

Research Protocol: Phase 1

Feasibility of the Strength in Numbers program
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Background

High school students' mathematics performance in Australia has been on a steady decline, a trend that carries serious long-term implications for their academic and career prospects (Larsen, 2024). Poor performance in mathematics can limit future opportunities, particularly in fields requiring strong numeracy skills, such as science, technology, engineering, and mathematics (STEM)(Li & Schoenfeld, 2019). Factors such as distraction, high stress levels, and lack of focus in class contribute to this decline, prompting teachers to adapt their practices in an effort to improve student engagement and outcomes (Gallagher et al., 2022; Maamin et al., 2021). Approaches such as differentiated instruction, collaborative learning, and technology integration have been implemented, but despite the well-documented benefits of classroom movement breaks, they remain an underutilised strategy in high school classrooms.

In the mathematics classroom, maintaining on-task behaviour is crucial, as it indicates the degree to which students are actively engaged in their activities, focused on the task at hand, and following instructions without distractions. One of the most significant findings from interventions that incorporate classroom movement breaks is their effectiveness in enhancing on-task behaviours (Daly-Smith et al., 2018; Masini et al., 2020; Watson et al., 2017). A focus on delivering curriculum outcomes is often a deterrent for teachers to use this pedagogical approach.

More recently, academic performance in mathematics is negatively affected by maths anxiety. There is strong evidence of a significant negative correlation between maths anxiety and mathematics performance ($r = -.34$) (Nelson & Powell, 2018). Students with higher levels of maths anxiety report enjoying mathematics less, displaying lower levels of motivation and confidence in the subject, and are more likely to avoid taking mathematics courses (Li et al., 2021). To this end, it is worth noting that participation in physical activity, especially higher intensity activity can reduce anxiety levels in youth(Caplin et al., 2021).

Providing Classroom Movement Breaks that simultaneously deliver mathematics syllabus content may provide an opportunity to increase on task behaviours and reduce maths anxiety.




Strength in Numbers

Strength in Numbers is an innovative educational initiative that integrates muscle strengthening activities into mathematics lessons. The intervention consists of a series of 5-minute videos that are delivered by teachers at the beginning of maths lessons. Each video presents numeracy questions aligned with the NSW mathematics syllabus.

Instead of responding to the questions by writing in their books, students indicate their answer by performing a corresponding muscle-strengthening activity. These activities are designed to be achievable for all skill levels and require no additional equipment or modifications to the learning environment. Strength in Numbers aims to reduce Maths anxiety and improve On-task behaviour for High School mathematics students.

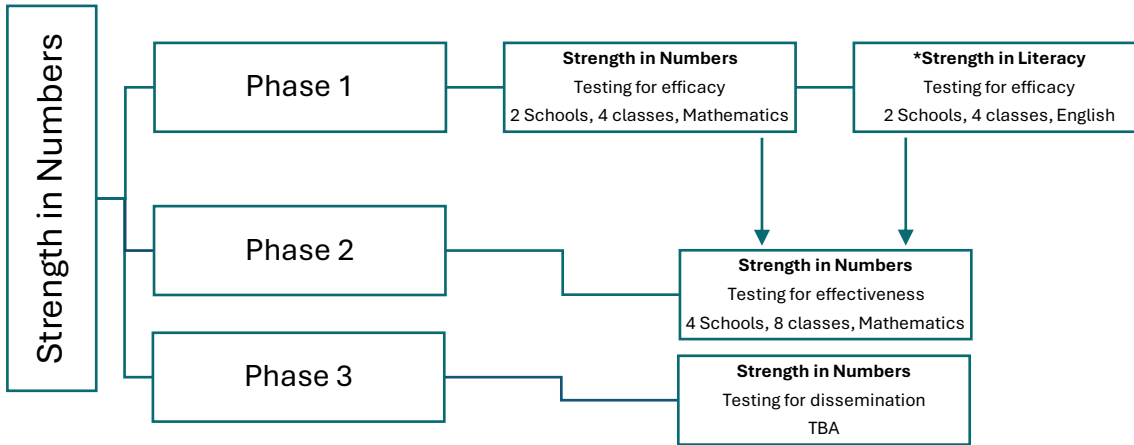


The intervention design addresses the following barriers to implementation of Physical Activity initiatives in schools.

	Time	Address challenges faced by teachers: Access to physically active maths resources for high school students Make teachers jobs easier: Improve on-task behaviour after completing the physical activity Minimise teacher preparation: Address numeracy outcomes Weblink format for delivery
	Expertise	Multi format professional learning Digital delivery reduces the skill level required Face to face workshop prior to delivery Online weekly support Evidence based behaviour change techniques Whole class behaviour management technique Confidence to embed movement into lessons
	Support	Engaging with school leaders and executive Whole school approach to delivering classroom movement breaks Encourage positive relationships between staff and students Partnerships with education and health Provide links to the University of Newcastle Partner with the Maitland/Newcastle catholic diocese Other indirect effects Wellbeing, mental health

Aims

The research team have a shared purpose to determine the feasibility and preliminary efficacy of the Strength in Numbers program on maths anxiety and on task behaviour of high school mathematics students. Diagram 1 illustrates the phases of the research.



The objectives of the **Phase 1 – Testing for feasibility** are as follows:

- i) Examine the feasibility of the Strength in Numbers intervention
- ii) Evaluate the preliminary efficacy of the Strength in Numbers program on Stage 5 mathematics students Maths anxiety and On-Task behaviour.

**Strength in Literacy is a targeted approach to determine if the project has scope to be extended beyond mathematics. It will be conducted as an honours project.*

The objectives of the **Phase 2 – Testing for effectiveness** are as follows:

- i) Evaluate the feasibility of conducting an effectiveness trial at scale, performing a cost analysis, and determining the potential for dissemination of the Strength in Numbers program.
- ii) The impact of the Strength in Numbers program on maths anxiety and on task behaviour.
- iii) Explore the acceptability of the intervention and the influence of school context on intervention implementation

The objectives of the **Phase 3 – Testing for dissemination** is stated in Phase 2

Overall, this research has the potential to explore the impact of classroom movement breaks on students' maths anxiety and on task behaviour.

Research team

	Individual/Team	Role
Chief investigator	Katie Robinson	The CI responsibilities will include submitting ethics applications, managing project timelines, designing the research proposal, designing research methodologies, and creating intervention resources. The CI will also manage school recruitment and maintain communication with them, supervise assessments, perform statistical analyses, generate reports, and handle publication submissions.
External Partner	NA at present	Catholic School Maths Head Teaching committee (TBA) MCLS Mathematics, cognition and learning sciences
Steering committee	Narelle Eather Elena Prieto	Approach for decision making and expertise
Project manager	Phase 1 – Katie Robinson	As CI
Research team	Phase 1 and 2 David Lubans	<i>Serve as the subject matter expert, providing guidance on the research methodology, design, and execution. Review and validate research findings before dissemination. Provide feedback on the preparation of research publications.</i>
*Honours student	Nick Riley	<i>Nick will provide expert opinion on the research methodology, design, and execution. He will assist with school recruitment, preparation of intervention resources and data collection. Also, Nick will provide feedback on the preparation of research publications.</i>
**Research assistant x 2	Myrto Mavilidi	<i>Myrto will support the project by providing expert opinion on research methodology, design and implementation. She has experience in measuring On-Task behaviour and Maths Anxiety in primary school children and has published extensively in this field.</i>
	Zara Ersozlu	<i>Zara will support the project by providing expert opinion relating to Maths Anxiety. Her expertise in quantitative analysis will be utilised in statistical analysis.</i>
**Strength in Literacy	Heaton Quick	Heaton will conduct an Honours project using the same protocols as Phase 1 but use modified stimulus for literacy. Ethics application as a variation.
Research assistants	Heaton Quick Holly Davis	Literacy video design, data collection Data collection

Schedule

5 Year plan

Task	Jul – Dec 2024	Jan – Jun 2025	Jul – Dec 2025	Jan – Jun 2026	Jul – Dec 2026	Jan – Jun 2027	Jul – Dec 2027	Jan – Jun 2028	Jul – Dec 2028	Jan – Jun 2029
Research design										
Ethics application		◆								
Phase 1										
Project evaluation				◆						
Phase 2										
Project evaluation						◆				
Phase 3										
Project evaluation and end										◆

Milestones

Milestone	Details	Date
Ethics application	Study approval allows for school recruitment to begin and Phase 1 to be delivered.	December 2024
Phase 1 evaluation	Evaluation of Phase 1 will inform the delivery and modifications for Phase 2	December 2025
Phase 2 evaluation	Evaluation of Phase 2 will inform the delivery and modifications for Phase 3. Consider commercialisation opportunities.	December 2026
Phase 3 evaluation	Evaluation of Phase 3 will inform the longevity of the program.	December 2028

Note: Detailed Phase 1 timeline on page 12

Ethics application

To be completed by the Chief investigator Katie Robinson. Meetings with Professor David Lubans to discuss research methodology. Follow the checklist to ensure the application address key matters.

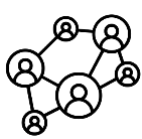
Refer to the - [National Statement on Ethical Conduct in Human Research](#).

Documents submitted as part of the application include:

- Head of school declaration
- Peer review checklist
- Research protocols (This document)
 - Surveys/ questionnaires
 - Interview scripts
 - Focus group script
- Flyer
- Social media material
- Email recruitment and follow up
- Participant information's Statements
 - School leader, Teacher, Parent or Guardian and Student participant
- Consent forms
 - School leader, Teacher, Parent or Guardian and Student participant

Consolidated framework for Implementation Research: Adapted for schools

The design of Strength in Numbers has considered the Consolidated Framework for Implementation Research (Damschroder et al., 2020). The research design and intervention development has attempted to address the complexity of schools and those who work and learn within them. The innovation for this project is in the nature of its delivery - videos. Easy to access, short and containing integrated syllabus outcomes the Strength in Numbers program has design elements that provide the potential for scalability.



Outer setting

Education authorities

Partnership with the Catholic Schools Office Maitland-Newcastle Diocese



Inner setting

Schools

Presentation to school executives to gain leadership support
Presentation to all teachers at a staff meeting
Provide resources



Individuals

Teachers

Professional learning for teachers to increase capability, opportunity and motivation to deliver the intervention.

Students

Introduce the program and provide a preparation session prior to participation



Innovation

Videos

Available on an easy to access LMS
Clear design with achievable exercises and appropriate syllabus content for the age group
Do not require teacher expertise



Implementation process

Practical application

Teachers are involved in designing the delivery
Support available at a weekly drop in session
Teachers complete an action plan

The Strength in Numbers feasibility study is designed to evaluate the design, delivery and acceptability of the project. The CONSORT framework for feasibility studies (Eldridge et al., 2016) guides the design of the intervention. To evaluate the Capability, Opportunity and Motivation to deliver the Strength in Numbers program we will use the COM-PASS approach (Verdonschot et al., 2024).

Study design – Phase 1

Project Title: Phase 1 – Feasibility of a classroom based resistance training and mathematics

intervention: *Protocol* and preliminary *findings* from the Strength in Numbers Pilot Study

Project summary: Determining the feasibility and preliminary efficacy of the Strength in Numbers program.

High school students' mathematics performance in Australia has been steadily declining, posing long-term consequences for their academic and career prospects (Li & Schoenfeld, 2019). Maths anxiety significantly contributes to this issue, correlating negatively with performance ($r = -.34$) (Nelson & Powell, 2018) and leading to lower motivation and avoidance of mathematics courses (Li et al., 2021). Off-task behaviours further hinder academic performance as students are regularly distracted and struggle to maintain focus on the task at hand. While educators have explored various strategies, classroom movement breaks which are proven to enhance on-task behaviours in primary school aged children (Daly-Smith et al., 2018; Masini et al., 2020; Watson et al., 2017) remain underutilised in high school classrooms. Only a handful of studies have tested active breaks with or without academic content in secondary schools (Mavilidi & Vazou, 2021; Robinson et al., 2022)

Significance: As a foundational subject critical for students' future success, mathematics often sees alarming levels of disengagement among adolescents. By exploring the potential of movement breaks to foster greater engagement and improve educational outcomes, this research addresses a pressing need in high school education and has the potential to transform mathematics instruction in classrooms across the country.



Potential benefit: If the delivery of the Strength in Numbers program—combining resistance training with mathematics skills—is shown to improve students' on-task behaviour and reduce maths anxiety, the findings could lead to significant changes in teaching practices. This could enhance academic outcomes, equipping students with the skills and motivation they need for success in mathematics and beyond.

Aim:

1. Examine the feasibility of the strength in number intervention
2. Evaluate the preliminary efficacy of the Strength in Numbers program on Stage 5 mathematics students Maths anxiety and On-Task behaviour.

Findings will then inform: **Phase 2 – Testing for effectiveness** and **Phase 3 – Testing for dissemination**

Strategic alignment: The Strength in Numbers program aims to enhance academic performance and physical health, directly contributing to these global goals. Additionally, this work aligns with the university's mission to advance public health and educational outcomes through innovative, evidence-based interventions.

	<p>University of Newcastle Engagement priorities</p>	<p>Better, healthier living Short exercise breaks to disrupt sedentary behaviours in high school mathematics lessons</p>
	<p>United Nations Sustainable Development Goals</p>	<p>Good health and well being Increased opportunity to achieve physical activity guidelines, specifically muscle strengthening activities.</p>
	<p>United Nations Sustainable Development Goals</p>	<p>Quality Education Integrating evidence-based resistance training into high school curriculum, with expectations of enhancing both academic achievement and on-task behaviour.</p>

Timeline:

This timeline allows for the flexibility required when performing research in schools.

Task	Oct/Nov 24	Dec 24	Jan 24	Feb 24	Mar 24	Apr 24	May 24	June/July 24
Ethics application	■	■						
Intervention design	■	■						
Participant recruitment			■ Break	■				
Intervention preparation				■	■			
Intervention delivery						■	■	
Data analysis								■
Present findings								■
Project end (date)								◆

Progression criteria for a potential future trial

Criteria for progression to a full-scale trial will be used to inform a decision on whether and how to proceed. Each progression criterion (PC) is outlined below.

PC 1. The teachers delivered 75% of the expected sessions for the program, averaging 1.5 sessions per week. Proceed: 75% or more; Review: 0–74%.

PC 2. At least 40% of children in the selected mathematics classes returned consent forms, which required signatures from both parents and children. Review: 0–39%.

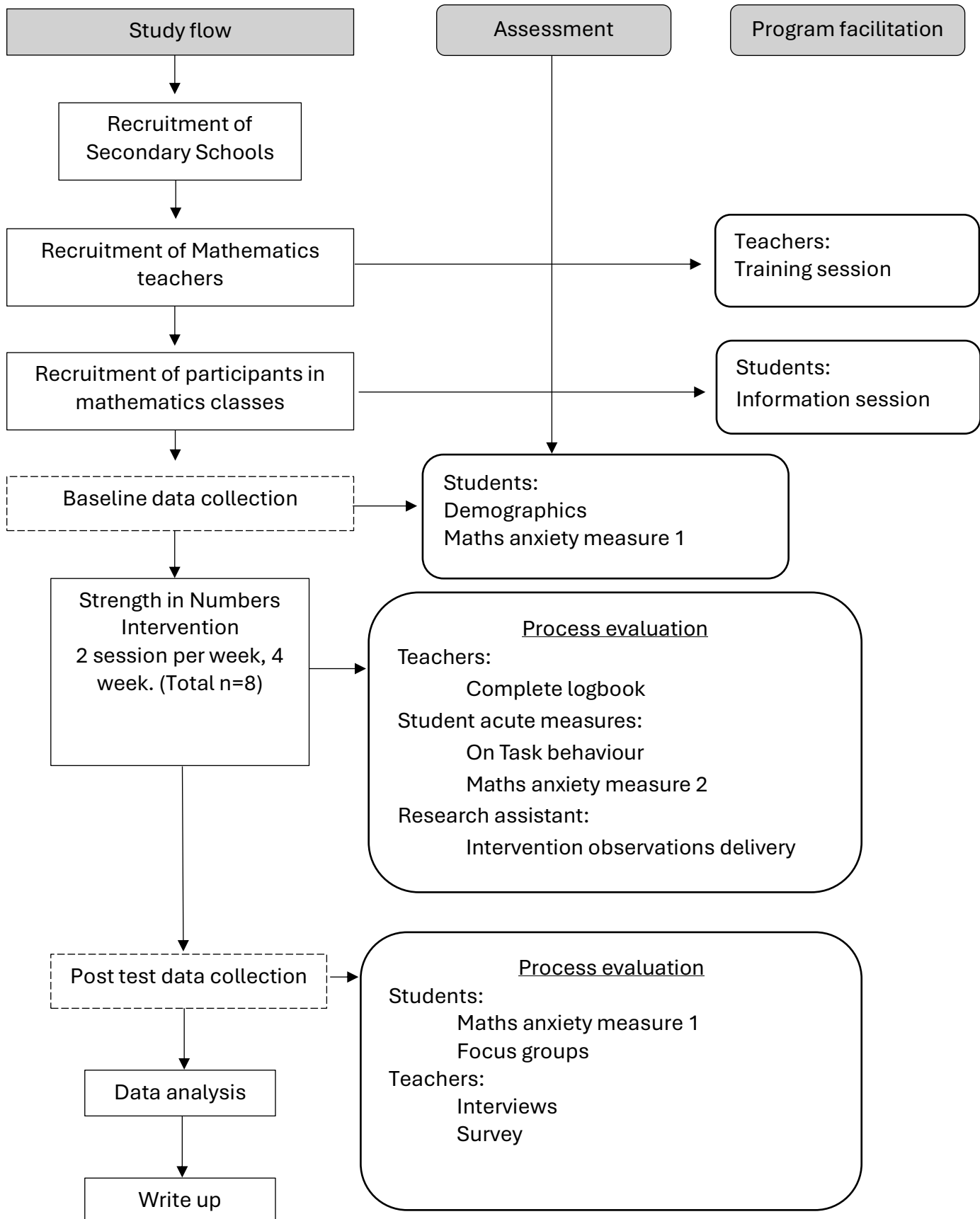
PC 3. Teachers agree or strongly agree that the program is acceptable. Proceed: 75% or more; Review: 0–74%.

PC 4. Both schools and at least 3 of 4 mathematics classes are retained throughout the study. At least 75% of assenting participants complete all outcome measures. Proceed: 75% of children complete baseline and post-test measures; Review: 0–74% of participants complete.

PC 5. At least 3 of 4 teachers who delivered the Strength in Numbers program participate in the interview and complete the survey. Proceed: 75% or more; Review: 0–74%. For participants, at least 2 students from each class agree to participate in the focus group. Proceed: 50% or more; Review: 0–49%.

These criteria have been agreed in advance of data collection with the Steering Committee. The SC will consider the quantitative and qualitative data to review and make an overall judgement on whether the intervention can be delivered with fidelity.

Study Flow



Recruitment

Recruitment Strategy for Strength in Numbers Feasibility Trial

Approval Process:

The first step in the recruitment process involves obtaining approval from the Catholic Schools Office (CSO) of the Maitland/Newcastle Diocese. Following the specific guidelines outlined on their [Research Applications - Catholic Schools Office](#) webpage, I will submit a formal research application, detailing the study's aims, methodology, and potential benefits. Approval from the CSO is essential to proceed with recruiting schools within the diocese.

Initial contact with schools:

Once approval from the Catholic Schools Office (CSO) is obtained, the Chief Investigator (CI) will ask for permission from the CSO to present the Strength in Numbers project at the next gathering of lead mathematics teachers in the diocese. This presentation will highlight the benefits of the program, explain how it aligns with curriculum goals. This strategy has been used in previous research projects but is dependent on the alignment of meeting schedules and can only be implemented when appropriate.

If the timing of the meeting does not align, the Chief Investigator (CI) will ask for permission from the CSO to send an email to the lead mathematics teacher in all schools who meet the inclusion criteria and present at school faculty meetings instead.

Recruitment strategy for schools:

The CI will follow up the forum presentation by sending the recruitment email to the Catholic Schools Mathematics lead and ask them to send recruitment emails to mathematics department heads at individual schools. These emails will include the [Strength in Numbers Flyer](#) and a QR code linking to the [recruitment letter](#). The goal is to secure the participation of 2 schools from the diocese.

Initial contact with school leaders

A meeting will be arranged between the CI and the School Leader to discuss their involvement in the Strength in Numbers program. An email will be sent prior to the meeting attaching the [School Leader Participant Information Statement](#) and [consent form](#). After receiving consent from the school leader,

teachers can be recruited. School leaders can return forms online to the CI and they will have one week to provide consent, followed by a one-week reminder, and then the final deadline.

Initial contact with Stage 5 mathematics teachers:

From each participating school, two mathematics teachers and their classes will be selected to take part in the study. Classes available to participate will be advised by the school leaders. All suitable teachers will be provided with the [Teacher Participant Information Statements](#) and those willing to participate will return [consent forms](#). Teachers will have one week to provide consent, followed by a one-week reminder, and then the final deadline.

Recruitment strategy for Stage 5 mathematics teachers:

If more than two teachers consent, selection will occur using an online random generator in the presence of the head mathematics teacher and the CI.

Initial contact with Stage 5 mathematics students and parents:

The consenting classroom teacher will invite the CI or a trained research assistant into the classroom to present an overview of the Strength in Numbers program.

Recruitment strategy for Stage 5 mathematics students and parents:

Participant Information Statements (PIS) will be sent home using the schools normal practice for delivering permission notes. If this is an online format the PIS and Consent form will be loaded as PDF or online survey using Question Pro, allowing parents and participants to consent online. A separate PIS has been prepared for [Students'](#) and [Parents or Guardians](#). These statements will explain the purpose of the study, the activities involved, and how data will be collected. Participants will have two weeks to provide consent, followed by a one-week reminder, and then the final deadline.

Inclusion in the Program:

To prevent exclusion, ALL students in the selected classes will participate in the Strength in Numbers program, regardless of whether they return consent forms. However, data used in the final research will only occur for those who have provided consent.

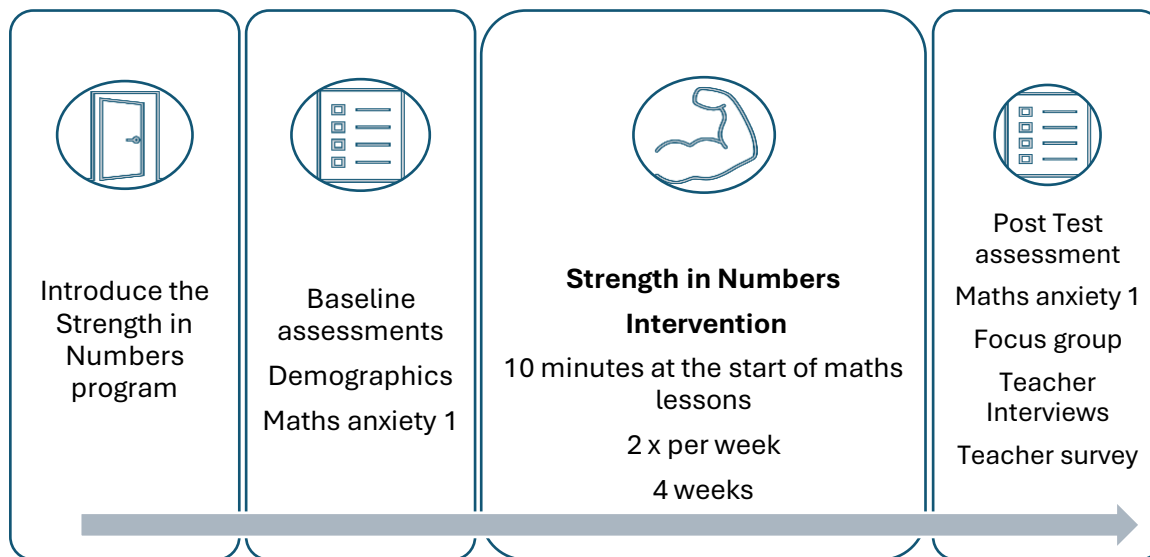
Intervention design

This trial is a non-randomised single group feasibility study with embedded process evaluation. Participants will be recruited from schools within the Newcastle/Maitland Catholic School Diocese. We aim to recruit 2 schools and 4 mathematics classes. Target participant numbers are (n = 60) students and (n = 4) teachers. Students studying Mathematics in Stage 5 can be included in the study. CONSORT adapted for feasibility studies acknowledges that a power calculation is not needed for this study (Eldridge et al., 2016).

Intervention

Strength in Numbers is a series of videos that require students to respond to mathematics questions, indicating their answers by performing the corresponding resistance training exercise. The Strength in Numbers Intervention is described in more detail on page 17, using the Template for Intervention Description and Replication (TIDieR) checklist (Hoffmann et al., 2014). Student's will complete 2 sessions per week for four weeks (Total session = 8). See Figure 1.

Figure 1. The delivery and assessment timeline for Strength in Numbers



The videos are presented by the classroom teacher and are accessed through Vimeo links.

Week 1	Introduction Video	Y / N
Week 2	Video 1 Video 2	Y / N
Week 3	Video 3 Video 4	Y / N
Week 4	Video 5 Video 6	Y / N
Week 5	Video 7 Video 8	Y / N

Template for Intervention Description and Replication (TIDieR) checklist

1. Brief name	Strength in Numbers
2. Why	As a foundational subject critical for students' future success, mathematics often sees alarming levels of disengagement among adolescents. If the delivery of the Strength in Numbers program—combining resistance training with mathematics skills—is shown to improve students' on-task behaviour and reduce maths anxiety, the findings could lead to significant changes in teaching practices. This could enhance academic outcomes, equipping students with the skills and motivation they need for success in mathematics and beyond.
3. What materials	The materials for the Strength in Numbers program include a series of eight 5-minute videos, designed to be delivered at the beginning of each mathematics lesson. These videos will integrate resistance training exercises with mathematics content, providing short, focused movement breaks that align with the curriculum.
4. What procedures	<p>Access to the Intervention videos will be available to classroom teachers via email after the completion of baseline measures. Teachers will then deliver the video intervention at the beginning of the lesson to their Stage 5 mathematics class on two occasions throughout the week.</p> <ol style="list-style-type: none"> 1. Allow students to enter the classroom with your regular procedure 2. Ask students to place their bag away from their chair or under their desk 3. No equipment, especially laptops should be removed from the student's bag. 4. Students stand behind their desk, with their chair behind them. 5. Once all students are ready play the Strength in Numbers video. The video lasts 5 minutes. During the video could you please encourage participation and ensure students perform exercises safely within their own desk area. You may also participate as this often encourages class participation. 6. Record each completed session
5. Who provided	The materials for the Strength in Numbers program are provided online as a video to increase consistency across classes. Each classroom teacher will play the video, and they are encouraged to use suggested strategies to promote student participation.
6. How	Stage 5 Mathematics classes occur 2-3 times per week. Teachers can select the most suitable lessons to deliver the intervention but this must occur at least twice during the week.
7. Where	Participants will complete the intervention while at their own desk in the mathematics classroom.
8. When and how much	The Strength in Numbers videos are 5 minutes long. They are designed using a Tabata protocol (20 seconds exercising and 10 seconds break, Total = 4 minutes). At the completion of the exercise there is 1 minute to complete a numeracy question, relating to the topic as a class.
9. Tailoring	All participants will take part in the Strength in Numbers program. The introduction video advises students to modify exercises if they can't do them because of an injury or their surroundings. For example, if someone has an arm injury, they can do squats instead of chair tricep dips. Each exercise has different difficulty levels, and participants are encouraged to try the highest level they feel comfortable with.






Professional learning workshop

A 3 hour training workshop has been designed to prepare teachers to deliver the Strength in Numbers program. Each 1 hour block will upskill teachers in the following areas. Schools can elect to run the session as one block or 3 one hour sessions.

Hour 1 - Use behaviour change techniques

Hour 2 - How to deliver the action plan

Hour 3 - Researchers give feedback on behaviour

	<p>Professional Learning</p>	<p>Online training Synchronous introduction session Online professional learning component tin the LTS</p>
	<p>Action planning</p>	<p>Video content Clear, easy-to-follow instructions. Demonstrations by a trained instructor. Visual and verbal cues for proper form and technique. Adaptations for varying fitness levels or injuries.</p> <p>Scheduling Create achievable routine delivery E.g., 2 per week Determine the best time to play the video</p> <p>Equipment Evaluate classrooms to determine if exercises are achievable Design exercises that require minimal space</p> <p>Delivery guide Includes potential problems and solutions: Lack of student engagement Consistency of implementation by teachers Variability in student feedback levels Space constraints Safety concerns Technology issues</p>
	<p>Executive Support</p>	<p>Whole school support Meet with executive Deliver a professional development session – Staff meeting</p>
	<p>Online support</p>	<p>Contact with research team Weekly pre recorded videos relevant to the action plan Weekly drop in sessions</p>
	<p>Feedback on behaviour</p>	<p>Delivery guide Includes potential problems and solutions: Lack of student engagement</p>

Summary of observed outcomes

Preliminary efficacy outcomes			
Outcome	Definition	Test	Testing point
Demographic information	Information that describes the characteristics of a population or a group of individuals.	Survey Name, Age, Sex, Postcode, Aboriginal Torres strait islander, Cultural background	Baseline and post test
On-Task Behaviour	On-task behaviour includes times when a child is actively engaged in an academic activity	Momentary time sampling Whole class observation form	Every session
Maths Anxiety	Math anxiety is a psychological condition characterised by feelings of tension and fear related to mathematical tasks, which can hinder performance and learning in mathematics.	Maths Anxiety Measure 1 Betz, N. E. (1978). Math Anxiety Scale (<i>Chronic measure</i>)	Baseline and post test
		Maths Anxiety Measure 2 Question Pro Survey (<i>Repeated acute measure</i>)	Every session
Implementation outcomes:			
Outcome	Definition	Test	Testing point
Recruitment	The process of identifying, attracting, and enrolling individuals or groups to take part in a research study	Recruitment and retention data Number of schools, teachers and participants recruited for the study Number of completed evaluation forms Number of completed focus groups	At time of delivery
Adoption	Proportion and representativeness of providers or the delivery team that deliver an intervention	Teachers Survey Part 1: Adoption Interview: Warm up questions	Post test
Dose delivered	Intended units of each intervention component delivered to participants by the delivery team	Teachers Survey Part 2: Dose delivered Checklist – What did you do?	Post test/ During
Fidelity (adherence)	The extent to which an intervention is implemented as it was prescribed in the intervention protocol - by the delivery team	Teachers Session observations Survey Part 3: Adherence to delivery protocol Interview: Delivery questions	Post test
Sustainability (maintenance)	Whether an intervention continues to be delivered and/or individual behaviour change is maintained; intervention and individual behaviour change may evolve or adapt with continued benefits for individuals after a defined period of times	Teachers Survey Part 4: Sustainability Interview: Acceptability questions	Post test

Implementation determinants:			
Outcome	Definition	Test	Testing point
Acceptability	Perceptions among the delivery team that a given intervention is agreeable, palatable, or satisfactory	Teachers Survey Part 5: Acceptability Interview: Acceptability questions	Post test
Adaptability	Extent to which an intervention can be adapted, tailored, refined, or reinvented to meet local needs	Teachers Survey Part 6: Design Interview: Acceptability questions	Post test
Feasibility	Perceptions among the delivery team that an intervention can be successfully used or carried out within a given organization or setting	Teachers Survey Part 7: Feasibility Interview: Acceptability questions	Post test
Compatibility (appropriateness)	Extent to which an intervention fits with the mission, priorities, and values of organizations or settings	Teachers Survey Part 8: Compatibility Interview: Acceptability questions	Post test
Culture	Organizations' norms, values, and basic assumptions around selected health outcomes	Teachers Survey Part 9: Culture Interview: Acceptability questions	Post test
Dose (satisfaction)	Delivery team's satisfaction with an intervention and with interactions with the support system	Teachers Survey Part 10: Dose Interview: Design questions	Post test
Capability	The teachers ability to deliver the Strength in number program, combining both physical skills (like strength and coordination) and psychological skills (like problem solving and challenges that arise).	Teachers Survey Part 11: Capability Interview: Delivery questions	Post test
Opportunity	Opportunity is the external support and resources, both physical (space, equipment, time) and social (support from colleagues and parents), that enable program implementation.	Teachers Survey Part 12: Opportunity Interview: Delivery questions	Post test
Motivation	Motivation is the internal drive to act, combining reflective motivation (e.g., recognizing benefits, planning) and automatic motivation (e.g., routine, enjoyment)	Teachers Survey Part 13: Motivation Interview: Delivery questions	Post test

Outcome protocols

Ethical consideration relating to outcome protocols

Student outcome protocols			
Assessment	Potential risks	Modification	Risk reduction
Demographic information	Students removed from class Obvious exclusion for those without parent consent Difficult for the teacher to manage students moving in and out of the classroom Increases the time it takes to complete the assessment	Two piles of papers are printed. CONSENTING students complete the sheet that includes demographic data. NON-CONSENTING students complete a mathematics task.	No students removed from class Reduced exclusion Teacher management improves Reduces time to 10 minutes
Maths Anxiety Measure 1	Students removed from class Obvious exclusion for those without parent consent Difficult for the teacher to manage students moving in and out of the classroom Increases the time it takes to complete the assessment	CONSENTING students complete the Maths Anxiety Measure 1 assessment. NON-CONSENTING students complete a mathematics task.	No students removed from class Reduced exclusion issue Teacher management improves Reduces time to 10 minutes
Maths Anxiety Measure 2	Isolating participating students Obvious exclusion for those without parent consent Difficult for the teacher to manage students and offer support to those who should be completing the assessment	Students will be provided with two links. CONSENTING students complete the Maths Anxiety Measure 1 assessment. NON-CONSENTING students complete a mathematics task.	Consistent instructions to all students before and after the intervention Improve classroom management Less burden on the classroom teacher Reduced exclusion issue
On Task Behaviour	Partial consent as students are not aware if they have been selected to be observed.	Explain the procedure in detail as full transparency helps to maintain trust and create a more accurate and ethical observational environment. Research assistants are discreet and avoid obvious positions in the classroom	Students feel more comfortable knowing the observation details. Less intrusive so students can focus on learning as per normal routine.
Focus group discussion	Pressure to participate Not willing to miss 20 minutes of class	Research assistant not present. Classroom teacher to follow a list of suitable students and approach them the day before to gain consent if they will participate in the focus group.	Reduce peer pressure to attend Time to make an informed decision

Teacher outcome protocols			
Assessment	Potential risks	Modification	Risk reduction
Teacher survey	Pressure to complete the survey at work Conflict with colleagues who were not randomly selected to participate	Provide the survey in an online format allowing for completion at any time	Privacy to complete the survey when suitable
Teacher interviews	No suitable time during work hours	Researcher is flexible to complete the interview at a time suitable for the participant	Flexibility to complete the survey when suitable

Distinguishing between participants and non-participants

To distinguish consenting and non-consenting students a seating plan will be enforced for the lessons where students are being observed. In consultation with the teacher students will be arranged in a way that indicates consent as well as maintains the integrity of the learning environment.

Acute measures of maths anxiety will require **CONSENTING** students to select one link and **NON-CONSENTING** students to click the other link. This will be sent via email to all students or placed on the online learning platform used within the school. This process has been considered as an effective way to manage exclusion.

Room	Class:	Teacher	

Demographics and maths anxiety for CONSENTING students

CONSENTING participants will complete the survey before the start of the Strength in Numbers program.

Participant information sheet

BASELINE / Baseline + 4 Weeks

Student ID NUMBER (*office use*):

First Name: _____ **Surname:** _____

Age (Circle): 14yrs 15yrs 16yrs 17yrs **Postcode:** _____

Male Female Non-Binary I prefer not to answer

Gender (Circle): I use a different term (please specify)

Cultural Background (Circle): Australian European African Asian Middle Eastern

Aboriginal/Torres Strait Islander: Yes No

Rate your ability in maths (Circle): Not successful Somewhat successful Very successful

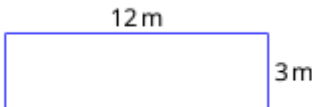
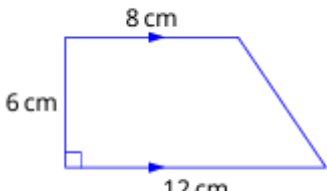

Instructions: Please complete the Betz Mathematics Anxiety Scale by rating each statement honestly based on how you feel about math-related tasks.

	Strongly Agree	Agree	Undecided	Strongly Disagree	Disagree
1. It wouldn't bother me at all to take more maths classes.	5	4	3	2	1
2. I have usually been at ease during maths tests.	5	4	3	2	1
3. I have usually been at ease in maths courses.	5	4	3	2	1
4. I usually don't worry about my ability to solve maths problems.	5	4	3	2	1
5. I almost never get uptight while taking maths tests.	5	4	3	2	1
6. I get really uptight during maths tests.	5	4	3	2	1
7. I get a sinking feeling when I think of trying hard maths problems.	5	4	3	2	1
8. My mind goes blank, and I am unable to think clearly when working on mathematics.	5	4	3	2	1
9. Mathematics makes me feel uncomfortable and nervous	5	4	3	2	1
10. Mathematics makes me feel uneasy and confused.	5	4	3	2	1

Betz, N. E. (1978). Math Anxiety Scale

Mathematics activity for NON-CONSENTING students

NON CONSENTING Participants will complete a maths activity not related to the Strength in Numbers program. This information will not be used by the research team.

<p>Q1 $2 \times 2^3 =$</p> <p> <input type="radio"/> 4^3 <input type="radio"/> 2^4 <input type="radio"/> 4^4 <input type="radio"/> 12 </p>	<p>Q11 Find the value of $16 - 3a$ when $a = 2$.</p> <p><input style="width: 50px; height: 20px;" type="text"/></p>												
<p>Q2 $3967 + 743 =$ <input style="width: 80px; height: 20px;" type="text"/></p>	<p>Q12 $4a \times 3b =$ <input style="width: 80px; height: 20px;" type="text"/></p>												
<p>Q3 The difference between -15°C and 12°C is</p> <p> <input type="radio"/> 3°C <input type="radio"/> 7°C <input type="radio"/> 17°C <input type="radio"/> 27°C </p>	<p>Q13 Complete the table for: $y = x + 4$.</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse; text-align: center;"> <tbody> <tr> <td style="padding: 5px;">x</td> <td style="padding: 5px;">-1</td> <td style="padding: 5px;">0</td> <td style="padding: 5px;">1</td> <td style="padding: 5px;">2</td> <td style="padding: 5px;">3</td> </tr> <tr> <td style="padding: 5px;">y</td> <td style="padding: 5px;">3</td> <td style="padding: 5px;"></td> <td style="padding: 5px;"></td> <td style="padding: 5px;"></td> <td style="padding: 5px;"></td> </tr> </tbody> </table>	x	-1	0	1	2	3	y	3				
x	-1	0	1	2	3								
y	3												
<p>Q4 Write $\frac{1}{4}$ as a decimal. <input style="width: 80px; height: 20px;" type="text"/></p>	<p>Q14 Solve: $2x + 3 = 13$ <input style="width: 60px; height: 20px;" type="text"/></p>												
<p>Q5 Write 24 out of 50 as a percentage.</p> <p><input style="width: 60px; height: 20px;" type="text"/></p>	<p>Q15 Solve: $3m + 1 = 2m + 7$ <input style="width: 60px; height: 20px;" type="text"/></p>												
<p>Q6 Simplify the ratio 12:9.</p> <p><input style="width: 60px; height: 20px;" type="text"/></p>	<p>Q16 Find the area of the rectangle.</p> <div style="text-align: center; margin-bottom: 10px;">  </div> <p><input style="width: 80px; height: 20px;" type="text"/></p>												
<p>Q7 120 km in 3 hours = <input style="width: 40px; height: 20px;" type="text"/> km/h</p>	<p>Q17 Find the area.</p> <div style="text-align: center; margin-bottom: 10px;">  </div> <p><input style="width: 80px; height: 20px;" type="text"/></p>												
<p>Q8 Find the selling price if the cost price is \$200 and the gain is 30% on cost.</p> <p><input style="width: 80px; height: 20px;" type="text"/></p>	<p>Q18 Use the approximate value $\pi = 3$ to find the area.</p> <div style="text-align: center; margin-bottom: 10px;">  </div> <p><input style="width: 80px; height: 20px;" type="text"/></p>												
<p>Q9 Expand: $3(a + 5) =$ <input style="width: 100px; height: 20px;" type="text"/></p>													
<p>Q10 Factorise fully:</p> <p>$2x + 8 =$ <input style="width: 100px; height: 20px;" type="text"/></p>													

Acute maths anxiety for CONSENTING students

Before and after each Strength in Numbers session **CONSENTING** participants will complete a measure of maths anxiety. This will be provided as a link and students complete the questions on Question Pro.



Acute Measure of Maths Anxiety



Complete these questions **BEFORE** exercising

Thank you for providing consent and participating in this survey. Please answer all of the questions honestly. This survey has Human Research Ethics approval from the University of Newcastle and is part of Chief Investigator Katie Robinson's Strength in Numbers Research project - katie.robinson@newcastle.edu.au

Next Question

Participant information

First Name

Last Name

Teachers name

- Mr A
- Mrs B
- Mr C
- Miss D

Start

How are you feeling before the maths lesson?



Rate your readiness for learning BEFORE doing the Strength in Numbers exercise



Rate your confidence level BEFORE doing the Strength in Numbers exercise

Not at all confident 😞 A little confident 😐 Okay 😊 Very confident 😄

Your rating

STOP - Do the Strength in Numbers program before completing part two

Complete these questions AFTER exercising

How are you feeling AFTER the Strength in Numbers exercise?

Nervous 😞 Okay 😊 Excited 😄

Your rating

Rate your readiness for learning AFTER doing the Strength in Numbers exercise

Not ready ❌ A little ready ❌✅ Ready ✅ Very Ready ✅✅

Your rating

Rate your confidence level AFTER doing the Strength in Numbers exercise

Not at all confident 😞 A little confident 😐 Okay 😊 Very confident 😄

Your rating


Thank you for completing this survey.

Powered by [QuestionPro](#)


Survey adapted from:
Ersozlu, Z. (2024). The Acute Math Anxiety Scale (AMAS): Psychometric Properties and Applications for Immediate Anxiety Assessment. *[Unpublished Manuscript]*.

Alternate task for NON-CONSENTING students

To avoid feelings of exclusion and improve classroom management for teachers an alternate task has been designed. This task does not collect identifying information and is designed to take the same amount of time as the acute measure of maths anxiety.



**Strength
inNumbers**



THE UNIVERSITY OF
NEWCASTLE
AUSTRALIA

Non Consent activity ↗

It's closer to lunch than dinner right now.

Your rating

Ture False

I brought a water bottle with me today.

Your rating

Ture False

The date today is an even number.

Your rating

Ture False

Start

I can see the sun from where I am sitting.

Your rating

Ture False

I have at least one pen or pencil with me right now.

Your rating

Ture False

I am seated in the same spot I was yesterday.

Your rating

Ture False

<

Done

On Task Behaviour

Equipment Required: Printed Momentary time sampling sheets, clipboards x 4, pens, timer (or phone), ability to collect student names.

Explanation: Researchers to assess student behaviour in a normal Mathematics lesson.

NOTE: The lesson needs to run as normal, students have been made aware of the protocols of this measure in an earlier introduction session, so no introduction is given as to what researchers are looking at. Teacher is also advised that they are not critiquing or providing feedback on their lesson.

Instructions:

Researchers to enter the room and select 6 CONSENTING students to assess. Collect the names of these students from the demographic survey.

Agree on a start time. Begin timers together and track student behaviour over a 30 minute time frame.

At intervals indicated on the Momentary time sampling sheets researchers will use the following codes to determine activity:

Observer Code	Examples
AE = Actively engaged	Answering questions, completing set tasks, discussing class content with peers
PE = Passively engaged	Listening to teacher instructions, listening to peers instructions
OM = Off task motor	Out of seat, distracted by equipment around them, drawing off task, phone use.
OV = Off Task Verbal	Non subject specific discussion with peers or teacher.
OP= Off task passive	No attempt at completing set tasks, head on desk, daydreaming.

At the completion of the 30 minutes researchers can leave the room without interruption.

Results

Date:

Class:

Observer:

	Child A Name:	Child B Name:	Child C Name:	Child D Name:	Child E Name:	Child F Name:
	Descriptors:	Descriptors:	Descriptors:	Descriptors:	Descriptors:	Descriptors:
AE						
PE						
OM						
OV						
OP						
Total Check (20)						

Strength in Numbers - Momentary Time Sampling Observation Form

Date: _____ **Time Start:** _____ **Time End:** _____ **Class:** _____ **Observer:** _____

Time period (15 second intervals)	Child A Name: Descriptors:	Child B Name: Descriptors:	Child C Name: Descriptors:	Child D Name: Descriptors:	Child E Name: Descriptors:	Child F Name: Descriptors:
00.15-1.30	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP
1.45-3.00	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP
3.15-4.30	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP
4.45-6.00	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP
6.15-7.30	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP
7.45-9.00	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP
9.15-10.30	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP
10.45-12.00	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP
12.15-13.30	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP

Strength in Numbers - Momentary Time Sampling Observation Form

Date: _____ **Time Start:** _____ **Time End:** _____ **Class:** _____ **Observer:** _____

Time period (15 second intervals)	Child A Name: Descriptors:	Child B Name: Descriptors:	Child C Name: Descriptors:	Child D Name: Descriptors:	Child E Name: Descriptors:	Child F Name: Descriptors:
00.15-1.30	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP
1.45-3.00	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP
3.15-4.30	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP
4.45-6.00	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP
6.15-7.30	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP
7.45-9.00	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP
9.15-10.30	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP
10.45-12.00	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP
12.15-13.30	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP	AE PE OM OV OP

Observer Code - AE Actively engaged, **PE** Passively engaged, **OM** Off task motor, **OV** Off Task Verbal, **OP** Off task passive

Adapted from: Alberto.P and Troutman.A (2003) Applied Behaviour Analysis for Teachers-6th edition, Pearson Education, Australia

Recruitment strategy assessment tool

		<i>(1 = Strongly disagree to 5 =Strongly agree</i>				
Approval process	i) The approval process with the Catholic Schools Office was completed within a reasonable timeframe.	1	2	3	4	5
	ii) The approval process was straightforward, with clear guidelines and requirements.	1	2	3	4	5
Teacher engagement	iii) The attendance rate at the Mathematics staff forum presentation was satisfactory.	1	2	3	4	5
	iv) Lead teachers showed interest in the Strength in Numbers program during the presentation.	1	2	3	4	5
	3. The feedback from lead teachers after the presentation was positive.	1	2	3	4	5
Flyers and emails	4. The response rate to the emails and flyers was satisfactory.	1	2	3	4	5
	5. Follow-up efforts (e.g., additional emails or phone calls) effectively increased school engagement.	1	2	3	4	5
School participation	v) The number of schools agreeing to participate met the targeted goal.	1	2	3	4	5
	vi) The distribution of Participant Information Statements (PIS) and consent forms to students was easily achievable with the support of teachers.	1	2	3	4	5
	vii) A high percentage of students returned signed consent forms within the expected timeframe.	1	2	3	4	5
	viii) School leaders were supportive and cooperative in the recruitment process.	1	2	3	4	5

Teacher logbook

Teacher Checklist – What did you do?

School: _____ **Class name:** _____

First Name: _____ **Surname:** _____

Please tick the box 'Done' when completed

		Number of students	Done
	i) Introduction video		5
Week 1	ii) Session 1		5
	iii) Session 2		5
Week 2	iv) Session 3		5
	v) Session 4		5
Week 3	vi) Session 5		5
	vii) Session 6		5
Week 4	viii) Session 7		5
	ix) Session 8		5

Teacher Interview questions

Strength in Numbers – Teacher interview

Welcome and thank you for volunteering to take part in this interview. You have been asked to participate as your point of view is important. I realise you are busy, and I appreciate your time.

Introduction: This discussion is designed to assess your current thoughts and feelings about the Strength in Numbers intervention that you have been delivering over the past four weeks. The discussion will take no more than 15 minutes. May I tape the discussion to facilitate its recollection? (if yes, switch on the recorder)

Anonymity: On your initial consent form you have agreed to participate in a short interview at the completion of the study. I thank you for taking the time to share your honest opinions about your experience. Despite being taped, I would like to assure you that the discussion will be anonymous. The files will be kept safely in a locked facility until they are transcribed word for word, then they will be destroyed. The transcribed notes of the interview will contain no information that would allow individual subjects to be linked to specific statements. You should try to answer and comment as accurately and truthfully as possible. If there are any questions or discussions that you do not wish to answer or participate in, you do not have to do so; however please try to answer and be as involved as possible.

At this point, or any point during the interview you are welcome to cease the interview.

Are you happy to continue?

Begin interview.

Warm up

Questions:

1. How do you feel about teaching mathematics?
2. Why did you become involved in the Strength in Numbers program?

1. Research Design

Questions:

1. Did you feel adequately prepared to deliver the Strength in Numbers program?
2. How did you find the overall structure of the program (4 weeks, 2 videos per week)?
3. Were the assessments manageable and appropriate for your class?
4. How would you describe your interaction with the research assistants?
5. How was your experience working with the chief investigator throughout the study?

Prompts:

- Were there any challenges in keeping up with the schedule of delivering 2 videos per week?
- Did you receive adequate support from the research team during the testing phases?

2. Intervention Fidelity

Questions:

1. Was the delivery of the program in your classroom feasible within your teaching schedule?
2. How easy was it for students to follow the resistance training exercises in the classroom setting?
3. Did you notice any impact (positive or negative) on students' mathematics learning during the program?
4. Were the mathematics questions in the videos suitable for your students' year level and did they align with syllabus outcomes?
5. How did you approach student participation in the program and were there any strategies you used to encourage engagement?
6. Can you discuss some of the barriers to delivering the Strength in Numbers program?

Prompts:

- Were there any logistical challenges in delivering the program, such as time constraints or classroom space?
- Did you feel that students were able to stay engaged with both the physical and academic components?

3. Acceptability

Questions:

1. Do you think the Strength in Numbers program is a useful pedagogical tool for teaching mathematics?
2. What did you like most about the program?
3. Do you think you would continue using this program or a similar one in your classroom?
4. What improvements, if any, would you suggest for the program moving forward?

Prompts:

1. Did you see any benefits to integrating movement into mathematics lessons in terms of student engagement or focus?
2. Was the balance between physical activity and academic content appropriate for your teaching style and objectives?

Other

1. Do you have any further ideas comments on anything that was not covered in the questions?

Teacher Survey

To evaluate the Capability, Opportunity and Motivation to deliver the Strength in Numbers program this validated survey has used the COM-PASS approach (Verdonschot et al., 2024). The questions will be moved to Question Pro after ethics approval and delivered to participating teachers via email.

Adoption	<ul style="list-style-type: none"> Name What is your gender? (Female, Male, Non Binary, I prefer not to say, I use a different term (please specify)) What is your cultural background? (Australian, European, African, Asian, Middle Eastern, Other) What is your age? (18-24, 25-34, 35-44, 45-54, 55-64, 65 or older) Do you identify as Aboriginal and/or Torres Strait Islander? (Select all that apply) (Yes, Aboriginal; Yes, Torres Strait Islander; Yes, both Aboriginal and Torres Strait Islander; No; Prefer not to say) Which of the following best describes your current role? (Select one) (Head teacher Mathematics, Permanent Mathematics teacher, Temporary mathematics teacher, Other teacher not trained in mathematics) How many years have you been teaching? (Less than 1 year, 1 - 5 Years, 6 - 10 years, 11 - 15 Years, > 15 Years) Select the school you currently work in (School A, School B) Have you completed the Strength in Numbers training session? (Yes/No) Have you delivered the Strength in Numbers program in your school as part of this project? (Yes/No)
Dose delivered	I was able to meet the required delivery of 2 sessions per week for four weeks of Strength in Numbers (SD/D/N/A/SA)
Fidelity (adherence)	When you delivered Strength in Numbers sessions, did you: (<i>select all that apply</i>) <ul style="list-style-type: none"> Watch the introduction video (yes / no) Play the entire video (yes / no) Complete the final question as a class (yes / no) Need to adjust furniture in the classroom (yes / no)
Sustainability (maintenance)	<ul style="list-style-type: none"> In the future I could see myself using Strength in Numbers videos (yes/no) If yes, how often would you use them per week? (1-2, 2-3, 3-4, every lesson)
Acceptability	<ul style="list-style-type: none"> Strength in Numbers is acceptable to me (SD/D/N/A/SA) Strength in Numbers program videos were well designed and of high quality (SD/D/N/A/SA) The Strength in Numbers mathematics questions were acceptable to me as a mathematics teacher (SD/D/N/A/SA)
Adaptability	<ul style="list-style-type: none"> I could adapt Strength in Numbers to meet the needs of my students (SD/D/N/A/SA) I could adapt Strength in Numbers based on the facilities available in my classroom (SD/D/N/A/SA) <p>If you have adapted Strength in Numbers, please explain how/what has been adapted:</p>
Feasibility	Strength in Numbers is easy to implement (SD/D/N/A/SA)
Compatibility (appropriateness)	I believe it is appropriate to deliver Strength in Numbers in my school (SD/D/N/A/SA)
Culture	Teachers at my school generally support each other (SD/D/N/A/SA)
Dose (satisfaction)	Overall, I am satisfied with the Strength in Numbers program (SD/D/N/A/SA)

	<ul style="list-style-type: none"> • Overall, I am satisfied with the Strength in Numbers professional learning workshop (SD/D/N/A/SA) • Overall, I am satisfied with the support I received to deliver Strength in Numbers (SD/D/N/A/SA) <p>Is there any form of support you would like to receive more next time (e.g., school visits, phone calls etc.)?</p>
Capability	<ul style="list-style-type: none"> • I have the physical fitness (i.e., flexibility, aerobic and muscular fitness) to deliver Strength in Numbers (SD/D/N/A/SA) • I have the physical skills (e.g., I can demonstrate the activities) to deliver Strength in Numbers (SD/D/N/A/SA) • I know how to deliver Strength in Numbers (SD/D/N/A/SA) • I can deliver Strength in Numbers even when barriers emerge (e.g., lack of student engagement or lack of time) (SD/D/N/A/SA)
Opportunity	<ul style="list-style-type: none"> • My classroom had sufficient space to deliver the Strength in Numbers program (SD/D/N/A/SA) • My classroom had the equipment (e.g., IWB, speaker, desks and chairs) to deliver Strength in Numbers (SD/D/N/A/SA) • I had enough time to deliver Strength in Numbers (SD/D/N/A/SA) • The Strength in Numbers resources were easy to implement in my classroom (SD/D/N/A/SA) • I had the necessary support from school executives (e.g., principal or head of department) to deliver Strength in Numbers (SD/D/N/A/SA) • I had the necessary support from my colleagues to deliver Strength in Numbers (SD/D/N/A/SA) • I had the necessary support from parents and guardians to deliver Strength in Numbers (SD/D/N/A/SA)
Motivation	<ul style="list-style-type: none"> • I can see the benefits (e.g., improvements in students' classroom behaviour) of delivering Strength in Numbers (SD/D/N/A/SA) • I am planning to deliver Strength in Numbers in future (SD/D/N/A/SA) • I am motivated to deliver Strength in Numbers in future (SD/D/N/A/SA) • My students are motivated to participate in Strength in Numbers (SD/D/N/A/SA) • I enjoy delivering Strength in Numbers (SD/D/N/A/SA) • Delivering Strength in Numbers is part of my routine (SD/D/N/A/SA)

Student focus group questions

Strength in Numbers – Student focus group

Welcome and thank you for volunteering to take part in this focus group. You have been asked to participate as your point of view is important and since you have participated in the program you are in the best position to provide feedback on the program. I appreciate your time.

Introduction: This focus group is designed to assess your current thoughts and feelings about the Strength in Numbers intervention that you have been participating in over the past four weeks. The focus group discussion will take no more than 30 minutes. May I tape the discussion to facilitate its recollection? (if yes, switch on the recorder)

Anonymity: On your initial consent form you have agreed to participate in a focus group discussion at the completion of the study. I thank you for taking the time to share your honest opinions about your experience. Despite being taped, I would like to assure you that the discussion will be anonymous. The files will be kept safely in a locked facility until they are transcribed word for word, then they will be destroyed. The transcribed notes of the interview will contain no information that would allow individual subjects to be linked to specific statements. You should try to answer and comment as accurately and truthfully as possible. If there are any questions or discussions that you do not wish to answer or participate in, you do not have to do so; however please try to answer and be as involved as possible. It would be helpful to allow one participant at a time to answer.

At this point, or any point during the interview you are welcome to cease the interview.

Are you happy to continue?

Begin interview.

Warm up

Questions:

1. Describe your normal behaviour in a mathematics classroom

1. Research Design

Questions:

1. How did you feel about the structure of the SiN program (4 weeks, 2 videos per week)?
2. Were the assessments at the beginning, middle, and end of the program easy to understand and complete?
3. How did you find the videos that were delivered during the program?
4. Did you feel supported by your teacher and any other adults involved in the program?

Prompts:

5. Were there any parts of the program that you found confusing or challenging?
6. Can you suggest a more suitable frequency for the videos?

2. Intervention fidelity

Questions:

1. Were the mathematics questions in the videos relevant and appropriate for your year level?
2. Did you find the resistance training exercises easy to complete in the classroom?
3. How did participating in the SiN program affect you immediately after participating?
4. Did you notice an impact on your ability to learn mathematics immediately after participating in the SiN videos.

Prompts:

1. Were there any challenges you faced while doing the exercises?
2. Did you feel any changes to your on task behaviour, motivation, focus on learning, concentration, enthusiasm and/or persistence with problem solving activities.
3. Did the SiN program change your enjoyment of mathematics lessons.

3. Acceptability

Questions:

1. What did you like most about the SiN program?

2. How often would you choose to start your mathematics lessons with a SiN video?
3. The videos provided a new starting routine to your lesson. Compare this routine to what you do in Mathematics lessons.
4. Did your motivation to complete the videos change over time
5. Would you like to continue using this program or a similar one in your classroom?
6. What improvements, if any, would you suggest for the program moving forward?

Prompts:

7. Did encouragement from your teacher aid your engagement levels?
8. Did participating with your peers help maintain your motivation?

Other

1. Do you have any further ideas comments on anything that was not covered in the questions?

Session observations

Date:

Group/Class:

		<i>(1 = Not at all true to 5 = Very true)</i>				
Design	1. Students accessed the questions online before starting the video	1	2	3	4	5
	2. Students accessed the questions online after completing the video	1	2	3	4	5
	3. Students put the device away quickly and prepared for the lesson.	1	2	3	4	5
Fidelity	4. The teacher played the video within the first 10 minutes of the lesson.	1	2	3	4	5
	5. The videos were easy to access, loaded quickly and played as intended.	1	2	3	4	5
	6. Teacher had to use the USB back up to play videos	5	4	3	2	1
	7. The maths questions were achievable for all students in the class	1	2	3	4	5
	8. Students had sufficient room to safely complete all required exercises	1	2	3	4	5
	9. The timing on the video promoted engagement	1	2	3	4	5
Acceptability	10. Students appeared actively engaged during the videos	1	2	3	4	5
	11. Students remained on-task throughout the video	1	2	3	4	5
	12. Students appeared to enjoy the stimulus video	1	2	3	4	5

Data analysis

In this feasibility study, data analysis will concentrate on evaluating the Strength in Numbers program's feasibility. Analysis will be conducted using research software including SPSS, R data and NVivo. Each measure is aligned with the project's objectives and will be analysed using the techniques mention in the next section.

i) Examine the feasibility of the Strength in Numbers intervention

Analysis of recruitment data will be mainly descriptive (means and SD, median and 25th to 75th centiles for non-normal distributions, or N and %) as appropriate. Loss to post test will be reported. Interviews and focus groups will be analysed using computer software NVivo v12. Thematic analysis will be used to analyse all focus groups and interviews. Triangulation of the survey data will be used to combine qualitative and quantitative data analysis.

ii) Evaluate the preliminary efficacy of the Strength in Numbers program on Stage 5 mathematics students Maths anxiety and On-Task behaviour.

Demographic characteristics will be summarized descriptively. Categorical data will be reported as frequency counts, while continuous data will be expressed as means and standard deviations. For the self-perception of mathematics, the responses will be categorized into groups (e.g., low, medium, high self-perception) for further analysis. On Task behaviour final scores will be reported as percentages of time spent on-task or off-task. Repeated measures ANOVA will be used to assess significant differences in on-task behaviour across recorded time points. Additionally, a correlation analysis will explore the relationship between on-task behaviour scores and self-perception of mathematics. Scores from the Maths Anxiety Measure 1 will be totalled. A paired samples t test will be conducted to compare the means between the two time points. Pre and post exercise scores from the Maths Anxiety 2 measure will be assessed using a repeated measures ANOVA. Additionally, a correlation analysis will explore the relationship between maths anxiety scores and self-perception of mathematics.

Conclusion

Publication strategy

- | | |
|----------------------|---|
| 1. Feasibility trial | Results paper |
| Intended journal | European Journal of Teacher Education (Q2)
Mathematical Thinking and Learning, Taylor Francis (Q2) |
| 2. Efficacy trial | Protocol paper |
| Intended journal | European Journal of Education (Q1)
Teaching and Teacher Education (Q1) |
| 3. Efficacy trial | Results paper |
| Intended journal | European Journal of Education (Q1)
Teaching and Teacher Education (Q1) |

Opportunities to present findings

- Melbourne Mathematics Conference June 4, 2025
- 52nd Annual Conference of the Research Council on Mathematics Learning March 6-8, 2025
- 2025 MANSW Regional Conference will be held in May at the Pacific Bay Resort, Coffs Harbour. Registrations for the conference will open Term 4, 2024
- 2025 MANSW Annual Conference will be held 19 - 21 September at the Novotel Wollongong

Conclusion

Strength in Numbers aims to assess the feasibility and gather preliminary findings on the impact of integrating movement-based activities into Stage 5 mathematics lessons to improve students' math anxiety and on-task behaviour. The research team has collaboratively developed the methodology, with careful consideration for the ethical rights of all participants, ensuring alignment with educational priorities and respect for individual consent. This feasibility study will explore the practicality of delivering the program within regular classroom routines, requiring minimal teacher preparation and adjustments. Strength in Numbers is designed to integrate into existing structures as a low-risk intervention, with insights gained from this study informing potential future direction for the approach and supporting teachers in using movement as an effective pedagogical tool in secondary education.

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