Recovery which is research-based CPD. As a researcher I needed to ensure that I was systematic in my planning, actions, observations, interpretation of the data and reflections in order to provide actions.

I needed to consider reflexivity and my positionality as part of the research process. (Cohen et al, 2018). I acknowledged that I needed to consciously reflect on my own life experience and meaning constructed from this could influence the research. According to McCormick and James (1988) the researcher becomes a research instrument and therefore I needed to be mindful to closely monitor my own reactions, biases, situation and all interactions with all participants.

This involved, as a researcher, to consciously self-critique, evaluate my subjectivity and context, which could be influential on the research. Using reflexive practices to ensure decisions and conclusions were aligned throughout my research. Making ethical decisions within the generation of data from the real world that reflected the possible disorder of participants' experiences. Ignoring the reflexivity could have had a negative impact on the knowledge gained from this qualitive research, while also failing to look at the power dynamics that may occur between the interviewer and the participant. This could cause pressure for personal details to be disclosed that the subject is not comfortable with, or alternatively feel that they can't share experiences resulting in the subject being harmed and the data collected not a true reflection. I acknowledge my positionality, as a female teacher who also experiences Maths Anxiety. Reflecting on allowances made by myself as a researcher as well as

reflecting on my own views, beliefs and values which could impact on the design, implementation of methods and interpretation of results. Again, being aware of being consistent in terms of having an ongoing reflective process whilst undertaking the research. This meant that as a researcher myself and the participants, would effectively be able to link ‘theory and practice’ in order to suggest solutions and further research in the area of teachers and Maths Anxiety (Scribbr, 2022).

I also needed to consider the disadvantages of using this type of research methodology. Using contexts from real life settings meant that there was a possibility that the data could be unreliable, affected by factors not initially considered. The subjectivity of the research also means that the interpretation of the data could vary dependant on who was analysing the data. As part of the research was conducted with a small sample, I also had to be aware that conclusions made would be difficult to generalise and reflective of the wider population.

These are important features given the nature of my research question and proposed methods for gathering data as l also needed to take into consideration ontology and epistemology aspects of qualitative research (Al-Ababneh, 2020).

Ontology

I used a constructivist ontology which is described as individuals constructing meanings from their own situations in order to make sense of their world. From social situations creating meaning and act accordingly in response. (Cohen et al, 2018). These meanings used to interpret situations may be based on culture which would give rise to multiple realities and interpretations that are constructed through lived experience. This ontology fitted with my choice of action research because I needed to consider the participants understanding of their experiences of Maths Anxiety and make connections when interpreting the data. Consideration of this was accounted for when undertaking my chosen research methods and analysis because I wanted to ensure that as a researcher, I was being mindful of the interpretation of their experiences.

This was insightful in terms of drawing meaning from investigation of the experiences of the participants in order to inform better outcomes, policies and practices. It was uniquely suited to evaluate multiple perspectives providing a more balanced approach to the research. The constructivist approach does not require a fixed way of presenting the results. However, it does follow a process that discloses the multi layered circumstances involved in the area being investigated. The principles of a constructivist approach includes; in each learning experience individual learners will bring their own unique knowledge and beliefs; knowledge acquired will be done so uniquely and on an individual basis; the process of learning is active and reflective; it is a developmental process continually evolving; multiple perspectives are gathered through social interaction; the learner mediates and controls the learning taking place, (Hubbard 2022). This allowed for an understanding around how the

participants, individually and collectively, constructed meanings from their experiences around the subject of Maths Anxiety (Cupchik 2001).

Epistemology

Using interpretivist epistemology, by looking at how behaviour and data is placed in situations that are dependent on related rich contexts, (Cohen et al, 2018.) This is the study of knowledge and how we know what we know. Meaning that as a researcher I needed to look at the whole picture that evolved in order to understand, describe and explain many interpretations of situations, their uniqueness, starting points and consequences (Cohen et al, 2018). The research looked at the interactions and experiences that resulted in Maths Anxiety. Investigated the perceptions of the participants, which allowed for a focus on understanding the meanings of patterns of behaviour and feelings of the individual as well as the collective subjects that took part. As a researcher I gained an in-depth, intricate understanding of personal opinions, experiences, values, behaviours and emotions around the subject of Maths Anxiety from teachers. Describing and exploring the data in order to develop further practices in context. Ontology and Epistemology are intricately linked shaping assumptions and chosen methods of discovering the truth about situations in real life contexts.

Methods – Carrying out the research.

There are many advantages of using qualitative data in terms of gaining the opinions and feelings of the participants involved in the research. I was able to adapt my interview questions as new information and ideas became apparent. For example, during the semi-structured interviews I was able to explore the different influences that caused individuals Maths Anxiety. The structure of my research was investigated in real life, natural situations where the participant felt the most comfortable. As the interview was conducted online the participant could choose to be at home or in work, providing it was private and calm. Reflecting on the participants' experiences, perceptions and emotional responses in order to suggest solutions and improvements in addressing the research question. This allowed for new ideas, problems and opportunities to surface.

Primary research data was collected using two research methods, questionnaires and semi-structured interviews, carried out first hand which was the original information collected for the purposes of this research. The advantages of this are that data can be collected specifically to answer the research questions stated at the beginning of Chapter 3, and that there is more control over the methods used. The disadvantage is that it can be more expensive and time consuming to collect depending on the methods decided upon.

Sample of participants

I used a non-probability sample as I needed to gather the views of qualified teachers, but to try to minimise sampling bias I tried to ensure that there was a wide range of teaching experiences, Key stages and educational settings. The initial sample of seventy participants were teachers from primary & secondary schools from a range of settings including class teachers, maths subject teachers, principal teachers, local authority teachers and teachers from special schools. They were selected by voluntary response sampling but also by purposive sampling to try to reduce some elements of sampling bias, for example there may have been a large number of volunteers from one specific setting, or age range. They were also chosen according to locations determined by where the Maths Recovery CPD training was taking place and gathered across England, Scotland & Northern Ireland so that questions around Maths Recovery CPD would be more relevant to the participants. The initial data was gathered, using the pre and post questionnaires. This looked at teachers' confidence in teaching specific maths domains in relation to the Maths Recovery CPD and using the Maths Anxiety Scale. It was then used to identify a further small group sample of ten volunteer participants in order to investigate the research question in further detail by using semi structured interviews. This volunteer group came from the original sample of seventy participants.

Initial conversations had already taken place with local authority representatives where the Maths Recovery CPD was taking place and headteachers, who were the gatekeepers to the participants taking part. Initially this was to generate an interest in the research study but also to identify which schools would be more engaged in the process and gave permission to work with teachers. When this research proposal was approved, I then proceeded to contact the participants, discussing the research objectives, timeframe and research methods that were used. This was addressed by sending voluntary informed consent letters outlining the research and credentials of the researcher.

The benefit in working with these participants was that they were interested in the outcomes. The teachers approached gave their consent and engaged, giving honest responses to the questionnaire, and the anxiety scale which gave an indication of areas that were more likely to cause a higher level of Maths Anxiety. The incentive to take part and encourage participation was using the outcomes of the research to inform and support future practices and CPD in terms of Maths Anxiety and Maths Recovery. Taking a common-sense approach, I ensured that it didn't impinge on their right to their decision to take part.

The challenges that occurred were ensuring that, whilst the gatekeeper had consented to giving access to the participants, the individual class teachers had also given consent and were happy to be involved (See appendix 2). As a researcher I needed to ensure wherever possible individuals were reassured and understood that their involvement would only take place if they consented to it. I needed to be aware of any power relationships that could influence participants taking part, including my

own by working for a local authority. A small number of the participants worked in my local authority so I needed to be particularly reflective of the power relationship and ensure that the participants were at ease and knew they could withdraw at any time. I also needed to consider what effect the outcomes from the research would have on individuals taking part in this research. Taking responsibility in relation to my duty of care for the participants through planned meetings to introduce myself, giving lots of information prior to undertaking the research, ensuring that the participants felt reassured as well as giving them opportunities to ask questions in order to recognise and address any potential risks that arose.

Questionnaires

The first data collection involved questionnaires, administered pre and post training and accessed online by the participants, which was deemed to be more effective in obtaining information from a large sample of participants (see appendix 3 & 4). The questions were constructed to address the research objectives. They were developed to generate information, containing single words and brief phrases, using majority closed questions. This allowed analysis of answers to be more straightforward and more cost effective, (Cohen et al, 2018). Prior to sharing the questionnaires with participants, time was spent designing the questions, making sure the wording was clear and precise, considering the categories of response to each question and then piloting it. From this pilot, very minor refinements were made consisting of changing certain words to make it clearer to the participants what they were being asked.

The online questionnaires were designed to be self-administered without the researcher present. There are many advantages in using this approach rather than conducting face to face questionnaires. For example, it is a more efficient use of time, in terms of the participants being able to complete it in their own time. Additionally, anonymity for the participant being in place, so individuals may be more likely to be open about their responses as they won't be easily identifiable. The possibility of a high return rate as information would be collected from schools where I could liaise with the gatekeepers to set specific time aside for the completion of questionnaires. Using standard questions allowed control of the stimulus in terms of the responses given by the participants and the order in which the questions was presented to all participants. As a researcher I needed to balance and make judgements in terms of the appropriateness and type of questionnaire to be used (Kuphanga, 2024).

I was also aware of the limitations of this method which I have carefully considered before choosing it. The information collected in the responses would describe rather than explain why Maths Anxiety occurs. Although through the analysis of responses there may be indications as to what caused individuals Maths Anxiety. It may also lack in-depth insight into individuals own unique responses and there will be no opportunity to probe responses. Adequate time was needed to be spent on drafting

the questions and piloting it for it to be a useful tool in gaining information for the research objectives (Munn and Drever, 1990).

The main aim for using a questionnaire, pre and post, was to gain information around the participants' experiences of teaching specific domains of maths, from previous through to their current role, based on pre and post experiences of Maths Recovery training. The questionnaires contained the same questions, except for additional questions on the post questionnaire where the participants were asked to evaluate, in their opinion, the impact of the training on their confidence levels in specific areas of mathematics. The initial questions included in the questionnaire focused on the participants confidence of teaching specific maths domains identified in the Maths Recovery CPD. This led to completion of a scale for participants to take to measure the extent of their anxiety around Mathematics. Before deciding on which Anxiety scale I was using as part of the questionnaire, I had to look at the types of scales that were available and assess their suitability to be used as part of my research.

Anxiety Scales

An early scale that was used in a number of research projects was the Maths Anxiety Rating Scale (MARS; Richardson and Suinn, 1972). This consisted of 98 five-point Likert-type items. Drawbacks for using the Maths Anxiety Rating Scale are that it can be cumbersome due to the number of questions and the language it uses may make it less relevant to non-American English speakers.

The Abbreviated Math Anxiety Scale (AMAS) developed by Hopko and colleagues, 2003, is one of the popular tools for measuring Mathematics Anxiety. It is short, the value of short scales has been research by Widaman et al. (2011) and focuses on two factors or subscales – both of the factors are taken from the Maths Anxiety Rating Scales (MARS; Richardson and Suinn, 1972). The two subscales are learning and evaluation and this has been the subject of a range of studies in America, but developed from this was the Modified Abbreviated Math Anxiety Scale (mAMAS). The aim was to adapt the language and content to make it appropriate to a wider age range, as well as altering references to specific areas and practices that are unfamiliar to British English-speaking individuals.

Another scale that addresses the possible drawbacks of the size of the Maths Anxiety Rating scale is the Mathematics Anxiety Scale – UK (MAS-UK). This is a 23-item anxiety scale intended to give similar results but using a much shorter questionnaire.

It can be seen that there are a number of scales that can be used but when certain criteria are applied, such as the question of validity, the evidence base and the age range that it has been developed for, this reduces the choices to a few key scales.

Given all the research around the different scales it then became a choice between the Mathematics Anxiety Rating Scale and the modified Abbreviated Math Anxiety

Scale, I made the decision to use the full version of the Mathematics Anxiety Rating Scale (See Appendix 5).

My reasoning was that the data generated would then be considered as more robust, or comprehensive, giving more confidence to the conclusions drawn from the selected anxiety scale rather than a shorter version of an anxiety scale. The shorter version whilst may be quicker in terms of completion it would not give as much in depth insight as the full version would.

Looking at the research around the use of the Mathematics Anxiety Rating Scale (Richardson and Suinn,1972) there are a number of studies where the scores from the Mathematics Anxiety Rating Scale decreased after interventions to reduce anxiety. Given this previous research as a basis, the use of this scale gave reliable responses as well as being a valid tool in being able to give individuals a baseline score to then use for further investigation in terms of the Semi-structured interviews. Consideration was given to how the scale was presented, in terms of motivation for the staff for completing it. This was done by ensuring participants were aware of the purpose of the research being undertaken with context around the project. Providing the participants with an interest in the outcomes.

Interviews

Semi structured interviews are a common investigative tool used by many researchers in constructivism, this allowed for the same theoretical framework to be followed as was completed with the pre and post questionnaires. Giving the flexibility to investigate further questions that arose through individual participants interviews and the respective research question. Giving insights into participant's perceptions, attitudes, opinions, narratives and rationale. This was particularly useful in terms of the exploratory nature of Action Research identified earlier in this chapter and would be used further to provide a robust foundation for future research questions (George, 2022) and critical analysis.

However, as the interviewer I needed to be aware of the disadvantages. In terms of conducting the interviews, whilst allowing for some flexibility and exploring other themes that came up. I also had to be mindful of the participant responses going off on a tangent and being able to refocus them back to the relevant subject being investigated. I also was very aware that every interview would be unique and therefore not allowing for any standardisation of responses. Undertaking the interviews was time consuming, labour intensive and required me as the interviewer to be sensitive and knowledgeable in leading and navigating the discussions. The preparation involved for conducting the interviews was considerable to ensure success and also the time spent setting up the interviews and analysing the notes and transcripts (Adams, 2015). However, as the interviews were conducted online using Microsoft TEAMs, some time was saved due to the software being able to record and provide a transcript of each interview. Due diligence was paid to checking the transcripts generated to ensure they were a true reflection of the recording made.

The questions designed for both the interviewer and participant were aimed at gaining insights into their individual experiences of being taught maths throughout their education, being assessed, or sitting exams through to their ability to teach maths to pupils. Further questioning on how they felt about being taught maths and how they now teach it. The structure of the interview questions focused on three areas: environmental, intellectual, and personality factors – causes of Maths Anxiety according to Hadfield and McNeil (1994).

This research project was not concerned with a huge sample of interviewees, but instead more time was dedicated to collecting the views, experiences and information within a small, focused group. A semi structured interview is less formal than structured interviews, more relaxed, interactive and conducted conversationally with one participant at a time. As the interviewer I used a mix of preformulated closed and open-ended questions which allowed for more in-depth probing pursuing detailed inquiry and discussion around responses made. It was less rigid than a formal interview, with less strict adherence to questions in terms of allowing the order the questions were asked to be changed slightly so that new questions could emerge if necessary. The interviews were designed to last for at the minimum twenty minutes with up to one hour at a maximum. This was to minimise factors such as fatigue for both the interviewer and participant (See Appendix 6).

When undertaking the interviews, I needed to be sensitive to the fact that the research covers areas that may be considered to be sensitive and personal. Therefore, as an interviewer I ensured that the participants were aware and understood the research objectives, gaining their consent beforehand and that their responses would be confidential and anonymous. A considerate approach was employed to put the participants at ease and encourage them to respond in an open and honest manner.

The interviews were completed online, in a one-to-one situation which made it straightforward to focus on specific ideas with individuals and easier to control. The transcriptions of the online interview were shared with the participants to check with them that they agreed it was an accurate statement of their responses and to gain their consent to use it as part of the data. Participants were informed of their right to withdraw, at any time, for any or no reason. It needed to be factored in that the rooms the interviewer and also participants used to access the interview were private, reasonably quiet and allowed for comfortable interaction. However, things did not always go to plan in terms of other factors that are not directly related, that affected releasing the participant at the allocated time.

I needed to consider the interviewer effect and possible influence on the data that emerged in light of participants responding by fulfilling perceived expectations of the interviewer or affecting their willingness to divulge information. As it was a small-scale research project effort was made on behalf of the interviewer in being transparent with the participants and creating the right climate for the interviewee to feel comfortable.

Data Analysis

The collection of data was also very labour intensive in terms of having to check everything manually, despite using software that could aid in collecting transcripts and summarising the results of data collected from the questionnaires. The software used was Microsoft forms which was efficient and easy to use in terms of collating the responses given by the participants so that the data could then be analysed effectively. However, the software has limited options for using different formats thus it can make a long form seem repetitive.

The results from the questionnaires were collated and analysed online, using Microsoft forms that gave the results of the questionnaires as raw data as well as in graphs. It was possible to compare those who rated high on the scale and their experiences with maths. For teachers who completed the initial questionnaires a specific group were selected using non-probability sampling (purposive sampling) based on my expertise in the subject area and awareness of the sampling bias that this could entail. This resulted in the selection of ten participants to be invited to the semi structured interview. This was to explore issues further and draw connections between their experiences and their anxiety levels. Looking at the impacts on their approach to teaching, their empathy with pupils who struggle with maths and their awareness of Maths Anxiety.

In the next chapter I will discuss the results of the data analysis. Looking in depth at both the pre & post training questionnaires with a focus on confidence in teaching specific maths domains. Focusing on the outcomes of the Maths Anxiety scales and identify themes, both general and unique from the semi structured interviews that had been undertaken. I will reflect and make note which themes are common to all the interviews as well as considering any themes that may have arisen in one or a minority.

Chapter 4 Data Analysis Discussion

Getting Started

In terms of my research question, 'Teachers' perceptions and experiences of Maths anxiety. The impact of engaging with Maths Recovery CPD on Teachers Maths Anxiety and confidence in teaching Maths.' It was imperative in order to provide an answer, that the qualitive data collected needed to be credible, supported with an analysis of the data, with myself, as the researcher becoming an instrument and tool in the interpretation of the research undertaken. By deciphering meaning from the contexts and experiences of the participants, through interpretation and understanding of their perceptions. Seventy Teachers from a wide range of educational settings took part in the research in which I was able to gather the data. Their roles included LA support teams, outreach services, senior management teachers, special schools, primary & secondary Teachers, who took part in the pre and post Maths Recovery training questionnaires. As well as ten volunteer participants who took part in semi-structured interviews. Both the pre and post questionnaires and interview data were analysed to gain further insight into teacher's experiences & perceptions of Maths Anxiety and also in terms of the impact of Maths Recovery CPD on their own Maths Anxiety and confidence in teaching Maths. Table 4.1 shows an overview in terms of experience and areas taught, of each of the participants who took part in the semi structured interviews.

Participants	Teaching Years	Key Stages Taught	Maths Teaching
Participant 1	42	1, 2 & 5	Y3 - 6 SEND Mainstream
Participant 2	20	Pre-school, 1, 2 & 3	R – Y6 SEND, Y4 & 5 Mainstream
Participant 3	25	3, 4 & 5	Y7 – 11 SEND Mainstream
Participant 4	30	Reception, 1 & 2	Reception Mainstream
Participant 5	35	R, 1, 2, 3 & 4	Y2 Mainstream & special school
Participant 6	34	3 & 4	None
Participant 7	26	1 & 2	Y1 – 6 Mainstream
Participant 8	17	1 & 2	Y3 & 4 Mainstream
Participant 9	16	Pre-school, 1, 2 & 3	Reception – Y3 Mainstream
Participant 10	16	1	R – Y2 Mainstream

Table 4.1

A thematic approach

This was used to interpret the data, which involved investigating the data collected to identify repeated and singular patterns, interpret and report them (Braun & Clarke 2006). As well as providing a way to describe the data collected it also involved interpretation by way of selecting codes and constructing themes. Braun and Clarke use a six-point approach to data analysis which was chosen as the most relevant to understand the experiences, perceptions and behaviours across the data collected (Braun and Clarke 2012). In answering the research question, ‘

- Teachers’ perceptions and experiences of Maths anxiety.
- The impact of engaging with Maths Recovery CPD on Teachers Maths Anxiety and confidence in teaching Maths.’

I needed to search for common or shared meanings. This allowed themes to be constructed with the view to reinterpret and connect elements of the data. As a researcher I had greater flexibility in which themes to identify, that gave insights which addressed the objectives of the research. A thematic approach was relatively easy to apply as there was a greater flexibility in terms of exploring personal accounts of participants’ feelings and experiences. It allowed key features to be highlighted and interpretation of a wide range of data. The limitations were that some critics’ perceptions of this approach are that this it is perceived as not rigorous enough (Nowell et al, 2017) and can be conducted poorly due to inconsistent approaches. I needed to ensure that in terms of my own research that I was aware of this, being sensitive to the context and coherency of my analysis. I strove to adhere to this through prolonged engagement studying the data collected and participants views with my representation of them by allowing them to check the transcripts.

Inductive Reasoning

I used Inductive reasoning as it provided a broader analysis of the set of data and supported the derivation of themes from the data collected through specific observations, pattern recognition and general conclusions (Bradford et al, 2024). Looking at the past experiences and existing knowledge of the participants involved in the research so that conclusions could be made to inform future practice. The positive aspect of using inductive reasoning is that it allows the researcher to work with a range of probabilities encompassing a wide area. Informed conclusions can then be made from this initial starting point by narrowing down assumptions made with multiple solutions. Thus, encouraging additional research to be undertaken. The disadvantage of inductive reasoning is that the data may be limited around specific areas and this could reduce the evidence obtained leading to incorrect conclusions.

Doing the analysis

Pre & Post Questionnaires

Initially, I looked at the pre and post questionnaires linked to the Maths Recovery CPD that the participants had attended. This also included a Maths Anxiety scale for them to complete initially, in terms of looking at the impact on participants confidence in teaching different Maths domains once the Maths Recovery CPD had been completed.

The results from the questionnaires were collated and analysed online. Using Microsoft forms software that had generated the pre & post surveys that were completed by the participants. A comparison was made between the scores from the pre & post questionnaires.

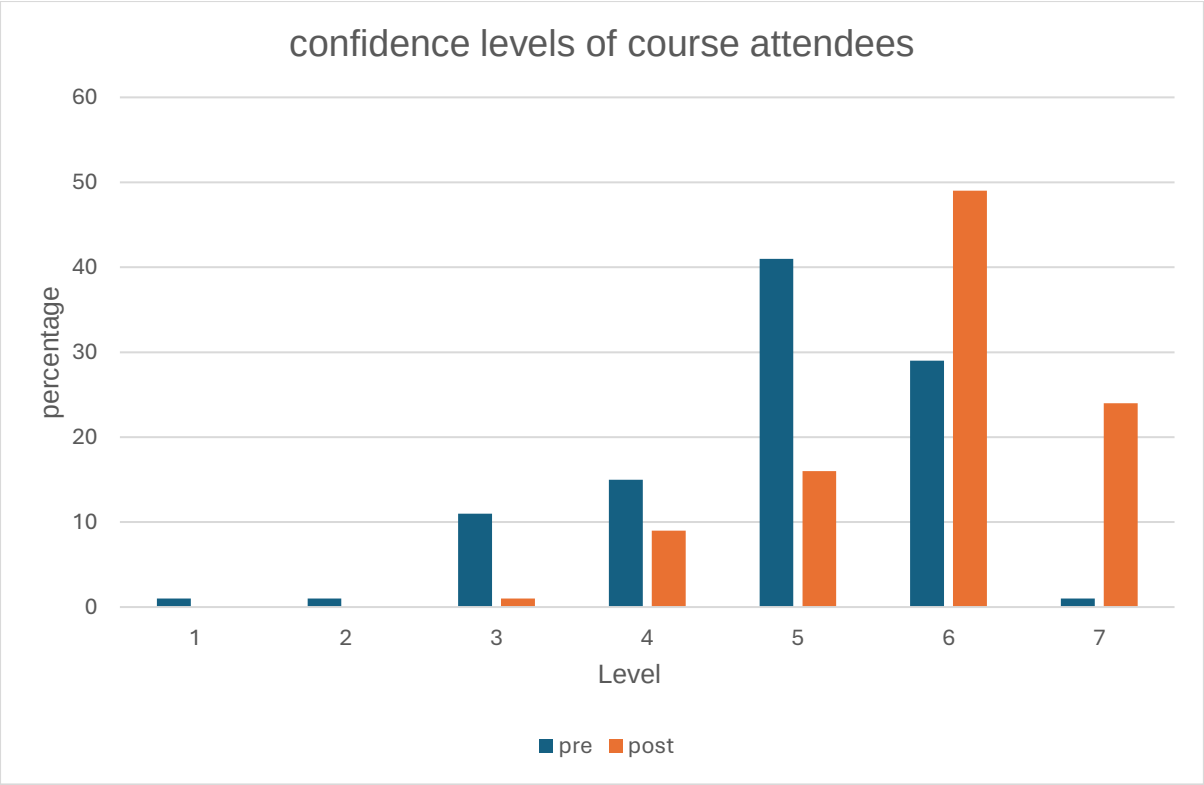


Table 4.2

In Table 4.2, Level 1 is not confident at all, whereas level 7 is extremely confident as indicated in the post questionnaire. The average rating pre course is 4.85, whereas the average rating post course is 5.85. Post course, those teachers who said that they are extremely confident in planning and delivering effective learning and teaching in Numeracy and mathematics rose from 1% to 24%. This shows that Maths Recovery CPD has a positive impact on those that attended the course in terms of their confidence levels.

Maths Domains

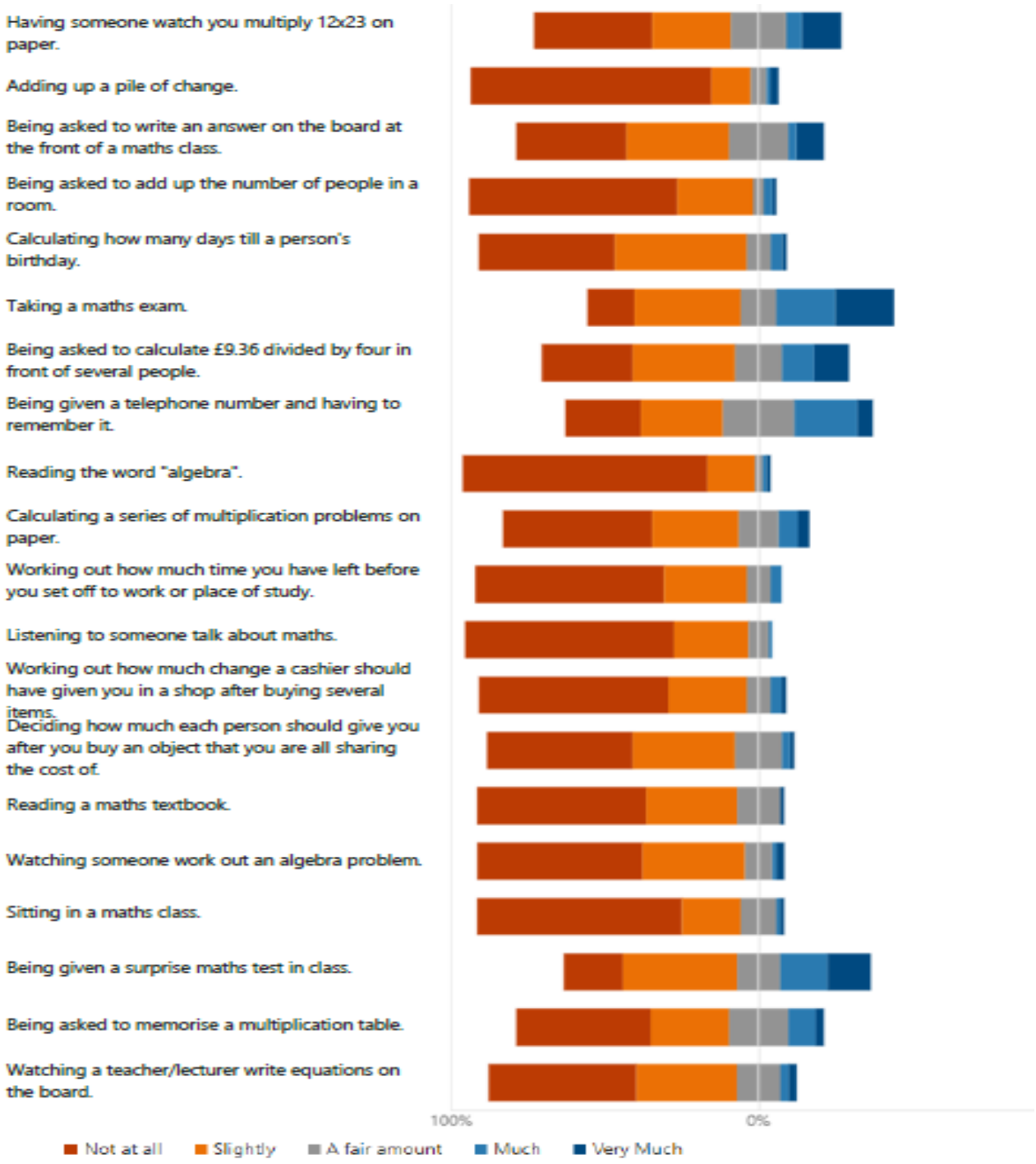
In analysing the impact in the maths domains that were covered in the training, confidence levels increased in all areas as shown in Table 4.3. The participants identified Number Words & Numerals, Structuring numbers 1 to 20 and Conceptual Place Value as the areas that they increased their confidence levels overall. Before undertaking the CPD some participants had no confidence at all in all areas, but after the Maths Recovery CPD this had reduced or been eliminated altogether. This was especially true in the areas of Early Structure and Conceptual Place Value.

How confident attendees felt about planning high quality learning and teaching experiences in the following areas:		
	Pre course	Post Course
Early Number Word & Numerals		
Early Structure		
Early Arithmetic Strategies		
Number Words & Numerals		
Structuring Numbers 1 to 20		
Conceptual Place Value		
Addition & Subtraction to 100		
Early Multiplication & Division		
Multiplicative Basic Facts		
Very confident	Somewhat confident	Not confident at all

Table 4.3

Maths Anxiety Scale and Results

Participants were also asked to complete a Maths Anxiety Scale as part of the pre-questionnaire. In the key provided not at all, relates to no confidence level and they knew therefore they were experiencing a high level of anxiety (See Table 4.4). The results of this show that in all areas every participant had some level of anxiety. The main areas identified with higher levels of anxiety appear to be linked to everyday life skills such as dealing with money and time. Also, mental addition and algebra also appear to cause higher levels of anxiety as well as listening to someone talk about maths and sitting in a maths lesson. It is interesting to note that these results show lower levels of Maths Anxiety occur in maths exams or tests with these participants.



Maths Anxiety Scale Results Continued

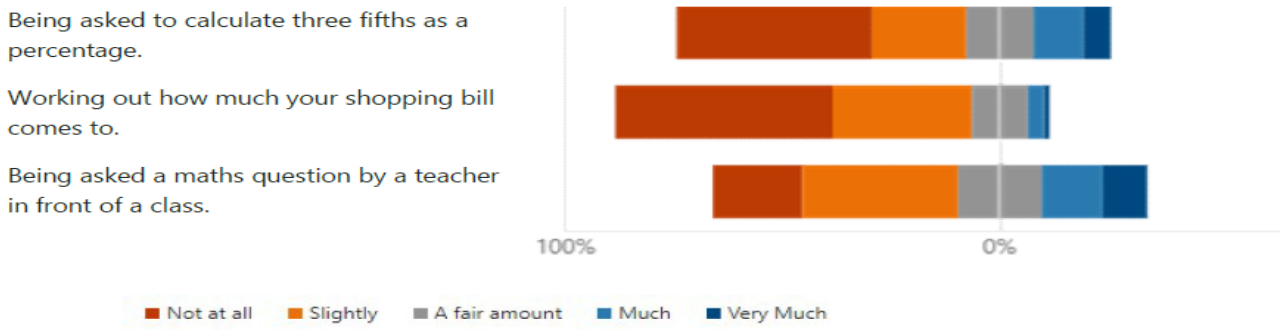


Table 4.4

Semi-Structured Interviews

Following the completion of the Maths Recovery CPD and the collation of results from the questionnaires. Ten participants volunteered who had undertaken the questionnaires and Maths Anxiety Scale, to participate in the semi structured interviews.

Six phase Thematic Analytic Process

Using the Six phase Thematic Analytic Process. I then proceeded to analysis the data collected from these interviews. (See Table 4.5).

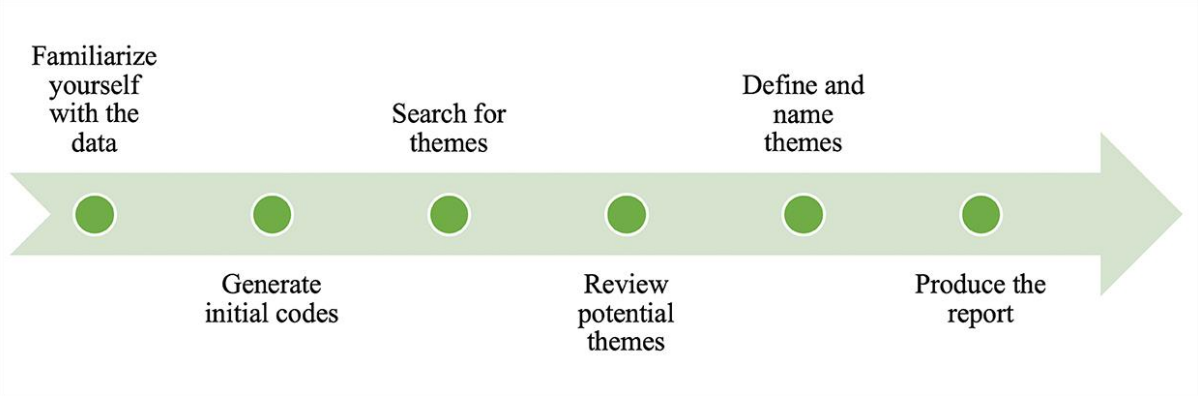


Figure 4.1 Six-phase Thematic Analytic process (adapted from Braun & Clarke, 2006, 2012)

Step one - Familiarisation

The first step was to familiarise myself with the data set. This involved repeated reading through the data collected through the semi structured interviews including the audio data that was transcribed. As these interviews were undertaken online using Microsoft Teams, I was able to record them and use the transcription provided. However, I still needed to check that the transcription was a true reflection on what had been said in the interview. On checking this there were a few errors, due to regional accents some of the words had been changed. As I had an audio recording

it was straight forward to amend these errors to make a true reflection on what had been said. This familiarisation was essential in allowing me to start to orient the information provided in the raw data.

Step two - Generating Initial Codes

The second step was to generate initial codes as coding helped to organise the data at a specific level. Notes were made on items of interest, questions and any connections noticed between the data was the start of this process. A code is 'the most basic segment, or element, of the raw data or information that can be assessed in a meaningful way' in relation to the research (Boyatzis 1998 p63). When generating the codes, they needed to be well defined ensuring that there were no overlaps with other codes and that they fitted together in a larger coding template or map. This was inductive and relevant to specific areas raised in the data. The same codes were applied to the rest of the data by labelling data extracts, making notes of any patterns and connections that informed theme development. In total 273 initial codes were generated. Due to constant revision & reviewing of the codes generated this was refined to the codes shown in table 4.5.

Step three - Define and name the Themes.

The third step was looking for themes by studying the coded data through an active and interpretive process. Themes were derived solely from the data and interpreted by analysing, combining, and comparing. Therefore, ensuring the themes were closely linked and reflective of the original data (Braun and Clarke 2006) so that key aspects of the research questions were answered. Thirteen themes were identified initially.

Step four - Reviewing the potential Themes

The fourth step was reviewing the potential themes which was a two layered process. Initially the thematic template or map was revised where the coded data was reviewed. Identifying whether themes were distinct from each other, have enough supporting data, commonality, and coherence. This was to ensure that in the final analysis all coded data was included. Detailed notes were kept on decisions around how and why themes were developed to strengthen the findings (Nowell et al. 2017). Next, the whole thematic map and data set was reviewed again to check that themes fitted meaningfully together and was a representative of all the data. Rereading and revising codes and themes were part of the analysis and relevant to the research question. On review five themes were identified as referenced in the Phase 4 column in table 4.5.

Step five - Definitions and Narrative Descriptions

The fifth step is where, for each theme, a definition and narrative description was created justifying the importance to the research question. Making explicit in the

narrative any unique insights from individual themes to the comprehensive understanding of the research (Braun and Clarke 2012).

Final Analysis in relation to, Teachers' perceptions and experiences of Maths Anxiety. The impact of engaging with Maths Recovery CPD on Teachers Maths Anxiety and confidence in teaching maths overall was positive

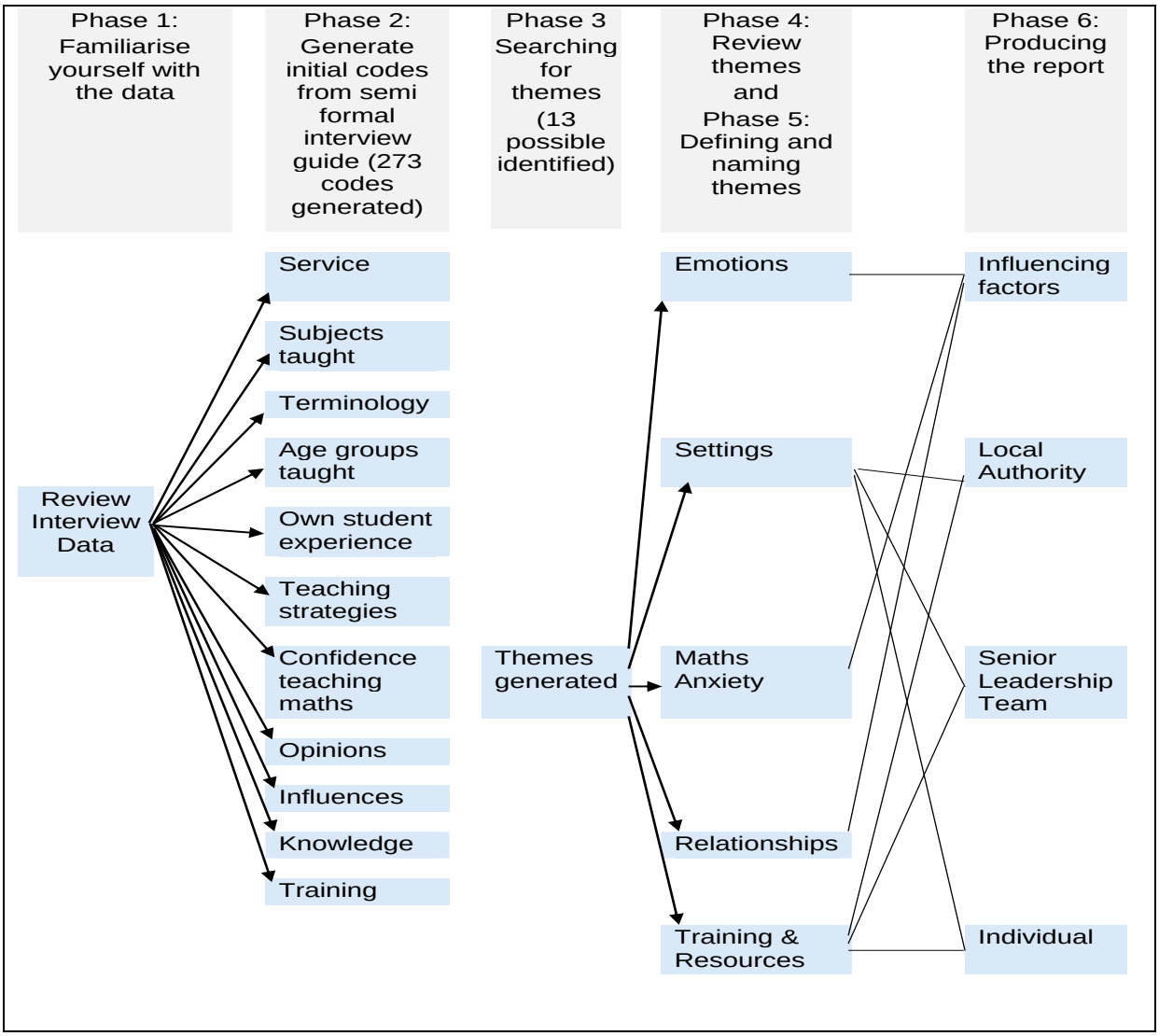


Table 4.5

Step 6 - The Report Findings

Influencing Factors

Influencing factors that were identified from the semi-structured interviews regarding the research question relating to the participants Maths experiences of being taught Maths are discussed below. All participants commented that experiences as a student influenced their own feelings towards Maths and in turn their confidence in teaching Maths.

Emotions

Some of the participants highlighted from reflecting on their own personal experiences and that of attitudes in schools that it seems to be acceptable to not be good at maths in contrast to not being good at reading. ‘I think there is still an attitude that its ok to be not good at maths and dismiss maths almost. Whereas that’s not the case for reading.’ Another participant commented, ‘I remember one of my parents saying they couldn’t do maths and that my uncle on the same side of the family couldn’t do maths. There was a sense of its inherited, so that’s why we can’t do maths in our family.’

This mindset is commented on in National Numeracy for everyone for life, looking at attitudes towards maths. It refers to researchers, Epstein et al 2010, who have looked at how in the UK, it appears to be culturally acceptable to not be good at maths in comparison to other skills needed in everyday life. Being perceived as a gift possessed by only a few.

Settings looking at Maths lessons at secondary school

Another influential factor discussed was the complexity and formality of the Maths lessons at secondary school. ‘At secondary it was all working out using textbooks, no concrete apparatus or anything. Showing your working out in your maths book, very much chalk and talk.’ ‘You sat in rows and just did your work. It wasn’t like there were many opportunities to go ask the teacher for help. You couldn’t go the lesson before as you were making your way over from the previous class. You relied on your friends.’ As stated in the responses it appeared that Maths teachers assumed the foundations were in place and were unaware that some of their students may have gaps in their learning. ‘I did quite well and felt confident in all subjects at primary. But at secondary when I asked a question because I didn’t understand, the teacher said you should have done that at primary. I was in set one but then moved to set 3 and the relief of having a teacher then who was happy to explain things in numerous ways until eventually the penny dropped’.

Consideration of the impact of style of teaching was looked at by Dr C. Rashaad Shabab from the University of Sussex, 2023. In the study it was found that Maths Anxiety is one of the main reasons why students turn away from studying maths. Stating that a safe environment needs to be provided where trial & errors can be made. Looking at individual progress rather than comparison to peers so that the threat of failure is reduced.

Maths Anxiety

Almost all participants responded that they currently had varying levels of Maths Anxiety linked to their own experiences of being a student. ‘It’s that mindset that you’re not going to make any progress anyway, no matter what, no matter how amazing somebody can teach you, it almost becomes irrelevant, when you’ve just decided you can’t do it.’

Most responses indicated that their levels of Maths Anxiety increased at secondary school when teaching became much more formalised in contrast to a more nurturing environment at primary school. ‘The teacher found it really, really frustrating that I couldn’t follow what he was telling the class to do. I’d gone from someone who was quite confident in primary to feeling I had no clue about anything about maths at all in secondary.’

In terms of identifying pupils with Maths Anxiety, one participant stated, ‘I worked with two pupils who had Maths Anxiety & it was really impacting on their confidence. When I went to pick one of them up from class & brought them back to the space where we were working, they just burst into floods of tears! When I spoke to her, she said I’m just so pleased to see you. She had no clue as to what was going on in the maths lesson that she was sat in.’ Another participant stated, ‘A little girl I was asked to go in to support, I used the Maths Recovery training to help me identify gaps in her learning. Her parents thought she was dyscalculic but reflecting on it now, it was Maths Anxiety. She is making progress now that we have identified the gaps and building her confidence. She just needed that boost of confidence. The class were working at a much higher level and expecting her to keep up. She just needed intervention and feel that sense of achievement.’

When asked if the participants would share that they had Maths Anxiety with their colleagues most replied that it would depend on the setting. Highlighting trust and supportive senior leaders as being the key to whether they would share or seek support. ‘I would think carefully about who I would share that I had Maths Anxiety with, and certainly would only do it, if I felt that they wouldn’t be judgmental.’

A recommendation in Dr Julie Whyte’s PHD Thesis on Maths Anxiety and Primary School Teachers, (2022), was to support teachers in allowing them to be honest about their anxieties and not hide it. Providing a positive and supportive maths culture through individual settings and teacher training where support can be easily accessed without judgement.

In addition to this all participants spoke about the pressure of having to give both mental & oral answers quickly both at primary and secondary School. Also, timed assessments added to their anxiety in Maths lessons. ‘Pupils sitting on the carpet and those times tables tests. It takes me right back. It’s your turn now to stand up and say your times table. You’d get a little star on the chart if you said it right and if you didn’t then disappointment from both the teacher and the idea you were letting yourself down. The pressure and fear of waiting for it to be your turn.’

Jo Boaler, in 2014, from her research suggests that Maths Anxiety can be caused by the pressure of tests that are timed and in turn disadvantaging these students. Boaler also goes onto suggests that this may promote memorising rather than understanding facts.

Relationships

This featured highly whether the participants had a negative or positive response to the subject of Maths. Many felt that they had better relationships with their primary teachers, ‘My memories of being in the infant class and sitting on a table with a close friend doing Maths. I enjoyed it and getting stars on a chart and praise.’

Whereas in secondary school these relationships weren’t developed to the same degree, ‘I just felt different around them (teachers) and that I couldn’t approach them for help.’ Another participant commented, ‘I had quite strict stern male maths teachers in high school so I didn’t feel I could ask for help.’ These comments on relationships with the participants teachers reflect findings from a study undertaken on student-perceived teacher support on Math Anxiety from Chau Wang, Qing Xu and Wei-Gun Fei (2024). The results indicated negative correlations with Maths Anxiety arising from perceptions of teacher support, relationships and self-efficacy.

Peer pressure was also mentioned in terms of the participants as students, not wanting to appear to be struggling and therefore not wanting to bring attention to themselves by approaching a teacher for help. ‘I wouldn’t put my hand up to answer questions, just be quiet and look busy, to not stand out from the others.’ A study on peer effect was conducted in 2020 by Garba, Aliyu; Ismail, Norulhuda; Osman, Sharifah; Rameli, Mohd Rustam Mohd. Which found that both positive & negative interactions, on a day-to-day basis can directly affect other students’ levels of Maths Anxiety respectively.

Training & Resources

The lack of concrete or pictorial equipment available in secondary school classes to support understanding was highlighted with complete reliance on the students at secondary school being able to do formal procedures and written methods. ‘Things weren’t explained particularly at secondary school as it was always just follow what the teacher did on the board. I had the same maths teacher and I got to year 9 before I realised that I didn’t understand any of this. I thought I’m not going to do well in my maths GCSE so may as well pretend. I would work out calculations knowing full well there was an incorrect answer, but I didn’t know how to work it out another way.’

In contrast to their experiences from primary school where these resources were available to support understanding, ‘breaking down skills and dependent on what that was, using practical and concrete resources as well.’ However, it was also mentioned transitions within Key stages at both primary and secondary school also had less resources available with a tendency to use workbooks and worksheets with pictures. ‘Maths wasn’t a strong subject for me as a child and I always had to work really hard at it. Using concrete resources really helped but then you were told you couldn’t use them in Y5 & 6. When I went to secondary school, they put me in the top set which was too high for me. I would say those years overlapping primary & secondary completely took away my confidence in maths.’

The participants commented that very often they felt that it was about getting the answers right than understanding the process. ‘Teaching often revolved around teaching processes & procedures but not necessarily focusing on understanding. In July 2018, Denis Abao Tan and Nino Richard Salingay, in their study found that pupils performed higher using a CPA approach compared to pupils that didn’t.

Training & Resources - Choice of Key Stage

Many of the participants reported that their experiences had influenced their choice of teacher training. ‘At teacher training college I was ok at the maths we did because it was KS1, so the actual expectations in terms of what I needed to know and do in maths was at a low level.’ Some participants chose to train as early years teachers, ‘I feel confident teaching younger children.’ Similar responses were gained for teaching in Key stage one where participants felt confident to teach within this key stage for Maths, ‘I was part of a team of three staff from my school who were a flagship for maths. We went around supporting schools. Lots of schools came in observing my lessons in KS1. But I wouldn’t be confident teaching in KS2, particularly Y5 & 6’.

Alternatively, teaching SEND pupils was also an area identified as an area chosen to teach, ‘I taught a small community of pupils withdrawn from the Maths curriculum in secondary school. You taught to their level which was the basics, including life skills such as using money and reading bus timetables. But there is no way I would have taught secondary Maths!’ Another participant also commented, ‘I didn’t do anything with maths at teacher training college as I did English & History. I don’t think I have the breadth of knowledge that if a pupil didn’t get it in the first opportunity to explain it in a different way. I personally would be very anxious if I was told I had to teach maths. That’s why I support pupils with SEMH and not subject specific.’

When asked to teach older pupils in KS2 and KS3 all participants felt they would need support. Most responded that they would need to revise each night themselves before teaching lessons the following day. ‘I was learning with the children. It was one of those situations where I would practise the night before.’ If possible, the participants would try to avoid or refuse to be put in this position. A participant who was a SENDCo commented, I was asked to teach booster classes in Y5 & 6, but I refused’.

The collaboration research project undertaken at Sheffield University, between the Maths and Statistics help centre (MASH) and the Specialist Learning Difference Centre (SpLD), referred to in the Literature review in Chapter 2. This study established that many students at the University had Maths Anxiety as a result of early negative experiences of maths affecting the development of maths skills and causing avoidance of maths subjects later on in life. This is also reflected in the findings from my research.

Training & Resources - Maths Recovery CPD

All participants agreed that if CPD was offered around Maths Pedagogy and Maths Anxiety, they would access it. To have an understanding to help themselves but also

to support pupils in their classes. Many felt that this type of CPD was not widespread enough in terms of developing confidence teaching Maths, but more specifically very little on understanding and teaching pupils with Maths Anxiety, ‘Since COVID on getting back into school there has been a lot of training around general anxiety, but I can’t recall anything specific to Maths.’

In relation to undertaking the Maths Recovery training, all participants commented on how much more confident they were in planning, assessing & teaching within the Maths domains covered. ‘Using the Maths Recovery Programme over 40 weeks helped the pupils I was teaching make some real gains in terms of their confidence, as well as developing those building blocks to be secure’.

Participants felt that they had been given the knowledge and skills to identify gaps in pupils learning as well as strategies to teach in these areas, developing the pupils conceptual understanding. ‘We did the Maths Recovery training. I remember saying Oh God I thought I could teach maths. Had I known about the Maths Recovery Program before, I would have done an even better job!’

Three out of the ten participants who undertook the semi structured interviews also shared that from leaving school themselves they had not had any further Maths input including at teacher training college. This was because the degree that they had studied and qualified as a teacher in was in subjects such as Sports Studies, Art, and Drama. In the roles that they now undertake they felt that the Maths Recovery CPD had bridged the gap in terms of understanding why they had difficulties. On reflection they now had a deeper understanding of their own Maths Anxiety and the reasons it had occurred based on past experiences. The Maths Recovery CPD had given them the confidence to support pupils who also may have Maths Anxiety. As well as an awareness of the Stages of Early Arithmetic Learning that pupils need to go through to be proficient in number. ‘The Maths Recovery training and related texts helped me as a teacher. The mini assessments that give a baseline. Teaching to the gaps rather than to passing SAT tests.’

Sabnani, 2021, notes that in order for teachers to believe in themselves and have the confidence to teach maths then they need to have a strong conceptual maths understanding. ‘

Implications

Local Authorities & Schools

An independent review was undertaken by OFSTED, commissioned by the DFE, and updated in May 2024. It took into consideration the Early Career Framework published in 2019, and The Early Career Framework in 2021. The focus of the review focused engagement and training that teachers and senior leaders had undertaken since April 2021. In the report findings it suggests that access to training had an impact on improving teachers’ knowledge and practice. However, identifying specific programmes of training that had led to this improvement was difficult.

Findings also stated that there was a common view across schools that the confidence and well-being of teachers had increased due to effective training received as well as increased staff morale and motivation. Albeit this, there was no further evidence collected by schools looking at the success of any individual training. Whilst this is a general overview of professional development provided for teachers, I think that the areas highlighted within the review of being able to put in place more robust tracking of individual training programmes and their outcomes is one that needs to be considered by local authorities and Senior Leadership Teams in schools and settings. In the case of my research findings this needs to be applied to the area of maths pedagogy, as was done for the Maths Recovery training through the pre & post questionnaires when accessing training, showing a positive outcome on teachers' confidence in delivering maths domains and in particular addressing Maths Anxiety.

The National Centre for Excellence in the Teaching of Mathematics (NCETM)

The NCETM was originally formed in 2006 with the core aim of providing training for maths for teachers in schools and colleges. This work is coordinated through 40 Maths Hubs across England and professional development is offered through three forms, work groups, programmes and communities. Further materials are available on the NCETM website to help teachers plan and deliver lessons. However, whilst this is an excellent resource of support for teachers in terms of teaching for mastery, across the early years, primary & secondary, there is currently very little in terms of supporting teachers or pupils with Maths Anxiety.

Summary

In Summary the area of Maths Anxiety needs to be addressed nationally as well as through local authorities and senior leaders in schools. Forums such as the Maths Hubs who are national, need to offer support in order for teachers to overcome their anxieties so that they can access the content of the training courses they provide. Clear signposting to websites and training providers that provide evidence-based programmes such as Maths Recovery, needs to be put in place in order with clear methods of evaluating the successes of these programmes to improve practice and address the area of Maths Anxiety for both teachers and pupils. With clear systems and identification of need established to support teachers with Maths Anxiety in place. The development of safe, positive maths communities, promoting peer mentoring within our schools where teachers can seek support and advice without judgement. Maths Anxiety scales such as was used in this research could be used as a tool pre & post intervention to assess the success of support in place. There are adult & children's versions of the Maths Anxiety scales that can be used for both staff & pupils to target specific support needs. Individual teachers will then be able to recognise and identify their own areas to be developed. Reflecting upon and working on individuals own growth mindset & resilience. Being proactive in following signposting to relevant training from local authorities and senior leaders as well as searching for and accessing research based CPD to support their own learning.

The next Chapter will discuss further the conclusion to the research question, ‘Teachers’ perceptions and experiences of Maths anxiety. The impact of engaging with Maths Recovery CPD on Teachers Maths Anxiety and confidence in teaching Maths.’

Chapter 5 Conclusion

Reflective Cycle

In terms of my research question regarding, ‘Teachers’ perceptions and experiences of Maths anxiety. The impact of engaging with Maths Recovery CPD on Teachers Maths Anxiety and confidence in teaching Maths.’ I have referred to Gibbs reflective cycle (1988) This provided a framework in order to reflect on the research I have undertaken so that I am able to learn, form conclusions and plan future steps which I will discuss further below.

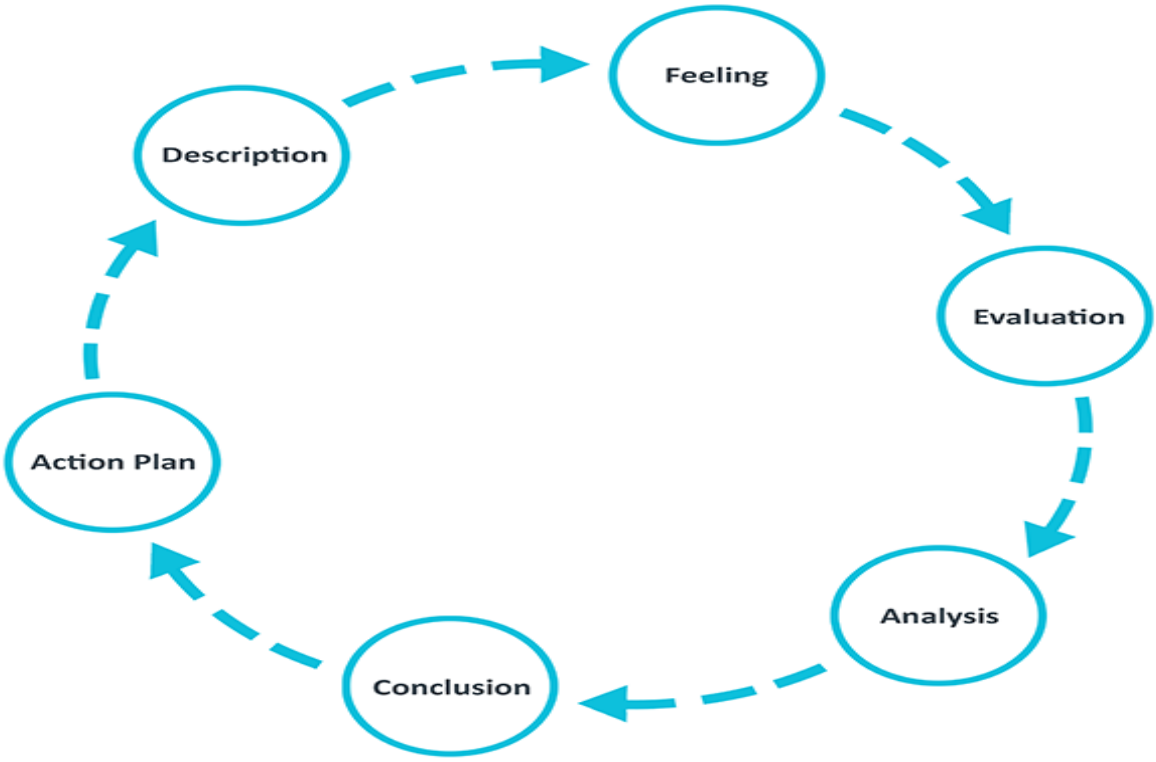


Figure 5.1 Gibbs Reflective Cycle, University of Edinburgh, 2020

Teachers’ perceptions and experiences of Maths anxiety.

The aim of this research was to explore initially, teachers’ perceptions and experiences of Maths Anxiety. Through the data analysis from the anxiety scale on the questionnaires and dialogue from the semi-structured interviews it has become apparent that from the sample of teachers looked at, all the participants experienced anxiety in some areas of mathematics which in turn has affected their teaching of the maths curriculum. In terms of addressing this, research findings from earlier studies undertaken by Dr Julie Whyte (2022) and Dr H Flavio Santos (2022) have suggested the importance of developing a supportive maths culture within education settings. Where teachers are not judged for having Maths Anxiety. Starting with initial teacher training and having effective training around pedagogical content alongside understanding Maths Anxiety and having strategies to draw upon for themselves with delivering teaching but also for those pupils within their classrooms that may be

experiencing Maths Anxiety. That this support is continued into teaching roles within educational settings primarily through CPD but also in developing positive learning communities. So that teachers are encouraged to be honest about their Maths Anxieties which can then be addressed by senior leadership teams through using effective systems of support to help these teachers become more confident in their abilities to teach maths. It is the responsibility of all and not just the individual to draw upon each other's strengths to have effective teaching environments. Role modelling effective teaching, use of resources and expertise.

The impact of engaging with Maths Recovery CPD on Teachers Maths Anxiety and confidence in teaching Maths

The second part of my research question was regarding the impact of engaging with Maths Recovery CPD on teachers Maths Anxiety and confidence in teaching maths. As illustrated in Chapter four, the results collated in Table 4.2 regarding the post questionnaire Maths Anxiety scale linked to the Maths Recovery CPD had a positive impact on confidence levels in planning and delivering effective learning and teaching in Numeracy and mathematics. Table 4.3 also illustrated that confidence levels of teachers delivering different maths domains were positively impacted particularly in the areas of number words & numerals, structuring numbers 1 to 20 and conceptual place value. In Ruth Willey's PHD thesis (2009) on the impact of Maths Recovery training on teaching staff constructs about the teaching and learning of number, found that these constructs were related to changes regarding their teaching. This supports the results from this research paper in terms of teacher confidences levels rising. Table 4.4 illustrated the results from the Maths Anxiety scale, clearly showing that most anxieties that the participants experience occurs with time, money. mental calculation and algebra. In view of this the Maths Recovery CPD providers may want to develop the training course further in the future to include the areas highlighted from this research.

In terms of my rationale stated in chapter one. I will be able to use the completed data analyse of the qualitive data collected from my research, to inform future collective CPD within my role for the local authority that I work for whole school settings and individuals. Addressing an understanding of Maths Anxiety, useful strategies, and identification of research-based maths interventions, such as Maths Recovery, that can be used to support teaching and learning. Reflecting on the evidence presented in the data analysis has helped me to understand the type of support that needs to be accessed by all schools within my local authority.

Recommendations

- From my conclusion further recommendations would be for schools to access high quality training linking theoretical and evidence-based content in order to understand what Maths Anxiety is. How it manifests and also effective strategies and resources that can be used to eliminate Maths Anxiety.

- For Maths Hubs to look at the offer of training packages covering Maths Mastery provided for teachers in England in respect of Maths Anxiety.
- For Local Authorities to carefully research training providers that offer training in Pedagogical content as well as Maths Anxiety within their authorities. Ensuring that training offered is of high quality, evidence based and delivered by Specialists, e.g. Maths Recovery.
- For senior leadership teams within educational settings to develop positive maths learning communities where individuals are valued and supported. Developing trusted relationships where teachers can, without judgement, be honest about their Maths Anxiety & receive the relevant support.
- For schools to have effective systems of support in place, such as peer mentoring, developing growth mindsets and resilience. Using anxiety scales where relevant to help track the effectiveness of intervention on Maths Anxiety, whether it be the teacher or pupil.

Signposting & Further Support

The Maths Anxiety Trust

In 2018 the Maths Anxiety trust was formed with the main aim to remove Maths Anxiety. Striving to make more people aware of and to understand Maths Anxiety. Alongside, working with parents and educationalists to improve outcomes and the potential for both pupils and teachers in the workplace experiencing Maths Anxiety.

British Dyslexia Association (BDA)

This is an association and is a membership organisation that provides information and advice to promote a dyslexia & dyscalculic, (inclusive of Maths Anxiety), friendly society which will enable people of all ages who have these conditions to reach their potential and flourish. The BDA Website provides advice, information, training and resources to both educators, employers and students.

Professional Association of Teachers of students with Specific Learning Difficulties (PATOSS)

This organisation has been developed to support teachers of pupils that have a specific learning difficulty, including those who are dyscalculic and those that have Maths Anxiety. The website provides a range of advice, support and publications that can be accessed. Online courses can be accessed on Maths Anxiety that are based on theoretical evidence giving approaches and strategies to support pupils who have Maths Anxiety.

Maths Recovery UK and Ireland

Is a non-profit charitable organisation governed by a board of trustees. Maths Recovery is an international intervention programme that was developed by Professor Robert Wright at Southern Cross University in New South Wales Australia.

The training delivered is around the evidence-based programme of Maths Recovery which looks at teaching Maths Pedagogy in Number. Training courses offered are for specialists delivering 1 to 1 teaching, Classroom teachers and teaching assistants as well as teachers involved in organising CPD at local authority level.

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Appendix 1 Signed Ethics form

MA: Module PRL4021 'Developing Practice'

Application Form for Ethical Approval of the Research Project

Your name and student ID:	Catherine Staunton-Unsworth 21383006
Your Supervisor's Name	Marcus Hill

1. Project title Understanding Maths Anxiety: A study of Teachers Maths Anxiety and the impact of specific Professional Development in reducing this for Teachers in England & Scotland.
2. What is the rationale for your research project?
The rationale will be to use the analysis of qualitive data collected to inform future collective CPD, that the central team that I am employed by can deliver, for whole school settings and individuals. This will address an understanding of Maths Anxiety, useful strategies and identification of research-based maths interventions that can both be used to develop teachers' confidence in teaching mathematics and pupils learning. Reflecting on the evidence presented will help me understand, co-ordinate and plan effective support that can be accessed by all schools within my local authority.
3. What are your research aims?
To explore Teachers' experience of Maths Anxiety. To understand whether and to what level Teachers associate Maths Anxiety with their own feelings about Maths. To study the impact of a specific Professional Development Programme (Maths Recovery) on Teachers Maths Anxiety.
4. What are your principal research questions?
1. What do Teachers understand 'Maths Anxiety' to be? 2. How Teachers experience Maths Anxiety? 3. Can specific Maths Professional Development, such as Maths Recovery, alleviate Teachers Maths Anxiety?
5. Research Strategy (Methodology and Methods)
Methodology I am proposing to use a mixed approach to my research using both Quantitative & Qualitative data. The focus will be on exploring views and practices, collecting,

and analysing both numerical and non-numerical data to provide a better understanding of the research question.

I intend to use a constructivist ontology (truth-value comes from what my mind does with information from the world) which regards people 'who actively construct their own meanings of situations and make sense of their world'. (Cohen et al, 2018)/

Focusing on interpretivist epistemology (I can therefore only know truth from a subjective perspective) looking at how behaviour and therefore data 'are socially situated, context-related, context dependent and context rich'. (Cohen et al, 2018) Meaning that as a researcher I will need to look at the whole picture that evolves in order to understand, describe, and explain 'the multiple and differing interpretations of situations, their distinctiveness, causes and consequences'. (Cohen et al, 2018)

With consideration given to the oncology & epistemology I will gain an in-depth, intricate understanding of personal opinions, experiences, values, behaviours, and emotions around this topic. Describing and exploring the data in order to develop further practices in context.

I will need to consider reflexivity and the 'positionality' of myself as part of the research process'. (Cohen et al, 2018) I acknowledge that I will need to consciously reflect on my own life experience and meaning constructed from this could influence the research. According to McCormick and James (1988, p.191) the researcher becomes a research instrument and therefore will need to closely monitor my own reactions, role, biases, and interactions with those participating in the research.

Methods

Primary data will be used, which is the original information collected for the purposes of this research. The advantages of this are that data can be collected specifically to answer the research questions and that there is more control over the methods used.

I am proposing to use two main research methods to gain the relevant information.

The first will be a questionnaire prior & post to undertaking Maths Recovery Professional Development training. These will be developed to generate information that is more general, containing single words and brief phrases, using majority closed questions. This will allow analyse of answers to be more straightforward and more cost effective. They will be designed to be self-administered without the researcher present. It is a more efficient use of time, in terms of the participants being able to complete it in their own time. Using standard questions will allow control of the stimulus and the order to which it is presented to all participants.

The main aim for using a questionnaire is to gain information around the participants' Maths experience & knowledge.

At the end of the questionnaire would be a scale for the participants to take to measure the extent of their confidence and any anxiety around Mathematics. The scale that will be used is the Mathematics Anxiety Scale-UK (MAS-UK) which is a 23-item anxiety scale and shown to be a reliable and valid measure of maths anxiety.

Once the results from the questionnaires are collated and analysed it would be possible to compare those who rate high on the scale and their experiences with Maths. This will then form the basis for selecting a smaller number of participants to be invited to a semi structured interview. This will be to explore further and draw connections between their experiences and their anxiety levels. Looking at how this impacts on their approach to teaching, their empathy with pupils who struggle with maths and their awareness of the issues. This method will give an insight into participant's perceptions, attitudes, opinions, narratives, and rationale. These interview questions may be altered slightly based on the results of the initial questionnaires.

The questionnaire will be given out again once Maths Recovery Training has finished to measure impact.

6. What is the location of your research?

England, Scotland and Northern Ireland.

7. Describe how you will identify and recruit human participants

The research participants will be Teachers from a range of schools, as they are key to the research question and objectives. An estimate of numbers for the first stage of the research using the questionnaires and anxiety scale will be approximately 70 teachers from a range of educational settings. Then this data will be used to identify a smaller sample of Teachers to undertake the semi-structured interviews with, again an estimate of approximately ten teachers overall.

Initial conversations have already taken place with the Professional Development Providers (Maths Recovery) and Local Authority Officers, who will be the gatekeepers to the participants taking part. Once this research proposal has been approved then I can proceed in contacting the gatekeepers to discuss the research objectives, timeframe and research methods that will be used in order to gain access to the participants. It will be necessary to get approval from the identified Teachers accessing the Professional Development Programme. This will be addressed by sending letters of contact outlining the research and credentials of the researcher.

8. Duration of project

From: November 2022 To: April 2024

9. Data Collection dates

From: December 2022 To: March 2024

Compliance with BERA 2018 Guidelines and EHU Research Ethics Policy (2020-2023)

In this section use the BERA prompts to identify the main ethical concerns you must address in your research.

Having studied the BERA guidelines, state **briefly** how you have addressed and mitigated each of the following key ethical issues. ***All boxes must be completed***.

Voluntary Informed Consent	As a researcher I will need to ensure wherever possible individuals are reassured and understand that their involvement will only take place if they consent to it. I will need to be aware of any power relationships that may influence participants taking part, including my own by working for the Local Authority. I will also need to consider what effect the outcomes from the research will have on individuals taking part in this research. Taking responsibility of duty of care and to recognise any potential risks that may arise. When undertaking the interviews, I will need to be sensitive to the fact that the research covers areas that may be considered to be sensitive and personal. A considerate approach will need to be employed to put the participants at ease and encourage them to respond in an open and honest manner. As the interviews will be completed in a one-to-one situation it will make it straightforward to focus on specific ideas with individuals and easier to control. A clear list of issues will be addressed through the questions used but there will be flexibility in the order that the topics are considered with more emphasis on the interviewee elaborating on points of interest. Another advantage is that it will be easier to transcribe a recorded interview. Any transcriptions will need to be shared with the participants to check with them that they agree it is an accurate statement of their responses and to gain their consent to use it as part of the data.
Avoidance of Deception	As an interviewer I will ensure that the participants are aware and understand the research objectives, gaining their consent beforehand and that their responses will be anonymous.
Right to withdraw	Participants will be informed of their right to withdraw, at any time, for any or no reason.
Use of incentives	Participants are informed of the outcomes of the research and to take into consideration subsequent use of the research. Considering maximising the benefits of the research whilst minimising any risk to the participants and establishments involved. (BERA, 2018)
Possible detriment	

Disclosure of illegal behaviour	
The particular interests of children or other vulnerable groups (if applicable)	No children are involved in this study. Teachers involved in the study will be anonymised.
Minimisation of the burden on schools and educational settings	Use of questionnaires that can be undertaken in the Teachers own time prior to and on completion of the Professional development Course. (Or time given during the course)
Method(s) for securely storing your data.	Privacy and data storage requirements will be followed. Anonymity of participants will be kept by employing fictionalised approaches when reporting. Following legal requirements in relation to the use and storage of personal data including GDPR requirements. All data will be kept securely, including where possible online questionnaires using Edge Hill's JISC survey software, anxiety scales, recordings, and transcripts of interviews, kept digitally on my One Drive EHU account to be in line with GDPR.
Any other ethical considerations not covered above	
Any risks not covered above	

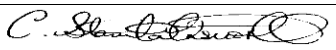
Special Considerations

Please state below any special measures that will need to be undertaken during this project due to Covid19

Measures to ensure Covid19-secure working
Questionnaires emailed to participants. Interviews undertaken over TEAMs.
Measures to enable the completion of the project during the pandemic, should field work become unavailable to you
The Professional Development course can be delivered online if necessary.

Student declaration

Statement	Tick to confirm
I confirm that I will follow appropriate ethical principles throughout my project.	√
I confirm that I have sought all relevant permissions and consent from all participating institutions and individuals (e.g., Headteacher / Principal).	√
I confirm that I have made provision for safe and effective working during the Covidi19 pandemic, and taken appropriate steps to mitigate risk to myself or participants	√

Student signature		Date:	29.11.22

Educational setting support for the project

(To be completed by an appropriate representative of the educational setting)

Statement			Click to confirm
I confirm that the MA participant and I have discussed this research proposal and that it satisfies our institutional ethical guidelines and policies (e.g., data protection, child protection, safeguarding, risk assessment, home-school liaison requirements and all other relevant guidelines and policies).			
Signature Charlotte Madine	Print name Charlotte Madine	Role: Chair, Maths Recovery Council UK and Ireland	Date: 1st December 2022

Statement			Click to confirm
I confirm that the MA participant and I have discussed this research proposal and that it satisfies our institutional ethical guidelines and policies (e.g., data protection, child protection, safeguarding, risk assessment, home-school liaison requirements and all other relevant guidelines and policies).			
Signature A. Worrall	Print name **Alexandra Worrall**	Role: **Manager TESS Team**	Date: **1.1.2022**

Please note: your proposal cannot be considered by the Approvals Panel unless there is a signature scanned into the box here or you get the senior leader in your setting to email Dr Francis Farrell (farrellf@edgehill.ac.uk) to the effect that they have agreed and approved your research in their setting.

Feedback	
Outcome	Approved
Approval status	**Approved**
Granted by	**Francis Farrell**
Date	**26/1/24**

Appendix 2 – Consent form

Edge Hill University

Faculty of Education,

St Helens Rd,

Ormskirk L39 4QP,

Tel: +44 (0) 1695 757 171

Participant Information Sheet

Title of Research Project: Teachers' perceptions and experiences of Maths anxiety. The impact of engaging with Maths Recovery CPD on Teachers Maths Anxiety and confidence in teaching Maths.

Researcher: Mrs Catherine Staunton-Unsworth

Email contact: 21383006@edgehill.ac.uk

Date:

Dear _____

I would like to invite you to take part in a research project led by myself as part of my Masters' Degree in SEND, at the Faculty of Education at Edge Hill University.

Before you decide if you wish to take part you need to understand why the research is being conducted and what it would involve for you. Please take time to read the following information carefully. Talk to others about the study if you wish. Ask if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

This document includes:

- Information about the purpose of the study (what we hope to find out).
- Information about what participation means (what you will be doing) and how to withdraw if you wish to do so.
- Details of what notes, recordings and other sources of information may be used as ‘data’ in the study for you as an individual.
- Information about how this data will be secured and stored.
- Information about how any quotations will be used and how you can be involved in checking, agreeing, and consenting to their use.
- How the information will be used in the research project and for other purposes such as conference presentations or publication.

The purpose of the study

To explore teachers’ experience of Maths Anxiety and understand whether and to what level teachers associate Maths Anxiety with their own feelings about Maths. To look at the impact of a specific Professional Development Programme (Maths Recovery) on Teachers Maths Anxiety. Providing an understanding of Maths

Anxiety, useful strategies, and identification of research-based maths interventions

that can both be used to develop Teachers’ confidence in teaching Mathematics and pupils learning.

What participation involves and how to withdraw if you no longer wish to participate.

Why have you been invited?

You have been invited to participate because your knowledge and experience will provide insights into the area of Maths Anxiety which will help to evaluate my research. Your involvement in the study is timely and relevant and in doing so will help improve future training provided for teachers in the area of Maths Anxiety.

Do you have to take part?

No, your participation is entirely voluntary. If you do not wish to take part, then please let me know. Portable devices will be encrypted where they are used for identifiable data. All data will be anonymized, and no third person will be able to identify your individual contribution to the research project.

You can withdraw from the project at any time. If you choose to withdraw your related data (recordings, notes) will be destroyed and all references removed.

What would taking part involve for you?

The aim of this research is inform an understanding of Teachers experience of Maths Anxiety and the impact of a specific Professional Development Programme (Maths Recovery) on Teachers Maths Anxiety. Participation in this research project is not a requirement of your role.

What will you have to do?

Firstly, you need to read this information sheet and consent form. I will be available for questions via email or telephone. Once you are fully happy with giving your consent to taking part in the research project you will need to sign the consent form. I will then confirm a date for the interview which will consist of approximately a 30-minute interview. The interview will be recorded and subsequently transcribed. If at any point in the interview process you feel uncomfortable with the questions or wish to end the interview, recording will be stopped, and the interview will be terminated.

Protecting your data and identity

What will happen to the data?

'Data' here means the researcher's notes and audio recordings and any email exchanges we may have had. Audio recordings will be transferred and stored on my password protected One Drive EHU account to be in line with GDPR and deleted from portable media.

Identifiable data (including recordings of your voice) with devices such as portable recorders will be deleted as quickly as possible. In the meantime, I will ensure the portable device will be kept in a locked drawer until the data is deleted.

You can request to view the field notes or listen to the audio recording at the end of the interview and any parts you are unhappy with will be deleted or disregarded from the data. Data may be used in the reporting of the research in any papers or

conference presentations. Please note that if your data is used, it will not identify you in any way or means.

You have the right to request your data is destroyed if withdrawing. You also have the full protection via the UK Data Protection Act. The completion of this study is estimated to be by June 2024.

How will your identity be protected?

Anonymity of participants will be kept by employing fictionalised approaches when reporting to protect your identity in the research report and any identifying information about you will be removed from the report.

Who to contact for further information or with *any* concerns.

If you have any concerns about the research ethics of this study and would like to register these concerns with an independent person, please consult the Secretary to the University Research Ethics Committee (email address: *Research@edgehill.ac.uk*)

If you would like further information on this project or have any concerns about the project, participation please contact the research team.

Thank you for reading this information sheet.

Please sign the attached form if you agree to be interviewed.

Yours sincerely Mrs Catherine Staunton-Unsworth

Edge Hill University

Faculty of Education,

St Helens Rd,

Ormskirk L39 4QP,

Tel: +44 (0) 1695 757 171

Title of Research: Teachers' perceptions and experiences of Maths anxiety. The impact of engaging with Maths Recovery CPD on Teachers Maths Anxiety and confidence in teaching Maths.

Name of Researcher: Mrs Catherine Staunton-Unsworth **Please read**	**Please Tick**
1. I confirm that I have read and understand the information sheet dated ……..	
2. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.	
3. I understand that my participation in this research study will not affect my role.	
4. I understand that my participation in this research study is voluntary. If for any reason I wish to withdraw during the period of this study, I am free to do so without providing any reason and the data will be destroyed.	
5. I understand that my comments in the interview process will be part of the data collected for this study and my anonymity will ensured. I give consent for all my contributions to be included and/or quoted in this study.	
6. I consent to the interview being recorded on a digital voice recording device.	
7. I understand that the information I provide will be used for a research project and will be published. I understand that I have the right to review and comment on an executive summary of the draft paper before the final submission.	
8. I agree to take part in the above study.	
Name of Participant:	
Signature:	
Date:	

Appendix 3 – Pre-Questionnaire

Effective Pedagogical Practice in Mathematics and Numeracy Training (Pre)

Your answers will be used to measure the impact of the Maths Recovery Course on your professional Development.

This form will be used as a 'pre' measure and will be repeated at the end of the series to assist with a research paper looking at the impact of the training on personal subject knowledge & development. Your answers will be treated in the strictest confidence and all data will be handled, processed and stored in accordance with the General Data Protection Regulation and Data Protection act 2018. None of the data you provide will be used to personally identify you and the data collated will be used for analysis and reporting purposes only. You have the right to withdraw your consent to processing your personal data at any time and you have the right to access your data. Information shared in these evaluation forms will be used to report on impact and will be used responsively to strengthen further professional learning events. Positive feedback may be shared anonymously via our social media channels.

If you have any questions about the survey please contact c.staunton-unsworth@wigan.gov.uk

please answer the questions below before proceeding to the survey. *

	Yes	No
I consent to my data being used for the purposes explained above	0	0
I understand that any information i give will be treated confidentially and securely, in accordance with the terms of the Data Protection Act 2018	0	0
I understand that I can withdraw from this survey at any time and that my data will then not be used or processed.	0	0

1. Which Establishment or sector do you currently work in? (Please select all that apply)

- O ASN Provision
- O Early Years and Childcare Setting
- O Primary School
- O Secondary School
- O Other

2. What is your job title?

0 Class Teacher

0 Maths Subject Teacher

0 Maths Coordinator Teacher

0 Head Teacher

0 Other

3. Overall, how confidant do you feel in planning and delivering effective learning and teaching in Numeracy & Mathematics.

1	2	3	4	5	6	7

Not at all Extremely

4. What previous professional learning have you engaged in with relation to Numeracy & Mathematics? (short bullet points)

5. How confident do you feel about planning high quality learning and teaching experiences in the following

	very confident	Somewhat confident	Not Confident at all
Early Number Word & Numerals	◯	◯	◯
Early Structure	◯	◯	◯
Early Arithmetic Strategies	◯	◯	◯
Number Words & Numerals	◯	◯	◯
Structuring Numbers 1 to 20	◯	◯	◯
Conceptual Place Value	◯	◯	◯
Addition & Subtraction to 100	◯	◯	◯
Early Multiplication & Division	◯	◯	◯
Multiplicative Basic Facts	◯	◯	◯

6. What is your main reason for signing up to this programme?

Teaching Approach

Reflecting on your practice in teaching Mathematics and Numeracy PRIOR to starting this training, rate yourself against the following statements.

7. I teach in an enquiry-based manner, with children thinking hard to solve challenging questions

1	2	3	4	5	6	7

Never Always

8. I use direct teaching, transmitting knowledge

1	2	3	4	5	6	7

Never Always

9. I assess continuously through teaching, always revising my understanding of the learner's knowledge

1	2	3	4	5	6	7

Never Always

10. I use assessment for summative purposes at fixed points in time.

1	2	3	4	5	6	7

Never Always

11. I teach just beyond the 'cutting edge' of a learner's current knowledge.

1	2	3	4	5	6	7

Never Always

12. I match my teaching or tasks to the curriculum rather than the learner's knowledge or performance.

1	2	3	4	5	6	7

Never Always

13. I use my understanding of learner's numerical strategies. to help them to develop more sophisticated ones.

1	2	3	4	5	6	7

Never Always

14. I tend to focus on procedures and learners getting correct answers.

1	2	3	4	5	6	7

Never Always

15. I make intensive observations of learners whilst teaching, and continually adjust my teaching as a result of these observations.

1	2	3	4	5	6	7

Never Always

16. I keep to my planning and timing of a pre-planned course rather than making adjustments based on pupil responses.

1	2	3	4	5	6	7

Never Always

17. I start from learner's intuitive, verbal strategies, and base the development of written methods on these.

1	2	3	4	5	6	7

Never Always

18. I start with direct teaching of standard, written methods.

1	2	3	4	5	6	7

Never Always

19. I focus on learners developing verification strategies when solving problems and to have intrinsic satisfaction from this.

1	2	3	4	5	6	7

Never Always

20. I am satisfied if a learner has one method to solve a problem and they get the correct answer.

1	2	3	4	5	6	7

Never Always

Appendix 4 – Post Questionnaire

Effective Pedagogical Practice in Mathematics and Numeracy Training (Post)

Your answers will be used to measure the impact of the Maths Recovery Course on your professional Development.

This form will be used as a 'post' measure and will be compared to the answers given from the pre training questionnaire in terms of the research paper looking at the impact of the training on personal subject knowledge & development. Your answers will be treated in the strictest confidence and all data will be handled, processed and stored in accordance with the General Data Protection Regulation and Data Protection act 2018. None of the data you provide will be used to personally identify you and the data collated will be used for analysis and reporting purposes only. You have the right to withdraw your consent to processing your personal data at any time and you have the right to access your data. Information shared in these evaluation forms will be used to report on impact and will be used responsively to strengthen further professional learning events. Positive feedback may be shared anonymously via our social media channels.

If you have any questions about the survey please contact
c.staunton-unsworth@wigan.gov.uk

1. please answer the questions below before proceeding to the survey. *

	Yes	No
I consent to my data being used for the purposes explained above	0	0
I understand that any information i give will be treated confidentially and securely, in accordance with the terms of the Data Protection Act 2018	0	0
I understand that I can withdraw from this survey at any time and that my data will then not be used or processed.	0	0

2. Which Establishment or sector do you currently work in? (Please select all that apply)

- O ASN Provision
- O Early Years and Childcare Setting
- O Primary School
- O Secondary School
- O Other

3. What is your job title?

0 Class Teacher

0 Maths Subject Teacher

0 Maths Coordinator Teacher

0 Head Teacher

0 Other

4. Overall, how confidant do you now feel in planning and delivering effective learning and teaching in Numeracy & Mathematics?

1	2	3	4	5	6	7

Not at all Extremely

5. Overall, has the pedagogy of Maths Recovery, and the strategies taught through this training improved your confidence in planning, teaching and assessing effective learning and teaching in Numeracy & Mathematics?

1	2	3	4	5	6	7

Not at all Extremely

6. How confident do you feel about planning high quality learning and teaching experiences in the following:

	very confident	Somewhat confident	Not Confident at all
Early Number Word & Numerals	○	○	○
Early Structure	○	○	○
Early Arithmetic Strategies	○	○	○
Number Words & Numerals	○	○	○
Structuring Numbers 1 to 20	○	○	○
Conceptual Place Value	○	○	○
Addition & Subtraction to 100	○	○	○
Early Multiplication & Division	○	○	○
Multiplicative Basic Facts	○	○	○

7. In which areas do you feel you have gained in confidence when planning high quality learning and teaching experiences?

	Yes	No
Early Number Word & Numerals	O	O
Early Structure	O	O
Early Arithmetic Strategies	O	O
Number Words & Numerals	O	O
Structuring Numbers 1 to 20	O	O
Conceptual Place Value	O	O
Addition & Subtraction to 100	O	O
Early Multiplication & Division	O	O
Multiplicative Basic Facts	O	O

Teaching Approach

Reflecting on your practice in teaching Mathematics and Numeracy now that you have completed this training, rate yourself against the following statements.

8. I teach in an enquiry-based manner, with children thinking hard to solve challenging questions.

1	2	3	4	5	6	7

Never Always

9. I use direct teaching, transmitting knowledge.

1	2	3	4	5	6	7

Never Always

10. I assess continuously through teaching, always revising my understanding of the learner's knowledge.

1	2	3	4	5	6	7

Never Always

11. I use assessment for summative purposes at fixed points in time.

1	2	3	4	5	6	7

Never Always

12. I teach just beyond the 'cutting edge' of a learner's current knowledge.

1	2	3	4	5	6	7

Never Always

13. I match my teaching or tasks to the curriculum rather than the learner's knowledge or performance.

1	2	3	4	5	6	7

Never Always

14. I use my understanding of learner's numerical strategies. to help them to develop more sophisticated ones.

1	2	3	4	5	6	7

Never Always

15. I tend to focus on procedures and learners getting correct answers.

1	2	3	4	5	6	7

Never Always

16. I make intensive observations of learners whilst teaching, and continually adjust my teaching as a result of these observations.

1	2	3	4	5	6	7

Never Always

17. I keep to my planning and timing of a pre-planned course rather than making adjustments based on pupil responses.

1	2	3	4	5	6	7

Never Always

18. I start from learner's intuitive, verbal strategies, and base the development of written methods on these.

1	2	3	4	5	6	7

Never Always

19. I start with direct teaching of standard, written methods.

1	2	3	4	5	6	7

Never Always

20. I focus on learners developing verification strategies when solving problems and to have intrinsic satisfaction from this.

1	2	3	4	5	6	7

Never Always

21. I am satisfied if a learner has one method to solve a problem and they get the correct answer.

1	2	3	4	5	6	7

Never Always

Appendix 5 – Maths Anxiety Scale

Mathematics Anxiety Scale-UK (MAS-UK)

		How anxious would you feel in the following situations?.....Please circle the appropriate numbers below.				
		Not at all	Slightly	A fair amount	Much	Very much
1.	Having someone watch you multiply 12 x 23 on paper.	1	2	3	4	5
2.	Adding up a pile of change.	1	2	3	4	5
3.	Being asked to write an answer on the board at the front of a maths class.	1	2	3	4	5
4.	Being asked to add up the number of people in a room.	1	2	3	4	5
5.	Calculating how many days until a person's birthday.	1	2	3	4	5
6.	Taking a maths exam.	1	2	3	4	5
7.	Being asked to calculate £9.36 divided by four in front of several people.	1	2	3	4	5
8.	Being given a telephone number and having to remember it.	1	2	3	4	5
9.	Reading the word "algebra".	1	2	3	4	5
10.	Calculating a series of multiplication problems on paper.	1	2	3	4	5
11.	Working out how much time you have left before you set off to work or place of study.	1	2	3	4	5
12.	Listening to someone talk about maths.	1	2	3	4	5
13.	Working out how much change a cashier should have given you in a shop after buying several items.	1	2	3	4	5
14.	Deciding how much each person should give you after you buy an object that you are all sharing the cost of.	1	2	3	4	5
15.	Reading a maths textbook.	1	2	3	4	5
16.	Watching someone work out an algebra problem.	1	2	3	4	5
17.	Sitting in a maths class.	1	2	3	4	5
18.	Being given a surprise maths test in a class.	1	2	3	4	5
19.	Being asked to memorise a multiplication table.	1	2	3	4	5
20.	Watching a teacher/lecturer write equations on the board.	1	2	3	4	5
21.	Being asked to calculate three fifths as a percentage.	1	2	3	4	5
22.	Working out how much your shopping bill comes to.	1	2	3	4	5
23.	Being asked a maths question by a teacher in front of a class.	1	2	3	4	5

Appendix 6 – Interview Questions

1. How long have you been teaching?
   What age groups and subjects have you taught?

2. What is your experience with teaching mathematics?
   How long have you taught it for?

3. What does "maths anxiety" mean to you?

4. What was your experience of being taught maths when you were a student? Do you feel confident in your own mathematical knowledge as a student & teacher? Is this different?

5. Do you have experience of dealing with students who have Maths Anxiety? How did you know they were experiencing Maths Anxiety?

6. What strategies, if any, did you use to help these students?

7. In your opinion, were these strategies effective in helping alleviate the students' maths anxiety? How effective?

8. Do you find your own personal experiences or perceptions of mathematics as an influential factor to your teaching?

9. What has the impact been on your own knowledge & confidence to teach mathematics to students who have maths anxiety and/or difficulties with maths?

10. How will you use what you have learnt from attending the Maths Recovery Training & delivering the gap tasks to make a difference to you pupils?