A Pilot Maths Anxiety Storybook Approach to Normalise Maths Talk in Children and to Support Emotion Regulation.

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Abstract:	Research and education stakeholders in the UK acknowledge math anxiety as a detriment to learning math and is associated with performance deficits, avoidance and limiting career opportunities. Support approaches and strategies have typically focused on instruction and emotion regulation, but not necessarily in younger children using a more sustainable resource, such as a targeted storybook approach. Therefore, in this qualitative study, children aged 6-7 years (N=15) across two UK primary schools took part in 1:1 discussion surrounding engagement with a math anxiety storybook approach. Following reflexive thematic analysis, three global themes were identified: [A1] Math Application: (1) counting, and (2) mathematical language, [B2] Strategies: (1) social learning, (2) resilience and self-regulation, and [C3] Emotive Responses: (1) perceptions of self and math, and (2) success and happiness. Overall, our findings suggest that children successfully engaged with a storybook approach - with integrated math problems - which normalised math talk in a non-judgment-based environment and led to more positive perspectives of math and more resilient approaches and solutions. We discuss these findings in relation to developing emotion regulation using a sustainable and flexible resource.

Table 1. Participant details pertaining to SEN status, attainment level, and CMAS-UK scores.

Participant	SEN Dyslexia/ Dyscalculia	Gender	Attainment Level (Working at)	CMAS-UK Score & (Mean; 1=lower anxiety; 3=higher anxiety)
School 1				
1	No	Male	Greater Depth	19 (1)
2	No	Male	Expected Level	30 (1.58)
3	No	Female	Expected Level	35 (1.84)
4	No	Male	Greater Depth	23 (1.21)
5	No	Female	Expected Level	38 (2)
6	No	Male	Expected Level	24 (1.26)
12	No	Female	Expected Level	28 (1.47)
13	Yes	Male	Not Expected Level	39 (2.05)
School 2				
7	No	Female	Expected Level	34 (1.79)
8	No	Female	Expected Level	38 (2)
9	No	Male	Not Expected Level	39 (2.05)
10	No	Male	Expected Level	34 (1.79)
11	No	Female	Expected Level	44 (2.32)
14	No	Female	Greater Depth	30 (1.58)
15	No	Female	Expected Level	33 (1.74)

Table 2. Example items from the CMAS-UK

Example Items
Item 3: *If I make a mistake in numeracy, I feel…*
Item 7: *When I see lots of numbers, I feel…*
Item 10: *Listening to the teacher in my numeracy class makes me feel…*
Item 15: *If I don't finish my numeracy work in class, I feel…*

Table 3. MA storybook standardised questions and events

Storybook Questions	Events & Problems to be Solved within the Story
Page 6 How do you think Noodle feels about maths? Why do you think she feels like this? Have you ever felt scared about maths?	The main character presents as nervous about maths.
Page 7 Why does Noodle start to sneak away? Have you ever tried to avoid maths before?	The main character presents as nervous about maths.
Page 9-11 How do you think Noodle feels now? Why do you think this? What did Leo suggest to help Noodle feel better?	Solving problem #1.
Page 12 How did Noodle feel? Why? What does Noodle think about maths?	The main character has helped solve the problem.
Page 16 How does Noodle feel about maths now? What has Noodle started to do that has made her feel better?	The main character again presented as nervous about maths and then helped to solve problem #2.
Page 17 How is Dad feeling about his maths problem? What does Noodle do to help him?	The main character observes someone else feeling nervous about maths and then helps to solve the problem #3.
Page 20 What would you tell someone who felt worried about maths? Do we think Noodle is scared anymore? Why? What could you do when you feel worried about maths?	The child reflects on what has happened in the story.

Figure 1. Thematic map of the identified global and organising themes (children aged 6-7 years; Year 2)

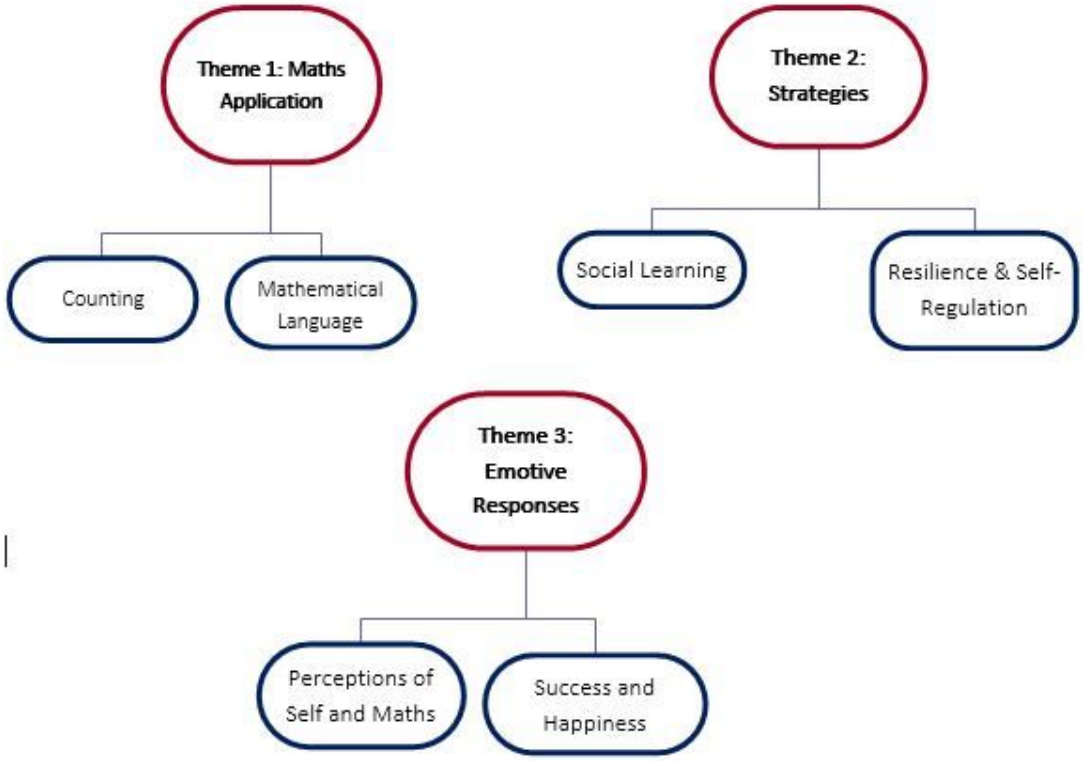

Table 4. Aggregated coding examples for some of the research questions.

Question	**Examples Codes** (aggregated for table example)
How do you think Noodle feels about maths? Why do you think she feels like this?	Child recognises different emotions that the character is feeling. Child seems to relate the emotions of the character e.g., fear and sadness to their own experiences. Child links emotions of the character to known factors of maths anxiety e.g., fear of failure. Child is self-critical but performance is not impacted (working at expected level) but highest anxiety of the group. Anxiety not yet affecting performance?
How do you help yourself to not feel scared?	Child considers the teacher as a support method. Try (& take time) => counters avoidance by not rushing. Child considers breathing techniques (example of self-regulation). Child demonstrates avoidance e.g., go to bed and watch tablet & pretend it's my favourite thing. Child alludes to the deleterious anxiety model i.e., worry causes performance deficit. This is perhaps situational worry about maths and is supported by the child previously implicating a maths quiz.
Have you ever tried to avoid maths before?	Avoidance => child states that they have tried to avoid school. Child agrees with learning from our mistakes. Child sees maths as a competition and claims to finish first. Child who said no to feeling scared about maths (earlier) also says no to having tried to sneak away, showing some consistency of response.
How do you think Noodle feels now? Why do you think this?	Child recognises changing emotions and can identify reasons for this. Child links being happy to being more secure with maths.

A Pilot Maths Anxiety Storybook Approach to Normalise Maths Talk in Children and to Support Emotion Regulation.

General response to reviewer comments:

May we take this opportunity to thank all the reviewers for their supportive and constructive feedback to genuinely encourage the development of this paper. This has been hugely appreciated by all.
Below, we address the main comments that were raised and have shown these in the manuscript using track changes throughout:

Comment: Abstract
Change "maths" to "math" here and throughout the manuscripts, depending on the editors' preference.

Response: This has been changed to 'math' throughout.

Comment: Change "tuition" to "teaching or instruction" here and throughout the manuscript (just for clarity for readers).

Response: All instances have been amended to 'instruction' (see track changes).

Comment: Use letters to label the main areas of A. Math Application, B. Strategies, and C. Emotive Responses.

Response: This has been amended as advised (see track changes).

Comment: Throughout the manuscript, add in more paragraphing to identify different areas of content.

Response: Some paragraphs have been added to the introduction section to help separate key sections of information.

Comment: Adjust some of the references to appropriate protocols.

Response: These have been checked and adjusted where required (see track changes).

Comment: Page 3
First sentence: Change "trialing" to "examining" or "testing." Good quote from the Department of Education.

Response: This has been amended as advised (see track changes).

Comment: Page 4
First paragraph, good premise for this research. Line 7: Add in to the purpose – ". . . experiences and

normalizing math talk . . . for the purpose of identifying emotional responses identified with math anxiety."
Response: This has been amended as advised (see track changes).

Comment: On the bottom of page 4, change reference to "Streubert Speziale & Carpenter, 2007).

Response: This has been amended (see track changes) – thank you for pointing this out.

Comment: Page 5
The research methodology is appropriate for the ages of the children. Good details of the methodology are given.

Response: Thank you for your positive feedback.

Comment: Page 7
With the storybook being central to this research, it is important for the authors to give a description of the story with details, added to the text or as a table. The reader needs to understand the story and its related questions as presented to the children.
If possible, the authors should offer information on the people who reviewed the storybook such as how many, and what was the consensus?

Response: Thank you for this point. On page 7, we have added additional information surrounding the story itself and we have added some general feedback that we received during the developmental and feedback gathering stage of the storybook. Unfortunately, we do not have specific numbers surrounding the review of the storybook, as this has included online feedback too through a dedicated Facebook page. However, we our amendments suitably addresses this point.

Comment: Page 8
At the top of page 8, how are the 19 items of the anxiety scale issued to the children? I am assuming this one done one on one. If so, add that information into the text.

Response: Thank you – this information has now been added (see track changes).

Comment: The paragraph under the heading "Children's Math Anxiety Scale," indicates "The scale has been shown to reliably measure the MA of children . . ." Is there a reference for this? Are the references CMAS-UK and Petronzi et al., 2019? Please indicate.

Response: Yes, this is correct, and the reference has been added (see track changes).
Comment: Page 9
Under "Standardised Question Schedule" at the top of p. 9, you do note for the readers to see table 3, however, would you consider maybe adding an example or two as well? Also, at the end of this section you share how the math specialist reviewed the questions for their appropriateness, relevance and terminology. Could you state the results of the review maybe just by saying he/she confirmed the validity of the questions?

Response: 2 questions have been added within this section in parentheses to provide the reader with some examples, separate from table 3. As advised, this section now also ends by stating that the maths specialist did confirm the validity of the storybook, as they did not have any suggestions for change.
Comment: Under the "Procedure," Petronzi et al, 2018 is not in the references. Also, clarify that the SEN math specialist read the storybook to the children individually.

Response: Apologies, the wrong date was added to this reference, and this has been amended. We have also made clear here that the storybook was read to children on a 1:1 basis (see track changes).

Comment: Page 11
Under "Results," at the bottom of page 11, to avoid confusion either label the three global these as A, B, and C or keep the numbers and label the subthemes a, b, and c.

Response: To be consistent with the changes made to the abstract, the global themes are labeled as A, B and C (see track changes).

Comment: Page 13
At the top of the page, third line, after the word "concern." Give the story problem(s) here so the reader has a frame of reference.

Response: Reference to problem #1 has been added shortly after 'concern.' (see track changes).

Comment: Page 14
Line 6: "aware of your feelings . . . This could be interpreted as the storybook in this pilot study . . ." Add in the underlined words.
After last sentence on this page, identify the story problem(s).

Response: This has been amended as advised (see track changes).

Comment: Page 15
In the middle of the page, you reference "the third problem." Could you identify the problem(s) in the story?

Response: This has been amended as advised (see track changes).

Comment: Page 17
Good examples of positive messages within the story.

Response: Thank you for your positive feedback.

Comment: Page 19
For the Resilience & Self-Regulation section, again, it would be helpful to have the context of the story (in a Table or elsewhere) so the reader can make judgements.

Response: Additional storybook information has now been added to the 'the storybook' sub-heading in the method section to give more context to this.

Comment: Pages 19-21
All your examples are good.

Response: Thank you for your positive feedback.

Comment: Page 21
Under the last section, "Perceptions of Self and Maths," first sentence, explain the storybook example.

Response: This has been amended to now refer to problem #1 and the focus of this i.e., counting, addition and division (see track changes).

Comment: Pages 22-24
Remarkable insights into children's feelings!

Response: Thank you for your positive feedback.

Comment: Page 25-26
Organize the Discussion section, so it is easier for the reader to follow. One suggestion would be to number the study aims from the first paragraph {i.e., 1) Normalize math talk . . . 2) Reveal emotive responses, 3) Explain reasons, 4) Math understanding, 5) Social Strategies . . ., etc.}, or something like that. Then follow these main points on pages 25—26. Use more paragraphs to delineate these sections. Organizing around your key points will strengthen your implications.

Response: Thank you for this suggestion! We have considered the discussion section as suggested and have broken this into main sub-headings to provide further clarity of the reader. These are, [1] the storybook and emotive responses, [2] math understanding and engagement, [3] normalizing math talk and emotion regulation, and [4] the utility of a storybook approach. We end the discussion by considering limitations and future directions, and outline concluding points. We have added supporting information to the opening paragraph of the discussion section where we allude to these sub-headings and number these (see track changes). However, the numbers can be removed if these are deemed unnecessary by the reviewers.

Comment: Page 27
Under Implications, first sentence, add to the end of the first sentence, "more positive perspectives and emotion regulation "regarding math."

Response: This has been amended as advised (see track changes).

Comment: Pages 27-28
Your Implications are well done! Be sure to paragraph and organize this section in order to communicate the ideas better.

Response: Thank you. This was addressed when responding to a previous comment surrounding the discussion section and using more sub-headings to separate key information.

Comment: On page 28, second paragraph, change the word "trialed" to "tested," and the word "tuition" to "instruction."

Response: This has been amended as advised.

Comments: Pages 28-29
Limitations and Future Directions/ Conclusion: Rewrite or reorganize these sections for a better understanding of future directions/conclusion. Rewrite part of the conclusion to focus on your findings and how the story book can be used as a targeted intervention. Be sure to let readers know why this research is important and how the storybook approach is useful to teachers and helpful for children.

Response: Thank you for these points. We have added a section of information into the conclusion to focus on the findings and how the storybook can be used an intervention, and how this can support educators and children. We have also more clearly defined sections within the conclusion using new paragraphs.

Comment: References
Your references are up-to-date and supportive of your research.
References Devine et al; Mohamed & Waheed, 2011; Vukovic et al, 2013 are not noted in the text.

Response: Apologies – these have now been removed from the reference list.

We hope that these changes appropriately address the points raised, and we look forward to hearing from you again.

With thanks and best wishes,
The research team

Abstract

Research and education stakeholders in the UK acknowledge math anxiety as a detriment to learning math and is associated with performance deficits, avoidance and limiting career opportunities. Support approaches and strategies have typically focused on instruction and emotion regulation, but not necessarily in younger children using a more sustainable resource, such as a targeted storybook approach. Therefore, in this qualitative study, children aged 6-7 years (N=15) across two UK primary schools took part in 1:1 discussion surrounding engagement with a math anxiety storybook approach. Following reflexive thematic analysis, three global themes were identified: [A~~1~~] Math Application: (1) counting, and (2) mathematical language, [B~~2~~] Strategies: (1) social learning, (2) resilience and self-regulation, and [C~~3~~] Emotive Responses: (1) perceptions of self and math, and (2) success and happiness. Overall, our findings suggest that children successfully engaged with a storybook approach - with integrated math problems - which normalised math talk in a non-judgment-based environment and led to more positive perspectives of math and more resilient approaches and solutions. We discuss these findings in relation to developing emotion regulation using a sustainable and flexible resource.

Keywords: math anxiety, math education, emotion regulation, storybook, strategies

Introduction

Mathematics anxiety (MA) is a pervasive global issue (Dowker et al., 2016; Luttenberger et al., 2018) and labelled a performance-based anxiety in view of empirically supported negative correlations with mathematics attainment (Ashcraft & Moore, 2009). Recent work in this area has identified a neural threat response to math stimuli – reflecting pain and fear - when high math anxious individuals (HMIs) are simply presented with a math problem (Pizzie & Kraemer, 2017) or merely numbers (Batashvili et al., 2020). As an emotional problem, MA places the individual in a cognitively passive state (Luo et al., 2009) and particularly impacts those whose ability is already poor (Witt, 2012), including those with Dyscalculia - an important but less prioritized area in learning math (Kunwar, 2021).

Comprehension and application of mathematical concepts is a key part of education and may define the career opportunities available to an individual (Ashcraft, 2002; Rahim & Koeslag, 2005). Indeed, MA is negatively related to wanting to pursue future study or work involving math (Ahmed, 2018) and can therefore steer pupils away from certain careers and opportunities. Indeed, OFSTED (UK; 2021) considers a lack of success in the subject as contributing to the development of MA and reflects the deficit theory (Carey et al., 2016). Despite this being a pertinent issue, MA research has implicated several influential factors (e.g., Petronzi et al., 2017) and more recently – within an educational context – has concerned practitioners own worries and contempt for math (Foley et al., 2017) and student perceptions of educator competency as a key predictor of student mathematics confidence (Lau et al., 2022). There continues to be widespread underachievement in mathematics - linked to MA and avoidance (OECD, 2013) and a 'wide' attainment gap exists between the lowest and highest achievers and disadvantaged and advantaged students (OFSTED, 2021). Indeed, there is an

emerging trend towards examining interventions to address MA in younger populations (see Petronzi et al., 2021 for a review).

Research implicates the significance of early classroom experiences and their contribution to negative math attitudes for some pupils (e.g., Rubinsten et al., 2018). Paying closer attention to the MA of younger children, 'teachers can influence pupils' resilience and beliefs about their ability to succeed, by ensuring all pupils have the opportunity to experience meaningful success' (Department for Education, 2019, p.26). To address this, many schools, for example, avoid dismissive feedback by adapting their marking policies to influence a growth mindset (Dweck, 2008), place more focus on time to discuss and reflect with a teacher (Elliot et al., 2016) and implement an active, accurate and on-going assessment to inform daily adaptations, including interventions (such as exploration-based games; Jeffrey, 2019) that provide access to learning rather than 'catch-up' and deepens conceptual understanding. Adding to this, the Education Endowment Foundation (Clark et al., 2021) advise the use of, for example, storybooks – as implemented in the current research - and games to promote mathematical exploration of key concepts that may 'transform pupils…beliefs about learning' (Department for Education, 2019, p. 17). Given our understanding of the cognitive implications of experiencing math anxiety (limited working e.g., attentional resources and tracking information; Carey et al., 2016), emotional implications (Luo et al., 2009; Young et al., 2012, Justicia-Galiano et al., 2016) and bi-directional relationship between anxiety and performance that can lead to an affective drop in performance (Ashcraft & Moore, 2009) it is proposed that prior to implementation of math instruction approaches, first - for a child to be ready to learn - emotion regulation must be accounted for.

Strategies designed to encourage emotion regulation have been successful in reducing math anxiety in older children or adults, e.g., expressive writing (Park et al., 2014) and focused breathing (Brunye et al., 2013). However, little work has been conducted with younger children in a bid to tackle MA, despite research showing that MA can be prominent in children as young as four years (Petronzi et al., 2017; Petronzi et al., 2019). As such, this study proposed a child-friendly storybook approach to promoting children's reflection on math experiences and normalising math talk for the purpose of identifying emotional responses identified with math anxiety. This strategy follows similar principles of reflection, for example, bibliotherapy (Wilson, 2009) that provides a framework for discussion, emotional responses, and a change in feelings towards a specific threat. More recently, Buckley (2020) detailed the importance of picture books to engage in follow-up discussions and activities with students to focus on the experiences of the characters and to link these to their own emotions. This aligns with principles of metacognition to limit, for example, self-imposed lower attainment goals in math, lower confidence, avoidance, and a reluctance to trial different approaches.

The current research aimed to trial a storybook approach to normalise math talk and qualitatively analyse feedback from children aged 6-7 years (UK, Year 2) regarding their math feelings and reflections during and following engagement with this resource.

Method

Design. The research aligned with interpretivism, and therefore applied a qualitative methodology, with core characteristics including giving participants an opportunity to express themselves and their experiences (Burton & Bartlett, 2009) with a wider aim of directing future

MA approaches and understanding individual perceptions of the world (Streubert Speziale & Carpenter, 2007). Participant's perspectives were obtained through one-to-one readings of a children's storybook during which reflective questions were asked, and therefore most closely aligns with semi-structured interviews. This data collection method allows the researcher to follow a schedule of questions to encourage elaborated responses and to explore novel perspectives, being led by the participants' experiences, perspectives, and attitudes (Cridland et al., 2014).

The research used Reflexive Thematic Analysis (RTA) as the analytical method, in accordance with the guidelines of Braun and Clarke (2006; 2019) which they describe as "patterns of shared meaning underpinned or united by a core concept" (Braun & Clarke, 2019: p.593). They also note that themes should not be regarded as waiting to be identified and that they are instead dependent on theoretical assumptions, the data, and the skill of the researcher. Braun and Clarke (2019) emphasise that these are not rigid or linear stages, meaning that a researcher may need to, for example, move back to other stages if the analytic process requires this. Moreover, they reiterate the importance of reflection and engagement with the data. Indeed, the 'process' requires thoughtful engagement with the data and the analytic process and this was adhered to as part of the current data analysis. Given the pilot study approach of this project, RTA was chosen to support the identification of broader patterns as the foundation for subsequent inquiry and led to pertinent themes of how children felt about math, their reflections, and actions when engaging with the storybook.

Reflexive Thematic Analysis was complimented by an inductive approach that allowed data to naturally inform, rather than imposing preconceived categories or frameworks (Moretti et al., 2011) given that targeted MA storybooks have not widely been tested.

Finally, a phenomenological epistemology was most suitable for the aims, data collection method and focus of the research, and allowed for understanding and interpretation of children's lived experiences and personal perspectives, attitudes and reflections surrounding math (Smith et al, 2009; Paley et al., 2017) and to develop meaning.

Participants. The research employed a purposive sampling technique and volunteer sampling for one-to-one discussions with children (N=15; 8 females & 7 males) as this was dependent on parents providing consent for their child. Sample demographics included children (fluent in English and aged 6-7 years; Year 2) from two different primary schools located in Northumberland (England) and was inclusive of non-Special Educational Needs (SEN) children and children already diagnosed with dyscalculia and/or dyslexia who were previously and currently working with a Specialist SEN Math Teacher (see table 1 for further participant information) and a trusting and supportive rapport had been established.

[Table 1 near here]

Materials.

The storybook. The MA storybook (20 pages in length, illustrated pages & written in rhyming verse) belongs to a wider series of research-informed children's books (blinded for anonymity) and is a self-published series (Amazon Kindle Direct Publishing) of which the author has full ownership. The book aims to normalise math talk and promote more positive attitudes. As our previous qualitative and scale development work (Reference blinded for anonymity)

included children aged 4-7 years – and the findings have been incorporated into this - the book is targeted at the early years of formal education to promote a positive trajectory. This book aims to address math conceptually and acknowledge key components of MA, for example, self-efficacy, math resilience, the value of math and building intrinsic motivation. In addressing these, known issues such as the no-attempt error (Chinn, 2012) and avoidance may be reduced and encourage children to persevere. The storybook is based on the learnings of the protagonist (Noodle) who demonstrates worry about math when she encounters three math-based situations at home (problem #1 is based on counting, addition and division; problem #2 is based on counting and fractions, and problem #3 is based on counting, addition and division) and with the support of her family, learns methods for approaching math problems and begins to demonstrate more positive attitudes as she grows in confidence. As the storybook is already based on math issues, this can limit hesitation in children.

During its development and feedback gathering stage, the storybook was reviewed by teachers, SENCo's, children and parents across several schools for appropriateness. Generally, children found the storybook engaging and the nature of the story led to naturally occurring discussion about the character's feelings. This was highlighted as a positive by primary care providers who also emphasised the importance of the images in terms of further encouraging children in maintaining focus and engagement, as well as the consistent positive message surrounding 'having a go' at math. Approaching the issue of math anxiety by means of a storybook was also viewed as favourable in terms of starting a discussion about math feelings. In the current research, the storybook was reviewed by the headteachers of the participating schools and the specialist SEN math teacher.

Children's Math Anxiety Scale (CMAS-UK; Petronzi et al., 2019). The Children's Math Anxiety Scale UK (CMAS-UK) consists of 19-items (see table 2) that refer to day-to-day numeracy situations that may cause anxiety for children, typically aged 4-7 years. The items of the scale are issued on a 1:1 basis for younger children, and groups of five for children aged 6-7 years. For each item, children can place a circle around the face which describes how they feel in relation to the situation (happy, score =1, uncertain, score =2 sad, score =3). The responses to the 19-items should be added together to provide a final score for each child (minimum score is 19 and the maximum is 57). To support understanding of an individual's level of MA, a mean score can be created by dividing their total by 19. There are no set labels for representing the mean scores, but a mean close to one indicates little-to-no MA, whereas a mean closer to 3 would indicate a high level of MA. This scale has been shown to reliably measure the MA of children ($\alpha = .87$) with a significant negative correlation with math performance (Petronzi et al., 2019).

[Table 2 near here]

Standardised Question Schedule. In this research, children were read the MA storybook on a one-to-one basis with a Specialist SEN Math teacher. Using a standard question schedule (see table 3) each child was asked a series of questions (e.g., How do you think Noodle feels about math? Have you ever felt scared about math?) at key points in the story in response to the actions of the protagonist and other characters to encourage them to reflect on the story and their own feelings and experiences. The questions were created by the researchers (also the authors of the MA storybook) with an understanding of the purpose and design of the story. To increase the

validity or 'trustworthiness' of the devised questions, the SEN math specialist reviewed these in terms of their appropriateness, relevance, and terminology, and confirmed the validity of the storybook.

[Table 3 near here]

Procedure. The study comprised of 4 stages: [1] A math children book was developed based on key research findings and themes within the area of MA, and [2] upon completion, the book was reviewed by practitioners (and other stakeholders) to ensure age-appropriateness and that this aligns with key issues in math education. [3] Prior to engagement with the math storybook, each child completed the Children's Math Anxiety Scale-UK (CMAS-UK; Petronzi et al., 2019) on a one-to-one basis to obtain an anxiety measure to support the understanding and context of comments and feedback, and attainment level was also provided by the SEN math specialist. [4] Following this (within the same sitting) the SEN math specialist (that currently works within the participating schools) read the book to the children on a 1:1 basis and a series of standardised questions were verbally asked during the reading of the storybook to encourage reflection on the story and personal feelings and experiences. Discussions were audio recorded only using a Dictaphone. Following data collection, the audio recordings were transcribed verbatim and analysed according to the principles of reflexive thematic analysis.

Analytical Strategy. The analysis process followed the 6 stipulated stages (Braun & Clarke, 2006; 2019) including a constant reflexive process. The guidelines urge [1]

familiarisation with the data and a detailed understanding of the content; [2] which then enables an initial list of codes to be produced. [3] Themes can then be generated through refocusing the analysis and sorting codes [4] that are then refined with some becoming redundant. [5] This leaves themes that best encapsulate the data, though further refinement may be required. [6] At this phase, a full set of themes has been established and data is reported. Adherence to this process lead to the findings of 3 global themes. The initial stages of reflexive thematic analysis led to a codebook, and these were considered and refined during the subsequent stages of analysis. For each transcript, the coding process transitioned from simple descriptive points to more latent insight, whereby points of interest were further considered and linked to theories and understanding of math anxiety where applicable, with caution surrounding over-interpretation (see table 4). It was considered that code saturation had been achieved whereby no additional ideas or perspectives were identified (Hennink et al., 2017) and therefore, the sample size was also deemed sufficient.

[Table 4 near here]

Ethics. The research was cleared through the university Research Ethics Committee and adhered to the British Psychological Society ethical guidelines.

Results

The analysis presents key reflections and math talk from children's engagement with the MA storybook and is formatted to show questions asked at specific points in the story and various responses to these. Pertinent extracts from each child are accompanied by contextual

information. Initial points of interest were identified in each of the transcripts, and these were reflected upon in accordance with reflexive thematic analysis and the suggested stages of this analytical method. The initial identified codes deemed as representing math experiences, reflections, and engagement with the storybook were categorised and developed. However, to increase trustworthiness, the assumptions and interpretations of the data were further questioned in the later stages of analysis (Braun & Clarke, 2019). Indeed, we advocate the importance of deep engagement with the data and analytic method (Braun & Clarke, 2019) and embrace the central role of the researcher in producing knowledge. There have been many suggestions surrounding theme conceptualisation within qualitative research, and our approach aligns with Attride-Stirling (2001) who suggested that thematic networks might be conveyed using 3 core types of themes: [1] Global theme, [2] Organising themes, and [3] Basic themes. The analytic process resulted in 3 global themes as capturing the discussions in their entirety: [A~~1~~] Math Application: *(1) counting, and (2) mathematical language,* [B~~2~~] Strategies: *(1) social learning, (2) resilience, and (3) self-regulation,* and [C~~3~~] Emotive Responses: *(1) self-perception, (2) success and happiness, and (3) perceptions of math* (see figure 1).

[Figure 1 here]

Global Theme 1 – Math Application:

As shown by the CMAS-UK scores, the participating children varied in their self-reported MA, and some scored higher for this measure, despite working at an expected level in math. The second question (page 6) asked children if they had ever felt scared about math, to

which 4 children said yes. Three of these children obtained medium to high mean scores for the CMAS-UK, indicating higher anxiety. This initial gauge of math feelings seemed to be consistent with later questions and discussion points (to be discussed later in the results). However, the MA storybook seemingly provided children with an opportunity to engage with math and to demonstrate their understanding – or to become involved - even though the resource did not explicitly request their participation in this way. Despite CMAS-UK scores and responses to having previously felt scared about math, 10 of the 15 children – including those who had previously felt scared about math - independently aimed to resolve the math problems within the story. Buckley (2020) previously outlined picture books as promoting follow-up discussions and activities, although the MA storybook encouraged the active application of mathematical strategies and language.

Counting. Counting is a complex and important process for the age of the children in this research. It is a concept that underpins other mathematical skills, including addition and subtraction, and an understanding of number order allows for the comparison of number sizes. In learning this skill, several errors are typically encountered, for example, counting an item twice, or using the same number (name) twice (Maclellan, 1993), and may still be a basis of some concern. Engagement with the MA storybook showed that many children were able to apply their counting skills e.g., when counting sweets equally for problem #1, or were prepared to attempt to solve the problem (and support the main character in the story) and therefore provided an opportunity – away from a formal classroom setting – to use their individual math ability and to discuss possible solutions, and in some cases, amend strategies. The extracts demonstrate this across varied participant information, particularly attainment level and CMAS-UK scores.

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P4	No	Greater Depth	23 (1.21)

"So that is 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12…Then, 13, 9, 13, 12, 11." [child noticing numbers from the calendar image]. *"So, 8, 12, 16, 20…"* [child helping the main character to solve problem #1]. "

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P13	Yes	Not Expected	39 (2.05)

"1, 2, 3, 4, 5, 6, 7. We'll get two each, no, 3 each." [child helping to solve problem #2].

For some children that previously indicated some fear of math and self-reported higher MA, rather than counting or applying mathematical understanding, they independently engaged with the story by saying numbers and symbols that they noted within the illustrations of the storybook.

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P11	No	Expected	44 (2.32)

"1, plus, 9, 6." [child noticing numbers and symbols].

The series of problems also encouraged some children to recite and apply their knowledge of multiplication and in other instances, children seemed to respond to important messages within the story (to not feel scared) which possibly encouraged their participation. This observation is seemingly supported by another child (P6, below extract) responding positively to a core message within the book that emphasises trying not to be worried, working together, and being aware of your feelings (promoting self-regulation). This could be interpreted as the storybook in this pilot study supporting emotion regulation to allow children to focus more on tasks (Ashcraft & Krause, 2007) or the problems within the story i.e., counting, addition, division, and fractions.

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P10	No	Expected	34 (1.79)

"4, 5, 6, 7…" [child counting after the main character is told to not feel scared about math].

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P6	No	Expected	24 (1.26)

"…even if it's a test or a contest, still, it's (math) ok."

Mathematical Language. Building on engagement with the math storybook generally, and in response to the series of problems within the story, some children – again, covering a range of CMAS-UK scores – also engaged with mathematical language. The words used by children focused on problem-solving and gave insight surrounding how children applied their math knowledge and understanding, and subsequent discussions of strategies arose from this. In some instances, children's problem-solving was again not explicitly requested, suggesting that many were comfortable taking part.

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P7	No	Expected	34 (1.79)

"Five. So, Sophie is putting it into quarters. Five quarters… She's missing three people […] We're doing fractions." [child helping to solve the 2nd problem in the book].

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P8	No	Expected	38 (2)

"Sort them out into piles of four." [child helping to solve the 3rd problem in the book].

In previous works, Ashby (2009) identified that children failed to understand the wider practicalities of math, although the storybook approach seemed to encourage contributions and

thinking about the application of math more widely. In other cases, a child applied their learning from a previous problem in the story when solving the third problem (counting and division) and another child demonstrated engagement with trial-and-error thinking and discussion.

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P5	No	Expected	38 (2)

"I think he like put them into piles like with the food" [child applying knowledge from the 2nd problem in the book].

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P5	No	Expected	38 (2)

"It might be a divide or a takeaway…probably a divide."

Finally, a child, with low self-reported MA appeared to draw attention to their own ability and positive engagement with the problems in the story ("helped and counted like me") as a form of self-affirmation that can promote confidence in the subject.

Global Theme 2 – Strategies

The MA storybook promoted reflection of strategies that children have or could use when doing math to "help yourself to not feel scared" and the range of suggestions is comparable to MA research findings, including seeking support (educators and family members); trying, and taking time (which counters the no-attempt error, Chinn, 2012); use of the concrete pictorial abstract approach (CPA) such as counting on fingers and number squares, and asking others (peers) for help as a coping strategy (Petronzi et al., 2017). Two children also discussed breathing techniques (Brunye et al., 2013) and how this supports their thinking about a math task which refers to the debilitating anxiety model (Carey et al., 2016).

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P4	No	Greater Depth	23 (1.21)

"I try to take in ten deep breaths and remember in my head what the math things were. So, then I think I get some right, but some of them wrong because I get worried…"

A child also divulged their avoidance of math – which can be useful for an educator to be aware of - while another (CMAS Score = 30, 1.58) indicated a growth mindset by "pretending it's [math] my favourite thing."

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P12	No	Expected	28 (1.47)

"Well, I just go to my bed, and I just watch my tablet."

Children indicated a link between feeling happy with math and having a secure ability and was framed around receiving help from friends and helping others, learning that math is not 'boring' through applying mathematical concepts (in the book), increasing understanding, and having a go. The storybook could be viewed as reinforcing these ideas and children's perspectives again covered a range of CMAS-UK scores and attainment levels.

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P1	No	Greater Depth	19 (1)

"Very happy about his math because he's helped the boy." [in response to problem #1].

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P13	Yes	Not Expected	39 (2.05)

"Happy…because now she knows it's not boring." [in response to problem #1].

Supporting the purpose of the math storybook, children were also receptive to the positive messages within the story and recalled different approaches to math, and some expanded on the ideas within the story, e.g., singing songs, asking educators for support, learning from mistakes and "having a good go" ("because you might get it right"), writing down feelings – linking to expressive writing, and, in accordance with emotion regulation, remaining calm and not being worried. Another child seemed to take reassurance from a character in the book stating that they sometimes struggle with math and drew on this point in their response to not worry because the character had said that they 'get mixed up too.'

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P4	No	Greater Depth	23 (1.21)

"…To learn from your mistakes…and nobody will be mad." [repeats a sentence from the book].

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P14	No	Greater Depth	30 (1.58)

"You don't have to be worried to do it because we all get it wrong sometimes."

Social Learning. In discussing math strategies, several children referred to social learning in the subject and considered this from differing perspectives, corresponding to previous knowledge of social coping strategies for children (Petronzi et al., 2017). For example, a child felt nervous when having done math work alone and contrasted with another who indicated that being able to help others was self-assuring and seemingly affirms a secure ability.

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P4	No	Greater Depth	23 (1.21)

"I get nervous, and I don't know the answers when I've done them alone."

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P1	No	Greater Depth	19 (1)

"Very happy about math because he's helped the boy."

Moreover, in response to the main character addressing math problems - with support from others - all children believed that the main character became "happy", "calm" and "confident" about math. At this stage in the story, children perceived the main character as more confident and able to apply their learnings and teach/support others, reflecting mastery learning.

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P1	No	Greater Depth	19 (1)

"[Happy] *Because she's helped dad, she's helped Sophie and Leo."*

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P8	No	Expected	38 (2)

"No, [main character not scared anymore] *because he listened to Leo and gave it his best try."*

Analysis also revealed some consistency of ideas such as a child discussing the main character as learning from the other characters and later stating that they could ask the teacher for support, showing that some children place a high value on social support, and this may have been reaffirmed by the storybook.

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P5	No	Expected	38 (2)

"I would tell them that it's ok to be scared and they can see the teacher or an adult."

However, although acknowledging social support within the story, a child also alluded to math success as being based on independence and 'effort.'

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P11	No	Expected	44 (2.32)

"...I would put all my best effort, try to do it, and if I get a question wrong, I just go back to my table and do the question again."

Resilience & Self-Regulation. Analysis identified some implicit links with resilience surrounding children's reflections and discussion of math which were again promoted through the storybook approach. These centred on attempting work (leading to more enjoyment) and three children also used the word 'started' when discussing the main character's emotions and engagement with math, showing recognition of math ability as emerging and developing. Although the lower CMAS-UK scores of the below extracts suggest that some children may have already developed a more resilient approach to math, the storybook also reinforced this.

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P6	No	Expected	24 (1.26)

"She doesn't like math because she doesn't know math. But, when you give it a try, it's actually really good."

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P4	No	Greater Depth	23 (1.21)

"She started to count and feel happy."

When considering what children would say to someone who was struggling with math, other examples of resilience were more explicit surrounding not giving up and demonstrated a growth mindset approach to math which had been reinforced throughout the story. This suggests that children are receptive to positive math messages and discussion opportunities – as shown by two children that reported medium-high CMAS-UK scores, of which one (P8) had previously felt scared about math.

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P8	No	Expected	38 (2

Keep on trying and if you get it right, you've done it."

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P15	No	Expected	33 (1.74)

"Try and try and never give up. Just keep on trying, never give up."

In thinking about how to respond when feeling scared about math, some children also referred to self-regulation strategies, specifically breathing techniques (Brunye et al., 2013). Interestingly, two of these children had self-reported medium-high CMAS-UK scores and were not working at an expected level, suggesting that the storybook had a positive influence.

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P9	Yes	Not Expected	39 (2.05)

"Just take a big deep breath."

Global Theme 3 – Emotive Responses

Previous research has linked emotional responses to MA (Luo et al., 2009; Young et al., 2012) and math stimuli, including math problems and numbers (Pizzie & Kraemer, 2017;

Batashvili et al., 2020). Therefore, it can be postulated that the series of problems within the MA storybook evoked emotions in some children which were discussed in response to questions and children were able to recognise and label the emotions of the character at different stages of the story. Negative emotions attributed to the character early in the story were framed around fear, a lack of confidence, not liking math, it being "hard", not having a secure ability in the subject ("not that good at math") and not knowing what do. However, as the character grew in confidence and successfully solved problems, children's perceptions of the character's emotions positively developed, for example, feeling happy due to receiving help, attempting work, and learning that mistakes are normal, suggesting an influence of the storybook.

Perceptions of Self and Math. In responding to the first question in the storybook (the main characters initial feelings about math in response to problem #1 – counting, addition and division) children seemed to be somewhat introspective and suggestions were potentially based on their own feelings at that time, supported by a child that explicitly framed this around their perceived ability.

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P11	No	Expected	44 (2.32)

"I don't know, probably sad because she's not good at it, like me."

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P14	No	Greater Depth	30 (1.58)

"Worried because she's not that good at math."

Moreover, when children were asked if they had previously tried to avoid math, this was used as an opportunity to either highlight ability e.g., *"I'm always the first one to finish, and we're*

always finished at the same time" (demonstrating a sense of competition associated with math e.g., Petronzi et al., 2017) or express concerns. Analysis also revealed consistency in responses from the first question (about feeling scared about math) and having tried to avoid math whereby those who had not felt scared did not avoid math and contrasted with those that had felt scared about math.

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P4	No	Greater Depth	23 (1.21)

"Probably. To be honest, I have [avoided math].

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P8	No	Expected	38 (2)

"Normally I go for the toilet, I sneak away."

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P11	No	Expected	44 (2.32)

"*Yes, I have even tried to avoid school and sneak away in every hard lesson."*

A child also considered that it is only through doing math work – rather than avoiding it – that we understand whether we have been successful and counters the no-attempt error (Chinn, 2012) although this also implicated the right or wrong nature of math ("if you don't have a go, you don't know if it's good or bad.", P12).

Success and Happiness. Conversations surrounding the storybook revealed that children associated being happy with a secure ability in math, and more positive emotions were

expressed in response to a range of factors, including the main character receiving help with math, increased understanding when the main character had made effort with math, and when reciting positive messages from the story such as 'it doesn't matter if you get it wrong.' Some children (e.g., P9 & P12, below) also indicated that completing a math task reduces worry.

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P7	No	Expected	34 (1.79)

"That math is fun…and that it's also easy."

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P9	No	Not Expected	39 (2.05)

"Some math is scary, but if you do all of it you won't be scared."

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P12	No	Expected	28 (1.47)

"No because she's learnt some math and now, she's not afraid."

Children perceived success as leading to happiness or feeling better about math when discussing the main character, although in reference to themselves, children indicated that success in math is not immediate and is a learning process. At the later stages of the storybook, this was seemingly linked to effort and resilience, and children with medium to high self-reported MA were more positive in their responses.

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P10	No	Expected	34 (1.79)

"The first time I started math I did [felt worried] *…but I have a go...there is stuff that is very hard and then I keep trying and then I manage to do it.*"

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P11	No	Expected	44 (2.32)

> *"I would put all my best effort, try to do it, and if I get a question wrong, I just go back to my table and do the question again."*

Another child (P4) alluded to the deleterious anxiety model of worrying about math causing a performance deficit (Carey et al., 2016). However, the same child previously referred to math quizzes as causing particular concern and supports MA as being both concept and situation specific.

Participant	SEN Dyslexia/Dyscalculia	Attainment Level	CMAS-Score
P4	No	Greater Depth	23 (1.21)

> *"I try to take in ten deep breaths and remember in my head what the math things were. So, then I think I get some right, but some of them wrong because I get worried at some times and it's a big one."*

Discussion

The current study explored feedback from children aged 6-7 years (UK, Year 2) regarding their math feelings and reflections during and following engagement with a storybook approach to MA. The study aimed to normalise math talk and generally discover the extent of pupil engagement with this format in accordance with this pilot study and explore children's perspectives. The storybook encouraged children to apply their math understanding and ability, discuss strategies, reveal emotive responses, and explain reasons for these that could impact their engagement in math lessons and situations. Pertinent findings and implications are considered surrounding [1] the storybook and emotive responses, [2] math understanding and engagement, [3] normalising math talk and emotion regulation, and [4] the utility of a storybook approach.

We end the discussion by considering limitations and future directions, and outline concluding points.

The storybook and emotive responses. The storybook generally encouraged all children to independently implement their individual math knowledge and understanding in varying ways, in some cases relative to their self-reported MA and attainment level, and in others, in contrast to these measures whereby in the latter stages of the story, children with medium to higher CMAS-UK scores expressed more positive math perspectives and suggests some influence of the positive messages and problem-solving opportunities within the story. This may indicate an extent of emotion regulation that led to more cognitive capacity (Ashcraft & Krause, 2007) and enabled children to partake in the problems within the story. Previous works have attested to the effectiveness of expressive writing ahead of math tasks to better manage math anxiety (Park et al., 2014) although the storybook approach could be regarded as an 'expressive discussion' and is a more scaffolded and supported format for younger children. In accordance with Buckley (2020), children focused on the experiences of the characters and linked these to their own emotions to provide a framework for understanding their own feelings.

Math understanding and engagement. In response to questions and discussions with the specialist SEN math teacher, children were encouraged to count – a crucial and complex process for children aged 6-7 years – and apply mathematical terminology and knowledge of mathematical processes, in addition to considering strategies that can be used when doing math, with some demonstrating critical thinking. The storybook, aligning with Education Endowment Foundation suggestions of this approach (Clark et al., 2021) could be viewed as having promoted social strategies through shared exploration and problem-solving, with the specialist SEN math

teacher. Placing more focus on discussions and reflections (Elliot et al., 2016) this approach appeared to encourage active participation and seemingly contributed to children asserting more positive emotions and increased understanding of the main character. Moreover, resilience and self-regulation approaches to math were implicitly alluded to by children, both with lower and higher CMAS-UK scores, including children who had (and had not) previously felt scared about math, suggesting that the storybook message of persistence and learning may have had a positive influence, regardless of underlying worries and ability. Several questions surrounding the storybook required children to reflect on their feelings and behaviours surrounding math, and these questions supported the identification of children who are seemingly more and less secure with their math ability and implicated avoidance. Indeed, this is a well-reported associate of math worry and anxiety (e.g., Dowker et al., 2012; Haase et al., 2012; ~~Dowker et al., 2012,~~ Petronzi et al., 2017). Children alluded to more positive math emotions because of doing more math, although children also acknowledged a learning process associated with the subject, perhaps in acknowledgment of other aspects of math e.g., being linked to intelligence (hierarchy in class). Furthermore, and regardless of self-reported CMAS-UK score or attainment level, all children's responses became more positive and solution-based, even for those who had previously said that they had felt worried about or avoided math.

Implications:

Normalising math talk and emotion regulation. The storybook approach aimed to normalise math talk in children to promote more positive perspectives and emotion regulation regarding math. This research advocated emotion regulation prior to implementation of math instruction ~~tuition~~ approaches to provide children with a more secure base in which to engage with math.

Emotion regulation approaches have been efficacious in previous works with students (e.g., Brunye et al., 2013, Park et al., 2014) and qualitative data in this study suggests that a storybook format can support this in younger children. Overall, these findings suggest that a storybook approach to primarily support emotion regulation and provide opportunities for math-based discussions generally promoted more positive perspectives and may provide practitioners with beneficial insight, particularly as there was some consistency in response to specific questions e.g., previous concerns about math, avoidance and how a child might respond when feeling concerned. Similarly, in cases where children were self-critical, but their attainment level did not necessarily indicate an adverse impact of this (working at expected level or greater depth) this implied that some may be in the early stages of math anxiety development and their performance is yet to be adversely impacted and could again be crucial insight for an educator. However, it is important to avoid claims of the storybook entirely leading to more positive perspectives and suggestions of correlation; indeed, subsequent quantitative work is required to establish significant effects of the storybook approach. Nonetheless, the data that we have presented in this pilot work has shown the importance of an approach to math learning and math attitudes that allows children to engage with and discuss math using a non-judgment-based resource and be recipients of consistent positive messages.

The utility of a storybook approach. Previously tested approaches that are based on intensive math ~~tuition~~ instruction sessions are typically resource intensive, not sustainable in the long-term, and require participants to engage with more math that may increase MA. Moreover, the practical application of some targeted strategies is dependent on resources, including time, funding, and curriculum demands. However, a storybook approach can minimise deviation from typical day-to-day activities and can complement the adopted math scheme of the school and

provide an opportunity for children to reflect on both areas of enjoyment and barriers, to promote and normalise math talk. This approach may further limit a sense of exclusion and peer evaluation, and a whole-class approach can be implemented whereby all children – regardless of math ability – can reflect on and apply the principles of the storybook. The approach may also support schools in focusing more on key priorities such as emotion regulation and mental well-being, and a simple-to-use resource can minimise the gap between disadvantaged and advantaged students (OFSTED, 2021). Indeed, the storybook can also encourage a cohesive learning environment as the talk and reflection opportunities will allow pupils to discuss and share ideas and feelings, as opposed to often segregated ability tables. Discussions between children will further support the role of the teacher in identifying and meeting the needs of pupils and may be an approach that can be more widely adopted across year groups and subjects, particularly if consolidatory age-appropriate activities are developed. Moreover, research has shown that negative math attitudes can transfer from parent/carers to child (Gunderson et al., 2012) and performance in math can be limited in cases where parents/carers hold their own anxieties towards math (Maloney et al., 2015) and thus, the storybook can also encourage positive math interactions with parents/carers in the home environment.

Limitations and Future Direction

The results of this pilot study are not without limitation. First, we acknowledge the inherent methodological limitations surrounding subjectivity associated with qualitative-based research, in addition to the limited geographical scope and breadth of the work. Therefore, the study could be replicated to include a larger, more diverse group of young children. Moreover, although the MA storybook was developed based on MA literature and insight from teachers, the current

research only explored children's engagement with the storybook. Indeed, triangulation (Turner & Turner, 2009) could be utilised in subsequent work to build on current insight, and the storybook implementation could also obtain parents and teacher insight (as well as child perspectives) to provide a more comprehensive viewpoint of the value and impact of the storybook. Additionally, we also suggest the use of content analysis whereby the overall global, organising and basic themes be guided by frequency, providing some rigour to the interpretation process. While some of these may initially be regarded as important, content analysis offers a systematic coding process of quantifying qualitative data obtained in focus groups and interviews and extracting and classifying important phrases and themes – as well as trends and patterns - into an efficient number of categories based on frequencies within the transcript (Webb & Kevern, 2001). Content analysis frequency encourages omission so that other high frequency themes take precedence. As stated by Hammarberg et al. (2016) the intention is to establish consistency (reliability) in our results whereby in similar contexts, other researchers would identify similar patterns. We suggest that the inclusion of frequency mitigates potential researcher bias and overinterpretation while focus groups could also be implemented with children to encourage wider discussions and ideas. Finally, taking a more quantitative perspective and utilising the storybook as an intervention approach with research and control groups in several schools across a wider area of the UK, a factorial multiple analysis of variance can be used to detect any changes in MA scores and math attainment at pre and post participation with the storybook, and supplementary activities could also be tested.

Conclusion

This paper has presented children's perspectives surrounding their engagement with a MA storybook approach. We have found that children, irrespective of math attainment level and self-reported MA, all actively engaged with the story and the integrated series of problems. Crucially, our findings show that known aspects of MA were identified by some relative to their personal experiences, and discussions of these were encouraged through the book, although all children indicated more positive perspectives and approaches to math after reading through the storybook. This suggests that children are receptive to positive messages integrated within this resource and encouraged more growth-based and resilient strategies, particularly in response to encountering any subsequent math difficulties. This approach has provided and shown the value of opportunities to normalise math talk to build towards emotion regulation in children.

This work advocates a storybook to addressing math anxiety as an engaging, sustainable, and simple to implement approach for educators, either as a standard whole-class approach, or as a more targeted intervention for children that are demonstrating early signs of difficulty with math, with the primary aim to open discussions about feelings and to receive positive messages about the subject. The findings have shown that discussions centred on a storybook allow children to use and trial their math knowledge in a non-assessment-based environment. Moreover, the storybook enables educators to explore how a child is feeling about the subject and potential underlying factors, while the child is given an opportunity to talk about math to normalise this and minimise emotive responses that are associated with math anxiety, such as shame and guilt. This may encourage the child to more independently seek support and maintain a positive student-teacher relationship.

Finally, to develop this work beyond a pilot exploration, we have considered research developments surrounding wider perspectives, including primary care providers, and implementing the storybook as a targeted intervention approach in a quantitative pre/post design study.

Disclosures

Author contributions. We note that DP is the lead author, with equal second authors of GS and RP. Contributions are as follows; DP conceived of the project and was principal lead. GS and RP contributed to early project development. Ethical approval was sought by DP and RP. Material set up and study administration was led by DP and GS. GS led data collection. Manuscript writing was led by DP with input from RP and reviewed by GS. All authors provided approval for the final paper submission.

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