Bringing Social and Emotional Learning into a Mathematics Classroom: An Action Research

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ARTICLE INFO	ABSTRACT
	In mathematics classrooms, self-management plays a critical role in helping students manage emotions, maintain focus, and persevere through challenging tasks. When self-management skills are underdeveloped, students may experience heightened frustration and disengagement, leading to avoidance behaviours and reduced learning outcomes. Although social-emotional learning (SEL) has been identified as a promising approach to address these challenges, practical guidance on embedding SEL strategies meaningfully within mathematics instruction remains limited. This action research aimed to examine how the integration of SEL strategies within daily Grade 3 mathematics lessons influenced students' self-management behaviours in the context of a Malaysian international school. Over twelve weeks with eight weeks of implementation, SEL strategies targeting emotional regulation, attention, and persistence (specifically growth mindset language, brief mindfulness routines, and reflective questioning) were implemented. Data were collected through classroom observations, student interviews, and pre- and post-intervention self-management surveys. Findings indicated improvements in students' perseverance, emotional regulation, and willingness to reattempt challenging tasks, as well as increased control of emotions and usage of self-management strategies. Survey results showed positive movement in indicators related to focus and task completion. However, variations in student engagement highlighted the importance of adapting SEL routines to ensure they are culturally responsive and relatable to students. The study concludes that embedding structured SEL strategies within mathematics instruction can effectively strengthen students' self-management. It contributes to educational practice by offering practical examples of SEL integration in mathematics teaching and by emphasising cultural alignment as a key factor in sustaining student engagement and behavioural change. Through the action research process, the teacher-researcher also developed deeper insights into student behavioural patterns and refined approaches to designing lessons that intentionally integrate SEL in culturally meaningful ways. The discussion also situates the findings within wider international evidence, drawing on UK

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primary-school research to highlight common implementation challenges and contextual differences.

1. Introduction

Challenges in emotional regulation and persistence often shape how young students engage with mathematics. The following section provides the background and rationale for exploring how SEL strategies may support students'self-management in this context.

1.1 Research Background

Self-management is an essential competency that shapes how students engage with and succeed in mathematics. Mathematical tasks often require students to sustain focus, attempt unfamiliar strategies, and persist even when errors occur. When students are still developing the ability to regulate their emotions and maintain attention, frustration and avoidance behaviours can arise, particularly during challenging activities. These patterns are commonly observed in primary mathematics classrooms and underscore the need for instructional approaches that help students respond more constructively to difficulty.

Social-Emotional Learning (SEL) offers a structured framework for supporting students' emotional and behavioural competencies. SEL encompasses skills such as emotional awareness, self-management, social awareness, and relationship building, all of which contribute to improved academic engagement and classroom functioning [1-3]. Empirical research demonstrates the value of SEL in strengthening students' motivation, emotional regulation, and adaptive learning behaviours as shown by studies [2,4,5]. Specific SEL practices, including growth mindset language, mindfulness routines, and reflective questioning, have been shown to help students manage frustration, regulate attention, and re-engage with challenging academic tasks [6-9]. Such strategies provide teachers with practical tools for supporting the emotional and cognitive demands that mathematical learning often entails.

Despite these established benefits, there remains limited guidance on how SEL strategies can be meaningfully embedded within everyday mathematics instruction. Much of the existing literature focuses on whole-school SEL programmes rather than classroom-based routines that can be implemented directly during subject-specific learning. Studies by [10-12] highlight the need for practical, developmentally appropriate approaches that help students apply self-management skills during mathematical reasoning. This gap is particularly evident in primary mathematics contexts, where students frequently encounter difficulty and require structured support to persist.

In response to this gap, the present action research investigates how selected SEL strategies, integrated into Grade 3 mathematics lessons, influenced students' self-management behaviours. The intervention focused on three key practices: growth mindset language, brief mindfulness routines, and reflective questioning. The study aimed to explore how these strategies supported students' emotional regulation, attention, and perseverance when engaging with mathematical tasks. The guiding research question for this investigation was: How do Social Emotional Learning (SEL) strategies affect students' self-management in a Grade 3 mathematics classroom?

This study is significant because it provides a classroom-based model for integrating SEL within mathematics lessons, addressing a need for practical examples that move beyond whole-school programming. By examining the everyday use of brief SEL routines, the study offers insight into feasible and culturally adaptable practices that can strengthen students' self-management skills. The findings contribute to broader discussions about the integration of SEL within subject-specific

teaching and highlight the potential of SEL-informed approaches to support primary students' engagement and resilience in mathematics.

1.2 Literature Review
1.2.1 Social-emotional learning and self-management: Global perspectives

Social-Emotional Learning (SEL) is widely recognised across education systems internationally as a framework that supports students' emotional, behavioural, and academic development [1,2]. Prominent global frameworks, including CASEL's five-competency model, UNESCO's social and emotional competencies, and the OECD Learning Compass, identified emotional regulation, persistence, and reflective thinking as core SEL competencies essential for students' readiness to engage with learning [1,2]. Self-management, in particular, encompasses students' ability to regulate emotions, sustain attention, and persevere through challenging tasks, making it a foundational component of SEL across different national contexts [1,12,13].

Recent international research also demonstrates that SEL is not interpreted or enacted uniformly across school systems. Studies of UK primary schools, for instance, show that teachers' understandings of SEL vary considerably depending on their professional identities, school ethos, and community expectations [14]. The same study also found that SEL is shaped by local norms and priorities, resulting in diverse interpretations ranging from emotional literacy to behaviour management [14]. National surveys of UK primary schools further reveal that, although teachers value SEL, implementation is inconsistent due to variations in training, workload pressures, and policy ambiguity [15]. Research across Asian contexts similarly demonstrates that SEL is interpreted and enacted in ways that reflect cultural values, educational traditions, and school-level expectations. Studies from China and parts of East and Southeast Asia indicate that SEL is often embedded within broader character and moral education frameworks, shaped by norms such as collectivism, respect for authority, and emotional restraint [16,17]. Within these contexts, SEL is closely intertwined with cultural values, influencing how students express and regulate emotions in classroom settings. These findings highlight that SEL operates not only as a theoretical framework but also as a situated educational practice influenced by cultural, organisational, and contextual factors. These contextual differences have important implications for classroom practice. In education systems where SEL is associated with emotional articulation and pupil voice, strategies such as reflective dialogue and self-affirmation may be more readily taken up. In contrast, in contexts where emotional restraint, relational harmony, and respect for authority are emphasised, SEL enactment may rely more heavily on teacher modelling, peer-mediated support, and non-verbal regulation strategies. Understanding these differences is critical for interpreting how SEL strategies function within subject-specific contexts, such as mathematics, rather than assuming uniform transferability across settings.

Global evidence also demonstrates that stronger self-management skills are associated with improved academic engagement, reduced avoidance behaviours, and more adaptive responses to academic challenges during cognitively demanding activities [2,3,12,13,18]. These competencies are particularly important in subjects such as mathematics, where students must tolerate mistakes, sustain attention, and persist through multi-step tasks [13]. SEL interventions have therefore been shown to enhance motivation and learning behaviours across a wide range of international contexts [13]. Collectively, the literature positions self-management as a globally recognised driver of both emotional well-being and academic performance, while also emphasising the need for culturally responsive implementation — an issue that is particularly relevant to this study's Malaysian international school setting.

1.2.2 SEL–Mathematics connections: What research shows

International research increasingly highlights the importance of SEL for supporting students' engagement and persistence in mathematics. Mathematics learning often requires sustained attention, flexible thinking, as well as tolerance for mistakes, making self-management particularly relevant within this subject area [13]. Studies consistently show that students with stronger emotional regulation and perseverance are more likely to persist with challenging mathematical tasks and less likely to engage in avoidance behaviours [13,12]. Broader SEL scholarship similarly indicates that competencies such as emotional regulation and sustained focus contribute to improved academic outcomes, including performance in mathematics [5,19]. These findings underscore that SEL-related skills provide a foundation for navigating cognitively demanding, multi-step mathematical problems [2].

Subject-specific studies further emphasise the relationship between SEL and mathematics learning. Studies in the United Kingdom (UK) show that teachers view SEL as important for supporting students' engagement and learning processes in mathematics, despite reporting barriers and limited guidance for implementation [10]. The study further indicates that teachers recognised the presence of SEL-related practices within mathematics lessons, even when these were not explicitly labelled or systematically implemented [10].

Similar findings have emerged in Asian contexts such as Singapore and China, where social and emotional competencies are commonly developed through broader values-based, character, and whole-child education approaches rather than delivered as standalone SEL programmes [16,17]. Recent subject-specific research further shows that when SEL principles are intentionally integrated into mathematics instruction, students demonstrate higher engagement, improved emotional regulation, and greater persistence during problem solving [9]. Within this regional context, a mixed-methods study of early childhood teachers in China found that teachers' beliefs, pedagogical knowledge, and attitudes towards SEL varied according to professional experience and educational background, highlighting the need for stronger SEL-focused professional support to enhance classroom practices [20]. Similarly, emerging correlational research in Thailand suggests that students' social-emotional competencies are associated with mathematics achievement, underscoring the role of emotional engagement and self-management in mathematical learning [21]. Quasi-experimental research conducted in South Asia further indicates that integrating SEL strategies into mathematics classrooms leads to significant improvements in both students' mathematics achievement and their attitudes toward the subject [22]. Taken together, these findings indicate that SEL-related competencies play a critical role in supporting students' persistence, focus, and self-management in mathematics across diverse cultural contexts.

These cross-context findings align with wider international evidence showing that explicit or embedded SEL practices improve students' focus, confidence, and engagement during mathematics learning [13]. Collectively, these studies highlight that SEL is not peripheral to mathematics instruction but a critical foundation shaping how students interpret challenges, regulate emotions, and sustain effort during mathematical reasoning. This insight directly informs the focus of this action research study.

1.2.3 Evidence-based strategies for embedding SEL in mathematics instruction

A substantial body of international research identifies several evidence-based strategies that effectively support the integration of Social-Emotional Learning within mathematics instruction. One widely studied approach involves the use of growth mindset language, which encourages students

to interpret mistakes as opportunities for developing understanding and has been shown to support more adaptive responses to academic challenges [23]. A study [8] shows that such communication increases students' willingness to persist with difficult tasks as well as reduces disengagement when students encounter academic challenges. These findings align with broader SEL research demonstrating that effort-based feedback promotes adaptive beliefs about learning and strengthens students' resilience during problem solving [13]. International examples, such as Singapore's emphasis on productive struggle in mathematics, further illustrate how growth mindset practices support students' perseverance in high-expectation learning environments [8,16].

Mindfulness routines constitute a second evidence-based strategy. Short breathing or grounding exercises have been shown to enhance emotional regulation and attentional control, which are essential for sustaining engagement in cognitively demanding subjects such as mathematics. Evidence suggests brief mindfulness routines help students reduce stress and regain focus [6], while other studies reported consistent improvements in students' ability to manage emotional reactivity during academic tasks [7]. Reviews of school-based mindfulness programmes similarly report reliable gains across diverse cultural contexts [24]. International SEL literature further emphasises that structured self-regulation strategies provide students with accessible, low-disruption tools for calming themselves before re-engaging with challenging academic tasks [19].

Reflective questioning is another strategy supported by a strong evidence base. Research [9] highlights that structured reflection strengthens students' metacognitive awareness by helping them evaluate strategy choices, monitor their thinking, and recognise factors that influence persistence during mathematical problem solving. This aligns with research showing that reflective dialogue enhances students' ability to monitor their thinking and adjust their approach when initial solutions fail, which is particularly important in multi-step mathematics tasks [19]. Reflective practices also support the development of self-awareness, a foundational component of effective self-regulation during mathematical reasoning. In many Asian contexts, reflective practices are embedded within problem-solving pedagogy, further illustrating their cross-cultural relevance [17].

In addition to explicit strategies, international studies indicate that teachers often embed SEL practices implicitly within mathematics lessons. Findings from UK primary schools similarly reveal that teachers rely on implicit emotional and behavioural support strategies due to constraints in workload and professional development, yet these practices remain integral to sustaining students' engagement and perseverance in mathematics [14,15]. Collectively, the literature suggests that effective SEL integration in mathematics involves a combination of deliberate instructional routines and naturally occurring teacher practices, each contributing to students' emotional readiness, focus, and persistence.

1.2.4 Cultural Responsiveness and the Transferability of SEL Approaches Across Contexts

Although SEL frameworks are widely promoted across global education systems, a growing body of research questions whether SEL approaches are universally transferable across all contexts [25]. Studies conducted in the UK reveal that teachers' understandings of SEL are shaped by local values, professional identities, and school cultures, resulting in significant variation in how SEL is interpreted and enacted [14]. Research suggests that SEL is not a singular, universally understood construct but one that is reinterpreted through the cultural and organisational contexts in which teachers work [14]. Similarly, national surveys of UK primary schools show that, despite valuing SEL, educators implement it inconsistently due to differences in policy expectations, training, and community expectations [15]. These findings suggest that SEL may function differently across cultural settings, supporting calls for culturally grounded interpretations of SEL [25].

Scholars have also cautioned that many widely used SEL frameworks reflect Western assumptions about emotional expression, communication, and individual self-regulation. Research has noted that SEL programmes often promote forms of open emotional disclosure and self-reflection that align with Western socio-emotional norms but may not translate seamlessly into cultural contexts that prioritise restraint, harmony, or collectivist values [25]. This raises critical questions about whether strategies such as growth mindset language, reflective dialogue, or mindfulness routines hold the same meaning for students in different cultural environments. International commentary increasingly emphasises that SEL cannot be viewed as a culturally universal model; instead, it must be examined for its alignment with local norms, communication practices, and community expectations [14,19].

These insights point to an important tension: while SEL offers a promising framework for supporting students' emotional and academic development, its cultural adaptability remains uncertain. For mathematics classrooms in non-Western contexts, this uncertainty is especially relevant, particularly in Asian classrooms where expectations for emotional expression and self-management differ from Western SEL assumptions [17]. Strategies such as encouraging students to verbalise emotions, reflect openly on frustration, or adopt individualised growth-oriented self-talk may require modification to resonate with students' cultural understandings of effort, emotion, and learning. As a result, the literature suggests the need for continued examination of how SEL practices can be adapted, reinterpreted, or localised to ensure that they are culturally meaningful rather than simply transplanted from one educational context to another.

1.2.5 Gap in literature

Although SEL has been shown to improve academic engagement and emotional regulation, there remains limited research explaining how SEL strategies can be embedded directly within mathematics instruction [18]. Much of the existing SEL literature focuses on whole-school programmes or general socio-emotional competencies, rather than subject-specific, classroom-level practices aligned with mathematics learning [10,12]. As a result, there is insufficient clarity regarding how SEL can support students' self-management during mathematical tasks, despite evidence showing that such skills are essential for success in mathematics [13].

Studies that do discuss SEL in mathematics frequently highlight its potential but provide few practical examples of how teachers can integrate SEL without disrupting lesson flow or compromising instructional time [10,12]. Teachers also report uncertainty about which SEL strategies are most effective for mathematics or how to adapt such strategies to meet the cognitive demands of the subject [11]. Furthermore, there is limited empirical work examining how brief, embedded SEL routines influence students' perseverance, attention, and emotional responses during mathematical problem solving, despite consistent claims that these competencies underpin effective mathematics learning [4,13].

Taken together, the literature highlights the need for research that investigates practical, classroom-based SEL strategies that can be embedded into mathematics instruction to strengthen students' emotional regulation, focus, and persistence. Addressing this gap provides the rationale for the present study.

2. Methodology

This section outlines the methodological approach used to investigate how SEL strategies influence students' self-management in a Grade 3 mathematics classroom. It describes the research

design, participants and setting, intervention procedures, data collection methods, and the analytic processes used to interpret the data.

2.1 Research Design

This study adopted an action research design to investigate how intentional SEL strategies could support students' self-management during mathematics lessons. Action research is well-suited to classroom-based inquiry because it enables teachers to implement and examine changes within their own instructional contexts through iterative cycles of planning, acting, observing, and reflecting, as described by research [26,27]. This design aligns with recommendations from [12], who emphasise the value of contextually grounded SEL implementation. The approach was appropriate for this study because it focused on improving observed self-management challenges during mathematics learning and supported ongoing refinement of instructional approaches based on emerging evidence.

2.2 Participants and Setting

The study was conducted in a Grade 3 mathematics classroom within an international school in Malaysia that serves a culturally diverse student population with students from various national backgrounds. Although the class comprised fifteen students, only four students participated directly in the data collection. The participants took part in semi-structured interviews, completed the SEL self-management survey, and were the primary focus of classroom observations. In addition, one mathematics teacher participated by assisting with the implementation of the planned SEL strategies during mathematics lessons and participating in a semi-structured interview to provide insights into classroom behaviours, student responses, and instructional practices throughout the intervention period. The remaining students continued with the usual mathematics lessons but were not included in the study's data set. Details of the student participants are presented in Table 1.

Table 1
Demographics of student participants

Participants	Age	Gender	Nationality	SEL score (pre & post)	Notes on Classroom Engagement
Student 1 (S1)	8	M	Canada/Malaysia	Pre- 23 Post- 40	Participated in tasks with frequent prompting and teacher support.
Student 2 (S2)	9	M	Malaysia	Pre- 24 Post- 36	Displayed low task persistence and limited engagement during independent work.
Student 3 (S3)	9	F	Pakistan/India	Pre- 26 Post- 47	Engaged more consistently during peer-supported activities, particularly when working with a familiar partner.
Student 4 (S4)	8	M	Bangladesh	Pre- 19 Post- 34	Frequently sought opportunities to participate and was eager to be involved in classroom activities.

2.2.1 Researcher positionality

The classroom teacher, who is the first author, served as both instructor and researcher. This dual role allowed for detailed insight into students' behaviours, engagement, and responses to SEL

strategies, while also creating the potential for bias due to pre-existing relationships and familiarity with students' learning patterns. To address this, the co-authors provided regular feedback, critically reviewed observations and interpretations, and facilitated reflective discussions throughout the study. Data were also triangulated across surveys, interviews, and classroom observations. This collaborative approach enhances transparency and situates the study within the reflective and iterative framework of action research.

2.3 Intervention Procedures

The intervention ran for twelve weeks and was structured into three phases.
Phase1:Pre-intervention data collection

During this phase, baseline data were gathered through a student self-management survey and structured classroom observations. The survey items were aligned with core SEL competencies outlined in established SEL frameworks [1], particularly emotional regulation, perseverance, and attention. Observations focused on behaviours such as task engagement, reactions to errors, and use of coping strategies. This baseline provided a reference point for evaluating change over the course of the intervention.

Phase 2: Intervention implementation (weekly SEL–maths routines)

Across eight weeks, three SEL strategies were embedded into daily mathematics instruction. These were selected because research indicates they directly support students' emotional regulation, persistence, and metacognitive awareness, which are essential during mathematical problem solving. The three strategies were:

1. Growth mindset language
   Growth mindset language was intentionally used to frame mistakes as learning opportunities and emphasised effort-based improvement. For example, when students showed signs of wanting to give up during problem-solving tasks, the teacher used brief verbal encouragement such as "You can do it" and "Keep trying" to support persistence and reinforce effort-focused engagement.

2. Brief mindfulness routines
   Each mathematics lesson began with a one to two-minute breathing or grounding exercise, with additional short routines used as brain breaks during challenging tasks. These included short, age-appropriate guided mindfulness videos accessed via online platforms, as well as quiet breathing exercises in which students placed their heads down on their desks and focused on slow, steady breathing for one to two minutes before resuming work.

3. Reflective questioning
   During and after mathematics tasks, students were encouraged to reflect on their emotional responses and consider alternative strategies they could use when they encountered difficulty. Example prompts included "What could you try next?", "Is there another strategy you could use?", and "What has helped you before?", encouraging persistence and strategic thinking rather than emotional discussion.

These routines were embedded consistently but briefly, ensuring minimal disruption to mathematics instructional time and addressing concerns often raised by teachers regarding feasibility [11]. Throughout the intervention, SEL routines were continuously refined in response to

students' engagement patterns and cultural norms related to emotional expression and classroom interaction. This included increased teacher modelling, peer-supported affirmation, and the use of brief non-verbal regulation strategies to ensure that SEL practices were culturally responsive and accessible to students. For example, rather than asking individual students to verbalise self-affirming statements, encouragement and reassurance were modelled by the teacher and framed collectively. When students showed signs of frustration or loss of focus, the class was guided to pause and engage in calming routines together, such as quiet breathing with heads down on desks, before returning to the task. Reflective questioning was also adjusted to focus on helping students identify next steps in problem-solving, using prompts such as "What could you try next?" or "Is there another strategy you could use?", rather than requiring explicit emotional disclosure.

Phase 3: Post-intervention data collection

The same survey used in Phase 1 was re-administered to measure changes in students' self-perceived self-management skills. Follow-up observations were conducted using the same behavioural indicators recorded during the pre-phase. Short student interviews, aligned with reflective SEL literature [9], were conducted to capture students' perspectives on how the routines influenced their focus, emotions, and perseverance during mathematics tasks.

2.4 Data Collection

A mixed-methods approach was used to obtain a comprehensive picture of student change. Research highlights the value of integrating quantitative and qualitative data to strengthen interpretations in educational research [28].
Data sources included:
1. **Student SELIS surveys** captured perceived emotional regulation, attention, and perseverance. The student survey was adapted from the Social and Emotional Learning Indicator System developed by the Massachusetts Department of Elementary and Secondary Education [29]. The survey items were reviewed and adapted to ensure they were culturally and contextually appropriate, clearly worded, and age-appropriate. A pilot test was conducted with a small group of students to confirm the clarity, relevance, and suitability of the items for this context. Minor adaptations were made to enhance accessibility while retaining alignment with the original SELIS self-management constructs. Specifically, items were reworded using simpler language and first-person phrasing to support comprehension (for example, "Staying calm when I feel stressed" was adapted to "Stay calm when I feel upset"), and abstract self-regulatory concepts were reframed as concrete classroom behaviours familiar to students, such as sustaining attention during lessons, persisting with challenging tasks, and seeking support from a trusted adult at school. The response scale was also adapted to reflect perceived ease or difficulty (ranging from Very Hard to Very Easy), which was considered more developmentally appropriate for younger learners than frequency-based scales.
2. **Structured classroom observations** documented behavioural indicators related to self-regulation. See Table 2.

Table 2
Observation sheet

Behaviour	Yes	No	Notes
Shows awareness of emotions	✓		Verbalised needing a moment to think
Uses breathing or mindfulness		✓	Needed reminding when losing focus
Remains focused for expected duration	✓		Took breathing breaks with prompting.
Reattempts difficult problems	✓		Tried second and third attempts calmly
Asks for help appropriately	✓		Asked questions but didn't want teacher to give answer
Follows routines independently		✓	Higher independence.
Completes work within expected time	✓		Completed quickly with some errors
Shows signs of frustration	✓		Mild tension but self regulated.

3. **Student and class teacher interviews** provided qualitative insight into emotional responses, strategy use, and perceived benefits of the routines. Sample interview questions include:
   o Student: "When something feels difficult in maths, what do you normally do?"
   o Student: "Are there any ways you help yourself calm down or stay steady when you feel upset or frustrated?"
   o Teacher: "What differences, if any, have you noticed in how students recognise when they are feeling frustrated or overwhelmed?"
   o

Using multiple data sources aligns with established recommendations for evaluating SEL interventions [12,13] and supports triangulation to strengthen the credibility of findings.

2.5 Data Analysis

Data were analysed using a mixed-methods approach that allowed patterns in students' self-management skills to be examined across surveys, observations, and interviews. Survey responses were analysed descriptively to identify pre- and post-intervention shifts in areas such as emotional regulation, perseverance, and focus. The student self-management survey consisted of 16 items, each rated on a 5-point Likert-type scale ranging from 1 (Very Hard) to 5 (Very Easy). Items assessed students' perceived ability to regulate emotions, sustain attention, persist with challenging tasks, and manage learning-related behaviours such as planning, goal-setting, and task completion. Total scores therefore ranged from 16 to 80, with higher scores indicating stronger perceived self-management skills. Pre- and post-intervention survey scores were interpreted descriptively to examine patterns of change over time rather than to establish diagnostic cut-off points. Survey results were triangulated with classroom observations and student interview data to support the interpretation of changes in students' self-management behaviours. Observation notes were coded for behavioural indicators such as pausing, re-engagement after difficulty, visible frustration, and strategy use. These codes were compared across lessons to track change over time.

Interview transcripts from the four students and the teacher were analysed thematically. Initial codes such as "calming down before continuing," "giving up quickly," "using breathing to reset," "rereading the question," and "seeking help immediately" were grouped into broader themes

reflecting emerging self-management patterns. These included Improved Emotional Regulation, More Adaptive Responses to Challenge, and Strengthened Use of Self-Management Strategies. Convergence across data sources (survey movement, observation patterns, and student/teacher accounts) was used to strengthen interpretations, consistent with recommendations for evaluating SEL outcomes through multidimensional evidence [12,28].

3. Findings and Discussion

At the outset of the intervention, student engagement with SEL routines was uneven. While participants generally complied with lesson structures, early observations indicated limited participation during activities and hesitancy in expressing frustration or uncertainty during mathematical tasks. All Participants also appeared uncomfortable engaging in self-referential statements about their abilities or emotions, particularly when asked to verbalise feelings related to difficulty or failure. Instead, participants responded more readily to compliments and reassurance delivered by peers and the teacher, which were therefore incorporated to support engagement during challenging tasks. When such external affirmation was not present, participants were more likely to disengage quietly or wait for teacher direction rather than articulate difficulty independently.

These patterns were interpreted within the cultural context of the classroom, which comprised participants from diverse backgrounds and reflected norms of emotional restraint, respect for teacher authority, and task compliance. Such norms have been widely reported in international and Asian-influenced educational contexts, where emotional expression is often regulated, and perseverance is emphasised over verbal disclosure of difficulty [17,19]. In response to these culturally mediated engagement patterns, the implementation of SEL strategies was refined to better align with these classroom norms. Greater emphasis was placed on teacher modelling of emotional regulation, peer-supported compliments, brief non-verbal mindfulness routines, and the normalisation of struggle through growth-oriented language. Following these refinements, participants demonstrated more consistent engagement and increased use of self-management strategies across mathematics lessons.

3.1 Development of Emotional Regulation in Mathematics Lessons

Pre-intervention observations revealed that participants often struggled to regulate their emotions during mathematics lessons. Across the class, S1–S4 displayed reactions such as fidgeting, abrupt stopping of work, or stepping away from their seats when tasks became confusing or cognitively demanding. These behaviours were especially apparent when activities involved multiple steps or unfamiliar procedures, and participants frequently disengaged before attempting strategies to steady themselves. Pre-intervention survey responses supported these observational patterns, with lower ratings in items related to calming down when frustrated and recognising emotional signals.

Following the SEL intervention, interview data and post-intervention observations showed noticeable improvements in participants' ability to recognise and regulate their emotions during mathematical tasks. S1 described using slow breathing to "feel calmer again," while S3 explained, "When I'm tense, I know I need to slow down." These reflections suggest that participants developed heightened awareness of their emotional cues and were beginning to apply regulation strategies purposefully. During lessons, participants paused more intentionally, used breathing exercises without immediately needing reminders, and verbalised their feelings ("I am stuck," "I need a

moment") rather than disengaging abruptly. Such behaviours were not present before the intervention.

The math teacher also reported a calmer and more stable emotional climate during mathematics lessons. Participants exhibited fewer reactive behaviours and demonstrated greater composure when encountering challenging problems, a pattern consistent with research showing that SEL-informed classroom practices can improve emotional climate and student regulation [3]. The teacher noted that participants were increasingly able to pause, breathe, and reattempt a task instead of escalating frustration, a shift that contributed to smoother lesson flow and more productive engagement.

Post-intervention survey results reinforced these qualitative findings. Items related to recognising emotional escalation and calming oneself showed the clearest positive movement, consistent with the regulatory behaviours observed during lessons and described in student interviews. Although the survey was not weighted as a primary data source, its convergence with observational and interview data strengthens confidence in the noted improvements.

These patterns align with existing research showing that mindfulness practices and reflective SEL strategies help students identify emotional cues and stabilise their responses during academic work [6,7,24]. In mathematics, where confusion and error are common, improved emotional regulation enabled students to remain engaged long enough to attempt solutions rather than withdrawing from the task. While some participants still required occasional prompting, the overall progression suggests that the SEL routines positively influenced how S1–S4 managed their emotions during mathematical learning.

3.2 Increased Perseverance and More Adaptive Responses to Challenge

Before the intervention, observations showed that S1–S4 often found it difficult to stay with a mathematical task once it became confusing or felt too demanding. When problems involved several steps or unfamiliar wording, participants tended to stop quickly, guess answers, or wait for teacher support rather than trying different approaches. Moments of frustration were often followed by disengagement, and participants rarely attempted to return to the problem once they stepped away. Pre-intervention survey responses supported these observations, as participants reported low confidence in continuing after mistakes or when tasks felt hard.

After the SEL routines were introduced, participants began approaching challenges in noticeably different ways. In interviews, S2 explained that he now tries to "slow down and do it bit by bit," and S1 shared that he rereads the question before deciding he cannot do it. S3 spoke about thinking "more carefully about what the question wants," showing a growing awareness of how to break tasks down rather than giving up immediately. These shifts suggest that the participants were becoming more patient with themselves and more willing to try again when their first attempt did not work, consistent with research showing that growth-oriented beliefs help students persist through academic challenges [23].

These changes were evident during lessons as well. Participants attempted problems more than once, revisited steps they had initially skipped, and showed fewer signs of impulsive guessing. Instead of stopping altogether, they paused, reconsidered their approach, and often made a second or third attempt before seeking help. The class teacher also noticed a clear difference, commenting that participants were "more willing to reread questions, try different strategies, and persist for longer periods" compared with the start of the term.

Post-intervention survey results reinforced these patterns, showing positive movement in items related to trying again after mistakes and sticking with challenging work. Although the survey served

only as supporting evidence in this study, its alignment with the observational and interview data strengthens confidence in the improvements noted.

These developments reflect wider findings in SEL research, which suggest that growth mindset language and reflective routines help students interpret difficulty as a normal part of learning rather than a sign of failure [8,9,19]. In mathematics, where confusion and error are common, the increased perseverance shown by S1–S4 allowed them to remain engaged with problems for longer and respond more constructively when their initial attempts were unsuccessful.

3.3 Strengthened Use of Self-Management Strategies to Support Focus and Engagement

Before the intervention, observations showed that S1–S4 often struggled to stay focused during mathematics lessons. The participants were easily distracted by noise, movement, or moments of confusion, and they rarely used strategies independently to regain their attention. When tasks felt overwhelming, several participants disengaged quickly or waited for adult redirection. Pre-intervention survey responses supported these patterns, indicating lower confidence in staying focused or bringing attention back to the task after becoming distracted.

After the SEL routines were introduced, the participants began using self-management strategies more deliberately and, in some cases, independently. In interviews, S1 shared that "sitting properly and looking at the board helps me pay attention," while S2 explained that keeping his hands still made it easier to focus. S3 described recognising her own stress signals, saying, "When I'm tense, I know I need to slow down," and S4 noted that "breathing is easy… I don't have to think too much," showing that the routine had become familiar and comforting.

These interview accounts were reflected in classroom observations. The participants paused intentionally when they began to lose focus, used slow breathing to reset, or momentarily closed their eyes before returning to the task. Several participants began applying strategies without waiting for a reminder, particularly during more demanding parts of the lesson. Even when prompts were needed, participants responded more quickly and were more willing to steady themselves before continuing. The math teacher also noticed this shift, commenting that the participants seemed "more settled during lessons" and were able to complete tasks more efficiently than at the start of the term.

Post-intervention survey responses reinforced these qualitative findings, showing upward movement on items related to maintaining focus and using strategies to manage distraction. While the survey served primarily as a supporting measure, its alignment with observational and interview data strengthens confidence in the changes observed.

These improvements mirror research suggesting that SEL routines, especially mindfulness practices and reflective questioning, support students' awareness of attention and emotional states and apply strategies to re-engage [6,9,19]. In mathematics, where sustained concentration is essential for following multi-step processes or understanding new concepts, the development of these self-management behaviours allowed S1–S4 to participate more steadily and confidently across lessons.

4. Conclusion

This action research examined how embedding SEL strategies within Grade 3 mathematics lessons supported students' self-management, particularly in relation to emotional regulation, perseverance, and engagement. Taken together, the findings suggest that changes in self-management did not occur through any single strategy, but through the interaction of consistent SEL routines, teacher modelling, peer interactions, and alignment with classroom norms. Growth

mindset language, brief mindfulness routines, and reflective questioning were most effective when they were integrated naturally into mathematics instruction and adapted to how students were comfortable engaging. This highlights that self-management in mathematics is not simply an individual skill to be developed in isolation, but a relational and context-dependent process shaped by classroom culture and everyday teaching practices.

The findings also revealed important nuances in the implementation of SEL strategies. While participants became more engaged and willing to persist over time, they were more comfortable receiving encouragement and reassurance from peers or the teacher than engaging in self-referential reflection or self-affirmation. This pattern aligns with research on Asian educational contexts, where norms of emotional restraint, respect for authority, and relational affirmation often shape classroom interaction and expressions of confidence. SEL approaches that emphasise individual emotional disclosure or self-directed affirmation may therefore require adaptation to align with students' preferred ways of engaging. Viewed alongside UK primary school research, which often emphasises pupil voice, verbal reflection, and individual emotional articulation, these findings highlight how differing cultural and pedagogical contexts shape the ways SEL strategies are enacted and taken up in mathematics classrooms. Although students demonstrated improved emotional regulation and perseverance, some continued to rely on teacher prompts, indicating that the development of independent self-management may require extended time, repeated modelling, and gradual release of responsibility.

Several limitations of this study must be acknowledged. First, the research was conducted in a single Grade 3 classroom within a Malaysian international school, with a small number of focal participants, which limits statistical generalisability but supports naturalistic generalisability by allowing readers to judge the relevance of the findings to similar educational contexts. Second, the intervention was implemented over a relatively short period, capturing early changes in self-management rather than longer-term development. Third, as the classroom teacher also served as the researcher, there is an inherent risk of researcher bias associated with action research, although this was mitigated through data triangulation and collaborative analysis with co-authors. Finally, the absence of a control or comparison group means that observed changes cannot be attributed solely to the SEL strategies implemented.

This study also raises several unanswered questions that warrant further investigation. Future research could examine how students' reliance on external encouragement changes over longer periods and whether greater independence in self-regulation emerges with sustained exposure to SEL practices. Comparative research across Asian and Western classroom contexts may further illuminate how cultural norms influence the enactment and uptake of SEL strategies in mathematics learning. Further research could also explore the role of peer-mediated SEL practices in mathematics classrooms and their influence on sustained engagement and perseverance.

Overall, this action research offers a contextually grounded account of how SEL strategies can be embedded within primary mathematics instruction to support students' self-management. Rather than claiming broad international applicability, the study contributes practice-based insight into how SEL routines may be adapted to align with classroom norms and cultural expectations. By explicitly examining how students' engagement with SEL strategies was shaped by cultural patterns of emotional expression, authority, and peer interaction, the findings contribute to international discussions on the contextual nature of SEL implementation, highlighting transferable considerations rather than universal solutions.

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