

ADVANCING AI-DRIVEN PEDAGOGY THROUGH THE REGULATION OF EMOTIONS: A VISION FOR SCHOOL PRACTITIONERS

PROMUOVERE A PEDAGOGIA BASATA SULL'INTELLIGENZA ARTIFICIALE ATTRAVERSO LA REGOLAZIONE DELLE EMOZIONI: UNA VISIONE PER I PROFESSIONISTI SCOLASTICI



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ABSTRACT

This paper introduces an emotion regulation (ER) intervention programme through teacher training designed to enhance learning, academic performance, and well-being in early years' classrooms. It assists teachers in implementing neuroscientific ER strategies based on Gross' 2015 model, addressing mental health and AI use issues. Its effectiveness was assessed through classroom observations and interviews, comparing an Intervention Group to a Control Group. The Intervention Group showed improved student behaviour and learning environments using antecedent-focused ER strategies, contrary to the Control Group, which used response modulation. This study provides valuable insights for educators to support children's emotional, social, and academic growth.

Questo articolo presenta un programma di intervento sulla regolazione delle emozioni (ER) attraverso la formazione degli insegnanti, progettato per migliorare l'apprendimento, il rendimento scolastico e il benessere nelle classi dei primi anni di vita. Il programma assiste gli insegnanti nell'implementazione di strategie neuroscientifiche di ER basate sul modello di Gross del 2015, affrontando problemi di salute mentale e di uso dell'IA. La sua efficacia è stata valutata attraverso osservazioni in classe e interviste, confrontando un gruppo di intervento con un gruppo di controllo. Il gruppo di intervento ha mostrato un miglioramento del comportamento degli studenti e dell'ambiente di apprendimento grazie all'utilizzo di strategie ER focalizzate sugli antecedenti, al contrario del gruppo di controllo, che ha utilizzato la modulazione della risposta. Questo studio fornisce preziose indicazioni agli educatori per sostenere la crescita emotiva, sociale e accademica dei bambini.

KEYWORDS

Emotion Regulation; AI; Intervention Programme; Neuroscientific Strategies; Self-regulation; Early Childhood Education
Regolazione delle emozioni; IA; Programma di intervento; Strategie neuroscientifiche; Autoregolazione; Educazione della prima infanzia

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1. Introduction

In today's educational setting, the integration of Artificial Intelligence (AI) tools into learning environments is accelerating at a remarkable pace (Rane et al., 2023). These tools, while enhancing certain cognitive functions and processing tasks with unprecedented efficiency, inherently lack emotional capacities (Galea, 2023; OECD, 2023). This dichotomy underscores the increasing importance of Emotional Intelligence (EI), particularly Emotion Regulation (ER)—a pivotal component of educational neuroscience (EN). It is essential to develop resilient, reflective, and self-regulated learners who are equipped not only with technical skills but also with robust emotional skills to handle the complexities of the modern world (Galea, 2024; Luna Scott, 2015).

As we delve deeper into the 21st century, the interaction between students and AI tools will become more prevalent, making it imperative to foster an educational system that balances technological proficiency with emotional insight. The absence of empathy, creativity, and interpersonal skills in AI poses significant challenges, particularly in contexts where emotional engagement plays a crucial role in learning and development (OECD, 2023). The importance of ER training becomes evident as it complements AI's capabilities, thus fostering a balanced development of students' intellectual and emotional capabilities.

The synergy between advanced AI capabilities and human soft skills, such as ER, is not merely additive but transformative. It creates a paradigm for innovation and problem-solving that neither could achieve in isolation. This integration can drive forward educational practices that are more inclusive, innovative, and effective, preparing students not only for the challenges of their future careers but also for personal success and well-being (Frey et al., 2019; Slade & Griffith, 2013). However, while the benefits are diverse, the integration of such advanced technologies in schools must be handled with care to ensure that the emotional and social growth of students is not overshadowed by technological advancement. This is where learning professionals and educators must play a crucial role.

Recognising this need, the proposed framework in this paper includes an ER intervention programme specifically designed to address this challenge. This programme aims to enhance effective learning and academic performance while also investing in the personal success and well-being of students. The ER intervention programme is not just a supplementary component of education; it is a necessary foundation for protecting against future mental health challenges and addressing potential problems associated with AI use (OECD, 2023).

Hence, the purpose of this study is to explore the impact of ER in Maltese early years classrooms on the quality of both teaching and learning. The ER intervention programme, implemented at a local co-educational private primary school, equipped a group of teachers in Kindergarten Two and Year One with ER strategies, enabling them through co-regulation to teach their students how to ultimately self-regulate their emotions. This research shows how the principles of ER can be transformed into practical tools embedded within the curriculum, allowing educators to support the integration of all students through a universal intervention programme.

2. The Impact of Emotions on the Teaching and Learning Process

The role of emotions in the educational journey of students is profoundly significant, influencing how they absorb, process, and recall information (Pekrun, 2014). Emotions influence how students view learning experiences, impacting motivation, engagement, and ultimately, academic outcomes (Bower, 2014).

Positive emotions, such as joy, curiosity, and excitement not only enhance a student's learning process by increasing motivation but also facilitate deeper cognitive processing and better retention of information, thereby promoting a more meaningful and enduring learning experience (Gregory & Kaufeldt, 2015). For instance, when students feel interested and excited, they are more likely to participate in discussions, explore additional resources, and approach learning tasks with enthusiasm.

Conversely, negative emotions such as anxiety, frustration, and boredom can hinder learning (Graesser & D'Mello, 2012). Anxiety is particularly prevalent in educational settings, often triggered by high-stakes testing, performance pressure, anticipation of events, such as school concerts, or interpersonal issues such as a fight with a friend during a lunch break (Zeidner, 2014). Such stress can impair cognitive functions critical for learning, such as working memory and attention, leading to diminished academic performance (Owens et al., 2012).

Recognising the profound impact of emotions on students' learning, research (Fried, 2011; Galea, 2024; Jones & Bouffard, 2012; Jones, 2014; Pervez & Galea, 2024) is increasingly promoting the integration of ER strategies into the curriculum, equipping students with tools for academic and AI success, and well-being (Jones, 2010).

3. Emotion Regulation in Educational Settings – Understanding Its Necessity and Impact in Schools

Children's emotions are transient, instinctive, and frequently expressed through sudden, intense outbursts (Kolitz, 2018). These emotions can be confusing and stressful for the students (Kolitz, 2018). Despite the rapid maturation of the nervous system during early childhood (Gogtay et al., 2004), the prefrontal cortex, which is critical for managing intense emotions, develops slower, leaving children with the lack of knowledge or skills necessary to manage their emotional responses. This hinders their ability to self-regulate (Shonkoff & Phillips, 2000; Perlman & Pelphrey, 2010), making children easily influenced by their environment (Leisman & Melillo, 2012; Martin & Ochsner, 2016).

This delayed development emphasises the vital role of primary caregivers, at home or in school, in developing children's ability to self-regulate (Kopp, 1982; Stuss & Benson, 1986). If children fail to develop strong ER skills, they may experience negative social outcomes and psychological issues later in life, such as depression, antisocial behaviour, and addiction, which we call *emotional dysregulation* (Campbell-Sills & Barlow, 2007; Cole et al., 1994). Hence, effective ER not only supports academic and social success but also contributes to better health and reduced stress levels (Denham et al., 2002, 2003; Gottman, 2011; Somerville & Whitebread, 2019). It lays a foundation for lifelong resilience, helping to develop stable, healthy, and capable individuals.

4. The Role of Emotion Regulation in Enhancing AI Interactions

The integration of AI into classroom settings has enhanced learning opportunities, offering personalised experiences and promoting an increased engagement with technology. However, the successful implementation of AI in education goes beyond just incorporating it with existing technology—it also heavily depends on the human aspects of learning, particularly ER among students (Molenaar et al., 2023). ER, the ability to manage and respond to an emotionally-challenging situation in an adaptive manner (Gross, 2015), plays a crucial role in enhancing interactions between students and AI-driven practices in classrooms. This core skill is fundamental to both human development and learning (Eisenberg & Spinrad, 2004; Kochanska & Knaack, 2003; Kopp, 1982).

Students often face new challenges that can provoke a range of emotions from excitement to anxiety (Rodway & Schepman, 2023) when using AI tools. Here, ER

becomes key in helping students manage their emotions, making sure these emotions do not hinder their learning processes but rather support their academic efforts (Kurki et al., 2017). Additionally, using AI as a tool in classrooms can accelerate the learning process by providing instant feedback, which, while beneficial, can also be a source of anxiety and frustration for some students (Rodway & Schepman, 2023). Effective ER strategies can help students manage these emotions, turning negative feedback into a constructive tool for improvement. For instance, viewing AI feedback as a helpful source of information rather than criticism can change the emotional experience and enhance learning outcomes.

Positive emotional engagement is vital for learning, and ER can help students maintain a positive state (Tan et al., 2021), enhancing their interaction with AI tools. When students can regulate emotions, such as boredom, frustration, disappointment or excitement, they can stay more engaged and motivated, regardless of the pace of learning (Mega et al., 2014). Additionally, AI in education often requires students to adapt to new ways of learning and interacting with content (OECD, 2023). This adaptability becomes crucial in AI-driven classrooms, where algorithms might frequently shift learning paths or strategies, requiring students to adjust their approaches and expectations accordingly (Das et al., 2023). In this context, teachers can assist students regulate their emotions, and guide them in understanding how to interpret and use AI feedback effectively (Das et al., 2023).

Therefore, to maximise the benefits of AI in education, schools must teach and support the development of ER skills, equipping students with strategies for managing stress, recognising their emotions, and responding appropriately to emotional cues (Zieher et al., 2024). Consequently, educators play an irreplaceable role in modelling and teaching ER (Ahn, 2005; Frankel et al., 2012).

However, ER coaching in schools should not be confined solely to the context of AI use, but rather it should be a continuous practice embedded within the daily school and classroom environment. This approach involves modelling ER skills during emotionally-challenging situations that students encounter throughout their day (Fried, 2011). By actively coaching students in managing their emotions as these situations arise, rather than waiting for a specific AI-related context, children can develop the resilience and emotional intelligence they need (Kraiss et al., 2020), learning to self-regulate their emotions and behaviour (Graziano et al., 2007). This empowerment enables students to control their own emotions and approach AI tools, as well as other aspects of their lives, with a balanced perspective. By

developing a strong ER foundational skill set, students are equipped to use these tools effectively and responsibly, ensuring that AI does not undermine their well-being or overwhelm them (OECD, 2023).

By achieving this, teachers effectively bridge the gap between technology and human emotion, guiding students in managing their emotional reactions and enhancing their learning experiences. As AI continues to transform education, the focus on emotional well-being will be crucial for creating a well-balanced, productive, and engaging learning environment for all students.

5. Overview of Emotion Regulation and Its Strategies

While Gross' definition of ER primarily focuses on intrapersonal characteristics, defining ER as the processes by which individuals influence which emotions they have, when they have them, and how they experience and express these emotions (1998), Thompson (1994) broadens this perspective. He describes ER as 'a series of processes, both intrinsic and extrinsic, responsible for monitoring, evaluating, and modifying emotional reactions to achieve personal goals' (p. 27), referring to this as instrumental ER. Intrinsically, a child's ER is heavily influenced by their temperament and cognitive processes, such as memory and attention. Extrinsic factors involve the caregiving environment—including parents, teachers, and peers—which shapes and supports the child's emotional and culturally appropriate behaviours (Fox & Calkins, 2003).

Gross' emotion process model (1998, 2015) is particularly influential, proposing that emotions can be regulated at various stages to align with desired behaviours or goals (Aldao et al., 2015). This model, noted for its flexibility and adaptability in real-life contexts, contrasts with other ER models by emphasising the malleability of emotions and their modulation to shape emotional responses (Dahlgren, 2014). Hence, Gross' ER strategy model is particularly effective because of its flexibility and its focus on situational context, making it suitable for addressing emotions as they occur within the classroom (Seeley et al., 2015).

According to Gross (1998, 2015), the ER process involves five key stages: situation selection, situation modification, attentional deployment, cognitive change, and response modulation. As one notes in figure 1 below, Gross' model categorises strategies into antecedent-focused, which occur before the full generation of an emotion, and response-focused, which happen after the emotion has arisen. Gross (2015) points out that antecedent-focused strategies are more effective in reducing

emotional experiences because they intervene early in the emotional generation process, thereby altering the emotional trajectory (Gross & John, 2003).

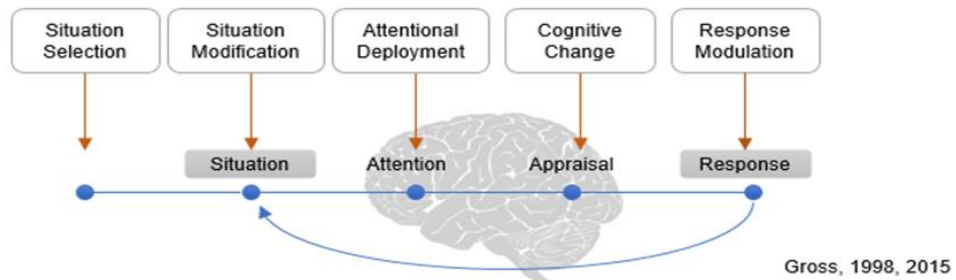


Figure 1. Gross' process model of ER (1998, 2015)

This study incorporates three antecedent-focused strategies—situation modification, attention deployment through distraction, and cognitive change through reappraisal—alongside response modulation. These strategies are selected for their evidenced benefits in enhancing interpersonal outcomes and overall well-being (Gross, 1998; Gross, 2007; Singh & Sharma, 2018; Somerville & Whitebread, 2019). The process model of ER elaborated by Gross (2015) divides the ER cycle into three stages: identification, selection, and implementation, each critical to the successful regulation of emotions in context-specific situations. This approach allows for the specific application of ER strategies, crucial for effective emotional management and development.

6. Co- to Self-Regulation through an Intervention Programme

Understanding and implementing ER strategies in schools from an early age is crucial in addressing the needs of students and helping form proper ER neural networks for future functioning (Uylings, 2006). This is especially crucial for those experiencing high levels of stress and trauma at home, which they bring into the school environment (Burns et al., 2010). Without these ER skills, students may struggle with social and emotional challenges when they begin formal schooling, potentially hindering their learning process.

Despite the recognised importance of developing ER during early childhood, variations in children's ability to self-regulate have raised concerns among educators (Jones, 2014). Teachers, who spend considerable time with students, play a critical role in refining and managing young children's emotional responses to different situations (Panfile & Laible, 2012), building their regulatory skills. If ER skills are internalised successfully, students might transfer these strategies to other contexts, such as their homes (Macklem, 2007).

However, early childhood educators often lack sufficient training to help children develop these skills effectively (McClelland et al., 2017). Hence, professional development workshops can help teachers in establishing more efficient classroom management by providing systematic approaches to ER interventions. Indeed, the primary goal of the current ER intervention programme presented within this study is to help children regulate their emotions in the mainstream early years' classrooms through systematic co-regulation. Co-regulation occurs when a teacher or a more emotionally-regulated peer helps manage another student's emotions and behaviour through modelling effective ER strategies (Silkenbeumer et al., 2016). This strengthens their ability to regulate emotions contextually from explicit, deliberate methods to more implicit, unconscious strategies, leading to self-regulation (Boekaerts & Corno, 2005; Silkenbeumer et al., 2016). Moreover, the consistent practice of these ER strategies within classrooms ensures that children develop the skills necessary for managing emotions effectively across different situations (Chaplin & Cole, 2005; Davidson, 1998). During the co-regulatory process, cognitive scaffolding is employed, which involves the teacher or a more regulated peer sharing self-regulatory processes with less regulated students, gradually transferring responsibility to help internalise these skills (Meyer & Turner, 2007). This approach is aligned with Vygotsky's 'Zone of Proximal Development,' which supports learning just beyond the child's current abilities.

Additionally, structured environments and supportive interactions with caregivers are essential for practising these new ER strategies. The effective implementation of Gross' ER strategies (2015) during whole-class instruction allows children to observe and imitate these approaches, enhancing their ability to modify their emotions suitably within the classroom (Bodrova & Leong, 2017; Braund & Timmons, 2021). However, the success of ER strategies in the classroom requires that teachers be adequately trained and supported. This ensures that teachers can model these strategies effectively and understand their dual role as facilitators of both emotional development and academic instruction (Nadelson et al., 2021). Ultimately, a well-designed ER intervention programme, coupled with professional

development for educators, is essential for promoting ER among students, thereby enhancing their academic and social success.

7. Study Research Question

After synthesising the evidence from the literature, the current project addresses the following key research question: Has the teacher training ER intervention programme altered the use of ER strategies within the classroom across various age groups?

8. Methodology

The main goal of this research was to test an intervention aimed at promoting ER strategies by teachers, assessing its effectiveness across two age groups—Kindergarten Two and Year One—at a private co-educational primary school. The project evaluated the effectiveness and feasibility of the ER intervention programme, focusing on how teachers engage with the intervention and its impact on their teaching practices. A mixed-methods approach (See Fig. 2), combining quantitative and qualitative methodologies, was adopted to explore various aspects of the research problem, reflecting a pragmatic paradigm considered effective in social science research (Creswell et al., 2003; Morgan, 2014; Feilzer, 2009).

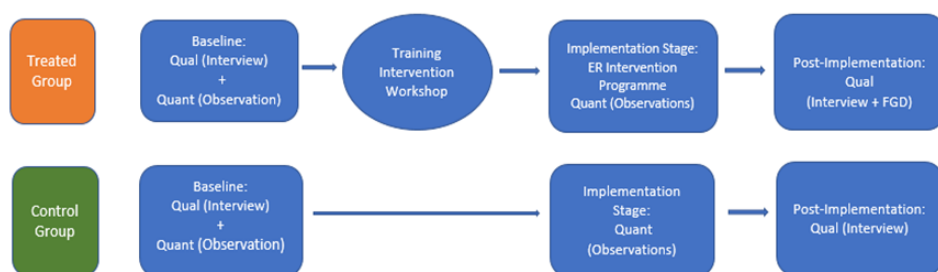


Figure 2. Mixed-Methods Approach using a Two-Group Control Design

In the study, systematic baseline observations were conducted prior to a teacher training workshop to assess the existing use of ER strategies by teachers in their classrooms. Following the training, further systematic classroom observations with

both KG Two and Year One (Control and Intervention) were conducted at implementation stage over a span of five months. Using a checklist during the classroom observations, the researcher, together with an inter-coder, recorded ER strategy use by teachers and students in both KG Two and Year One (Control and Intervention Groups), providing primary data on the effectiveness of these strategies and their impact on students and the classroom environment (Burmeister & Aitken, 2012; Maheshwari, 2011). The efficacy of the intervention was then assessed by comparing observations from KG Two and Year One classrooms in both the Control and Intervention Groups, which included evaluations of classroom environment quality and the success of ER strategy implementation (Neubauer et al., 2019). To gain deeper insights, further assessments were conducted through baseline and post-implementation semi-structured interviews (SSIs) and a post-intervention focus group discussion (FGD), focusing on teachers' perspectives on the intervention, its implementation, and the outcomes of applying ER strategies across the different year groups (Benbasat et al., 1987).

The research adopted a case study approach due to the restrictions imposed by the Health Authorities and the Ministry of Education during the COVID-19 pandemic. Consequently, the scope of the study had to be adjusted to comply with new guidelines. Specifically, visiting multiple schools was not feasible as it could disrupt the class 'bubbles' designed to prevent the virus's spread. Therefore, it was determined that the study would be conducted within the school where the researcher is employed, ensuring that the research could proceed without compromising the integrity of these protective class 'bubbles.' This method facilitated a rich understanding of the interactions between teachers and students and the application of theoretical concepts in real-time classroom scenarios (Creswell, 2006; Siggelkow, 2007). It emphasised depth over breadth in data collection, allowing for a detailed examination of the research area within the specific educational setting. The researcher took on the position of an insider-researcher, which, despite potential biases, provided an indepth, contextual perspective into the data collected. This approach was justified by the familiarity of the researcher with the setting and participants, enhancing the richness of the data and understanding of the trajectories in classroom dynamics (Adler & Adler, 1987; Brannick & Coghlan, 2007).

Additionally, a pilot study was conducted at the same school over five months prior to the main data collection, to test, modify, and refine the research tools and planning for the main study. This pilot ensured that ethical considerations and

procedures for ensuring validity and reliability were consistent with those of the main study.

8.1. Participant Sample and Ethical Considerations

Two age groups were selected for the study—Kindergarten Two (ages 4-5) and Year One (ages 5-6). For each year group, two classes were designated for the Intervention Group and two for the Control Group. All eight participating teachers were female, qualified in early years education, and aged between 25 and 60 years and fluent in both Maltese and English. Teachers in the Intervention Group were required to sign a non-disclosure agreement to prevent the sharing of information with the Control Group. The students, whose parents consent to the written recording of data of their children by the researcher, were participants solely within the classroom observations.

The research study emphasised privacy and ethical considerations, obtaining ethical approval from relevant authorities and ensuring strict confidentiality and anonymity for teachers through the use of codes and pseudonyms. Compliance with the General Data Protection Regulation (European Commission, 2019) was maintained with secure, encrypted data storage accessible only to the research team, and data will be kept in anonymised form for ten years. Additionally, due to the pandemic, COVID-19 safety protocols, such as social distancing and mask usage were strictly enforced during data collection, ensuring the safety and integrity of all participants and maintaining a respectful and ethically sound research environment.

8.2 Approach to Analysis

In this study, quantitative data from the classroom observation checklist was coded and analysed using Microsoft Excel and SPSS. Attempts were made to perform inferential statistical tests (chi-squared), but the small sample sizes rendered these tests unreliable, as the number of cells with an expected count of less than five significantly exceeded the 15% threshold. Consequently, the decision was made to focus solely on descriptive statistics and limit the analysis to the data observed within the participant sample. Analysis for the research question, 'Has the teacher training ER intervention programme altered the use of ER strategies within the classroom across various age groups?' was carried out by counting the type of ER strategy adopted across the weeks separately according to age group (KG Two and Year One). The percentages of ER strategy type use were compared for KG Two and Year One separately for the Control and Intervention Groups at baseline and

implementation stage. The data analysis does not include self-regulation situations generated by the students themselves but only includes engagements with ER strategy use adopted by the teacher herself.

Thematic analysis is used in this study to analyse data from teacher perceptions and interpretations collected through SSIs and FGDs, employing both deductive and inductive coding strategies to identify patterns that align with the research question (Hatch, 2002; Braun & Clarke, 2006). Following Braun and Clarke's six-phase guideline, the study involves familiarising with the data, generating initial codes, and developing themes that are thoroughly explored and coded using NVivo (Braun & Clarke, 2006; Bird, 2005). This approach ensured that themes emerged directly from the data (Fereday & Muir-Cochrane, 2006), and findings were verified through inter-coder discussions to maintain reliability. The analysis process also included memo writing to refine themes and continual comparison to ensure findings were empirically based, not biased by personal impressions (Hatch, 2002; Miles & Huberman, 2019). This structured methodological approach helped to effectively address the research question while ensuring the coherence of the themes.

9. Findings – The Use of Emotion Regulation Strategies within Different Age Groups

9.1. Quantitative Findings

With reference to the research question, the most interesting aspect of the data revealed in Table 1 below is that situation modification and cognitive change are the two most used antecedent-focused strategies that KG Two and Year One Intervention Group adopted at implementation stage.

	KG Two	Year One	Year One vs KG Two	Year One vs KG Two		
ER Strategy	Baseline Percentage	Implement ation Percentage	Baseline Percentage	Implement ation Percentage	Baseline Difference	Implement ation Difference
Situation Modificati on	16.67 (3)	29.72 (22)	8.33 (1)	45.50 (20)	-8.34 (-2)	15.78 (-2)
Distraction	16.67 (3)	10.81 (8)	8.33 (1)	13.6 (6)	-8.34 (-2)	2.79 (-2)
Cognitive Change	0 (0)	59.47 (44)	0 (0)	34.1 (15)	0 (0)	-25.37 (-29)
Response Modulatio n	66.67 (12)	0 (0)	83.34 (10)	6.8 (3)	16.67 (-2)	6.8 (3)

Table 1. Frequency distribution of ER strategy use for the KG Two and Year One classes for the Intervention Group at baseline and implementation stage (The frequency counts were inserted in brackets beneath each percentage)

Table 1 demonstrates that situation modification was used to a greater extent by the Year 1 class than the KG Two class at implementation stage (45.5% vs 29.72%), whereas at baseline stage this ER strategy was used marginally more by KG Two class in comparison to the Year 1 class (16.67% vs 8.33%). The situation at baseline stage however should be interpreted with caution as there were only 3 instances and 1 instance of situation modification used by the KG Two and Year 1 classes respectively. Minimal differences in the use of distraction between the two classes at both baseline and implementation stage was noted. Cognitive change was used substantially more by the KG Two class than the Year One class at implementation stage (59.47% vs 34.1%), whereas at baseline stage this strategy was never used in either class. Response modulation was used by the Year One class to a greater extent than the KG Two class at baseline stage (16.67 percentage points), and also marginally more at implementation stage (6.8 percentage points). The situation at implementation stage however should be interpreted with caution as there were only 3 instances of response modulation within the Year 1 class and none within the KG Two class.

It is interesting to note that the ER strategy used mostly by the KG Two group was cognitive change (59.47%, $F=44$) at implementation stage in comparison to situation modification (45.5%, $F=20$) by the Year One group.

It is worth noting that both year groups (KG Two and Year One) decreased their adoption of response modulation at implementation stage, making a shift from the use of this strategy at baseline to an adoption of the two above-mentioned antecedent-focused strategies (situation modification and cognitive change) at implementation stage. This is apparent through the reduction in prevalence of response modulation use when comparing the two time points, with the KG Two group not adopting the strategy at all at implementation stage from 66.67% ($F=12$) of all instances at baseline and the Year One class adopting this strategy for 6.8% ($F=3$) out of all instances at implementation stage from 83.34% ($F=10$) of all instances at baseline.

Hence, both year groups administered the two antecedent-focused strategies - situation modification and cognitive change - more frequently than they administered distraction and response modulation at implementation stage.

	KG Two	Year One	Year One vs KG Two	Year One vs KG Two		
ER Strategy	Baseline Percentage	Implement ation Percentage	Baseline Percentage	Implement ation Percentage	Baseline Increase	Implement ation Increase
Situation Modificati on	6.67 (1)	5.71 (2)	0 (0)	0 (0)	-6.67 (-1)	-5.71 (-2)
Distraction	13.33 (2)	0 (0)	7.14 (1)	0 (0)	-6.19 (-1)	0 (0)
Cognitive Change	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

Response Modulation	80 (12)	94.29 (33)	92.86 (13)	100 (25)	12.86 (1)	5.71 (-8)
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Table 2. Frequency distribution of ER strategy use for the KG Two and Year One classes for the Control Group at baseline and implementation stage (The frequency counts were inserted in brackets beneath each percentage)

In contrast to the Intervention Group, the teacher participants in the Control Group in both KG Two and Year One adopted response modulation more frequently both at baseline and implementation stage, though differences are more pronounced at implementation stage. As presented in Table 23 above, the adoption of the response-focused strategy by the KG Two Control Group increased from 80% (F=12) of all instances at baseline to 94.29% (F=33) of all instances at implementation stage. Meanwhile, the Year One group adopted response modulation in 92.86% (F=13) of all instances at baseline and 100% (F=25) in all instances at implementation stage. The use of response modulation was higher at implementation stage in comparison to baseline for both KG Two and Year One. The other ER strategies are adopted minimally by both groups, and differences in uptake are minimal across these groups and should be interpreted with caution as they reflect a difference of one or two instances.

It is interesting to observe that neither group adopted cognitive change at both stages (baseline and implementation) of data collection.

In sum, whilst cognitive change was the preferred ER strategy for the KG Two group and situation modification was the preferred ER strategy for the Year One group in the Intervention Group, response modulation was the selected ER strategy adopted mainly at baseline and implementation stage in the Control Group. The greater differences in ER strategy use across the two age groups observed for the Intervention Group compared to the Control Group would imply that the impact of the intervention varied by class.

9.2. Qualitative Findings

Situation modification was more extensively adopted by the Year One class (Intervention Group) than by the KG Two class (Intervention Group) at the implementation stage. In fact, a Year One participant (Intervention Group) stated that,

"I think situation modification the most. I think that at our age group, when they are 5/6 years, I think actions are easier to understand than words. Yes, with cognitive change, they understand why they're doing this and what their consequences are. I think situation modification, when they see something happening, they can....they notice that something, 'Ahhhh, okay, this is better like this'. I think that with actions they understand more."

Minimal differences were noted in the use of distraction between the two year groups (Intervention Group) at both the baseline and implementation stages. A Year One participant (Intervention Group) pointed out, 'But some would need some distraction, then you start with the cognitive change. It depends on the student...I am going to mention Sam. You can't just decide to do cognitive change with him'. Another KG Two participant (Intervention Group) agreed and explained, 'Nina, the one who comes in late, crying every morning, I have to distract her every morning for like that minute or so. And then, I'll start talking to her, using cognitive change, because if I don't, she will literally run out of the door for me'.

Interestingly, cognitive change was significantly more employed by the KG Two class than the Year One class during the implementation stage, despite not being used at the baseline stage by either class. In the Intervention KG Two classes where cognitive change strategies were emphasised, it became evident that specific guidance and encouragement were crucial. One KG Two educator noted the profound impact of this strategy, stating,

"Definitely the cognitive change. I had quite a few children in the class this year, who weren't really ready, so they started to give up, and I had children crying... but they were given individual attention and good explanation as to why they should try, and that it did not matter if they made a mistake. I think that was the most effective."

This approach emphasises the importance of consistent and thoughtful implementation of the cognitive change strategy. Another KG Two participant (Intervention Group) highlighted the role of social learning in cognitive regulation, explaining,

"The cognitive change regulation needs to be implemented frequently. When a child self-regulates, it often stems from observing others and being told how to act. It's a combination of seeing and acting; they eventually pick it up themselves. But without regular practice, they won't learn, especially if it's only once every three months."

These insights emphasise the necessity of regular and deliberate practice in teaching the cognitive change strategy to foster effective learning in self-regulation in children. Indeed, a participant teacher in Year One (Intervention Group) pointed out that ‘Sam was one of the children that I observed to have started self-regulating. It worked. He started self-regulating in the end.’

As noted in Table 1 above, both groups—KG Two and Year One (Intervention Group)—reduced their use of response modulation from the baseline to the implementation stage. Instead, they opted for antecedent-focused strategies such as situation modification and cognitive change, with minimal use of distraction. In fact, one Year One Teacher participant from the Intervention Group expressed, ‘Like Sam, understanding why he can't go to the bathroom all the time. It's...again situation modification with a mix of cognitive.’ Another KG Two teacher from the Intervention Group also mentioned that she uses the antecedent ER strategies which she deems effective, ‘I think, like, one child needs distraction and then cognitive change because there's no other way....otherwise she will refuse to come in the classroom.’

Teacher participants from the Intervention Group mentioned the effectiveness and the importance of training all school staff in this ER intervention programme because it is not only beneficial for the students but also for themselves. One Year One participant (Intervention Group) indeed mentioned,

“I think it's really important. I don't think just for teachers, I think anyone in the classroom, so LSEs [Learning Support Educators], class assistants....I think they all need to be trained in emotional self-regulation. I mean, you don't notice that you're suppressing until you know what suppression is. And it's normal for a teacher to say ‘Just just go back to your place. We'll deal with it later’ And I think everyone would need to know about ER strategies.... I think they would really benefit.”

Contrary to the Intervention Group, the Control Group, which includes both KG Two and Year One, continued to focus on implementing response-focused strategies, suppressing emotional expression and experience, throughout curriculum time. One Year One teacher from the Control Group expressed how ineffective her strategies were in dealing with a particularly emotionally challenging situation,

“Yes. But then I think that it is not effective really. As in I still don't feel she is getting it.....I don't feel like I am dealing with it the right way. I don't know how else to deal with it. As in there isn't the space for it, like sit her down, have a conversation, discuss about what is upsetting her because I feel stressed being close to a student

for a long time. I am trying to think about how I would do it in normal circumstances but now this has become the norm.”

10. Discussion

To date, there is limited evidence to suggest that different ER strategies are adopted due to difference in age within a school environment. Hence, the current study contributes to this knowledge by examining the use of different strategies adopted by the teacher participants in KG Two and compared the results of this data to those in a Year One setting.

Situation modification was used to a greater extent by the Year One class than the KG Two class at implementation stage. Modifying a situation's impact on emotions involves a wide range of behaviours, such as problem solving (Gross, 2015). Observation and critical thinking are key ingredients in problem-solving in order to arrive at an appropriate solution to a problem (Rahman, 2019). In saying this, the time for six-year-olds (Year One) is one of tremendous cognitive change for children, and they start to see themselves as more autonomous individuals, capable of basic independent problem-solving (Anthony, 2021). Hence, the reason why the participant teachers in Year One may have found adopting situation modification easier than the KG Two teacher participants with their own students. This finding is consistent with that of Lopez-Perez et al. (2016), who confirm that situation modification in ER may be used more often with older children. These abilities in children increase with age with the help of the teacher, and tend to show similar levels to adults by the time they reach seven years of age (Amsterlaw et al., 2009).

Minimal differences in the use of distraction between the two year groups (KG Two and Year One) at both baseline and implementation stage was noted. Comparison of this finding with those of other studies (Lopez-Perez et al., 2016; Zimmer-Gembeck & Skinner, 2010) indicates that the use of distraction decreases with age, and children begin using more sophisticated strategies, such as cognitive change, as they grow older. The current research finding also corroborates with Harris' research (1989), which found that children from three years of age use distraction to downregulate negative affect, and that the ER strategy use process becomes more complex as they grow.

It is interesting to note that cognitive change was used substantially more by the KG Two class than the Year One class at implementation stage, whereas at baseline stage this strategy was not used in either class. It is encouraging to compare this

finding with that found by Denham (1998), who proposed that pre-schoolers may start using strategies that require more complex social and cognitive processes, but will fall back to simpler ones if complex ones are unsuccessful. However, for the adoption of the more complex processes, there may be a prerequisite for the conscious awareness of emotions in order to use cognitive change as an adaptive ER strategy (Subic-Wrana et al., 2014).

The data presented in Table 1 above shows that the KG Two and Year One Intervention Group participants shifted from response modulation to antecedent-focused strategies. During the training workshop, the Intervention Group participants were made aware that the increased use of response modulation predicted increased levels of negative well-being (Srivastava et al., 2022). In fact, both year groups (KG Two and Year One) decreased their adoption of response modulation at implementation stage, making a shift from the use of this strategy at baseline to an adoption of the two antecedent-focused strategies (situation modification and cognitive change), with minimal use of distraction as a strategy use, at implementation stage. This is apparent through the reduction in prevalence of response modulation use with both the KG Two and Year One group at implementation stage.

The findings of the KG Two and Year One Control Group are contrary to those of the Intervention Group, whereby the former focused on implementing the response-focused strategy (the suppression of expression and experience of emotion) both at baseline and at implementation stage. The other ER strategies were adopted minimally by both groups, and differences in uptake were minimal across these groups. These findings reflect prior research (Richards & Gross, 1999), which states that adults in the Western culture tend to avoid expressing all that they feel, and this is reflecting in the teachers' choice of ER strategies with their students in class. However, this has its costs and as mentioned in the literature review, emotion suppression impairs memory for the information encountered within that particular situation. It not only produces behavioural and physiological consequences but it also has cognitive consequences too (Richards & Gross, 1999). Therefore, it would be beneficial to employ ER, not only to feel better in the short term, but also to improve overall well-being, particularly when adopting AI tools, as ER can enhance the effectiveness of these technologies.

11. Conclusion

This paper contributes to the expanding field of research that emphasises the critical role of ER in the early developmental stages of students, especially in the era of increasing AI integration in education. It highlights how an ER-focused intervention programme can positively impact classroom behaviour, which in turn helps students manage their emotions more effectively. This is particularly relevant in environments where AI tools are used, as enhanced ER creates a more supportive learning atmosphere and is crucial for students to engage productively with AI technologies, ensuring these tools enhance rather than disrupt the educational experience (Jones, 2010). The improvements in student-teacher interactions and peer relationships promoted by these ER strategies also help build a resilient classroom community, well-equipped to adopt AI effectively (OECD, 2023). This study provides evidence supporting the need for a novel mental health intervention programme, integrated within the school curriculum, to address ER processes and prepare children for a world increasingly shaped by AI.

The findings of this study have a number of important implications for future practice: (1) ER coaching significantly enhances students' academic performance by improving focus and participation, and prepares them to effectively adopt AI educational tools; (2) Embedding ER coaching in daily school activities and curriculum equips students with coping strategies to manage stress and anxiety, improving their overall mental health and well-being; (3) Additionally, ER coaching fosters long-term resilience and adaptability, essential for handling future challenges in a rapidly evolving technological AI world, thus ensuring students remain composed and capable throughout their academic and personal lives.

Future research could explore measuring children's self-regulation skills during AI-based activities to assess the effectiveness of the current study's ongoing ER intervention programme implemented throughout the school year. This study would provide insights into how continuous ER coaching influences students' ability to manage emotions when interacting with advanced technologies in educational settings.

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References

Adler, P. & Adler, P. (1987). *Membership Roles in Field Research*. Sage.

Ahn, H. J. (2005). Child care teachers' strategies in children's socialization of emotion. *Early Child Development and Care*, 175(1), 49-61. <https://doi.org/10.1080/0300443042000230320>.

Aldao, A., Sheppes, G. & Gross, J. J. (2015). Emotion Regulation flexibility. *Cognitive Therapy and Research*, 39, 263 - 278. <https://doi.org/10.1007/s10608-014-9662-4>.

Amsterlaw, J., Lagattuta, K. H., & Meltzoff, A. N. (2009). Young children's reasoning about the effects of emotional and physiological states on academic performance. *Child Development*, 80, 115 - 133. Retrieved from <https://www.jstor.org/stable/29738601>.

Anthony, M. (2021). *Cognitive Development in 6-7 Year Olds*. Retrieved from Scholastic: <https://www.scholastic.com/parents/family-life/creativity-and-critical-thinking/development-milestones/cognitive-development-6-7-year-olds.html>.

Benbasat, I., Goldstein, D.K. & Mead, M. (1987). The case research strategy in studies of information systems. *Management Information Systems Quarterly*, 11(3), 369 - 388. <https://doi.org/10.2307/248684>.

Bird, C. M. (2005). How I stopped dreading and learned to love. *Qualitative Inquiry*, 11(2), 226-248. <https://doi.org/10.1177/10778004042734>

Bodrova, E. & Leong, D.J. (2007). *Tools of the Mind: The Vygotskian approach to early childhood education*. Merrill/Prentice Hall.

Boekaerts, M., & Corno, L. (2005). Self-regulation in the classroom: A perspective on assessment and intervention. *Applied psychology*, 54(2), 199-231. <https://doi.org/10.1111/j.1464-0597.2005.00205.x>.

Bower, G. H. (2014). *How might emotions affect learning?*. In *The handbook of emotion and memory* (pp. 3-31). Psychology Press.

Brannick, T. & Coghlan, D. (2007). In Defense of Being 'Native': The Case for Insider Researcher. *Organisational Research Methods*, 10(1), 59-74. <https://doi.org/10.1177/1094428106289253>.

Braun, V. & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101. [10.1191/1478088706qp063oa](https://doi.org/10.1191/1478088706qp063oa).

Braund, H. & Timmons, K. (2021). Operationalisation of self-regulation in the early years: comparing policy with theoretical underpinnings. *International Journal of Child Care and Education Policy*, 15(8), 1 - 21. <https://doi.org/10.1186/s40723-021-00085-7>.

Burmeister, E., & Aitken, L. M. (2012). Sample size: How many is enough? *Australian*, 25, 271-274.

Burns, E. E., Jackson, J. L. & Hardin, H. G. (2010). Child Maltreatment, Emotion Regulation, and Posttraumatic Stress: The Impact of Emotional Abuse. *Journal of Aggression, Maltreatment & Trauma*, 19(8), 801 - 819. <https://doi.org/10.1080/10926771.2010.522947>.

Campbell-Sills, L. & Barlow, D.H. (2007). Incorporating Emotion Regulation into Conceptualisations and Treatments of Anxiety and Mood Disorders. In J. J. (ed.), *Handbook of Emotion Regulation* (pp. 542 - 559). The Guilford Press.

Chaplin, T. M., & Cole, P. M. (2005). The role of emotion regulation in the development of psychopathology: A vulnerability-stress perspective. In B. L. (Eds.), *Development of psychopathology* (pp. 49 - 74). SAGE.

Cole, P. M., Michel, M. K. & Teti, L. O. (1994). The development of emotion regulation and dysregulation: A clinical perspective. *Monographs of the Society for Research in Child Development*, 59(2/3), 73 - 100. <https://doi.org/10.2307/1166139>.

Creswell, J.W., Plano Clark, V.L. Gutmann, M. & Hanson, W. (2003). Advanced Mixed Methods Research Designs. In A. T. (Eds.), *Handbook of Mixed Methods in Social and Behavioural Research* (pp. 209 - 240). Sage.

Creswell, J. W. (2006). *Qualitative Inquiry and Research Design: Choosing among five traditions*. Sage.

Dahlgren, K. (2014). Don't go wasting your emotion: the process model of emotion regulation. Retrieved from *Emotion, Brain & Behaviour Laboratory*: <https://sites.tufts.edu/emotiononthebrain/2014/10/10/dont-go-wasting-your-emotion-the-process-model-of-emotion-regulation/>.

Das, A., Malaviya, S. & Singh, M. (2023). The Impact of AI-Driven Personalization on Learners' Performance. *International Journal of Computer Sciences and Engineering*, Vol. 11(8), pp. 15 – 22. <http://dx.doi.org/10.26438/ijcse/v11i8.1522>.

Davidson, R. J. (1998). Affective style and affective disorders: Perspectives from affective neuroscience. *Cognition & Emotion*, 110(3), 307 - 330. <https://doi.org/10.1080/026999398379628>.

Denham, S. A. (1998). *Emotional Development in Young Children*. Guilford.

Denham, S. & Kochanoff, A. T. (2002). Parental contributions to preschoolers' understanding of emotion. *Marriage & Family Review*, 34(3 - 4), 311- 343. https://doi.org/10.1300/J002v34n03_06.

Denham, S. A., Blair, K. B., DeMulder, E., Levitas, J., Sawyer, K., Auerbach–Major, S. & Queenan, P. (2003). Preschool Emotional Competence: Pathway to Social Competence. *Child Development*, 74(1), 238 - 256. 10.1111/1467-8624.00533.

Eisenberg, N. & Spinrad, T. (2004). Emotion-related regulation: Sharpening the definition. *Child Development*, 75(2), 334 - 339. 10.1111/j.1467-8624.2004.00674.x.

European Commission. (2019). *Data protection in the EU*. Retrieved from [https://commission.europa.eu/law/law-topic/data-protection/data-protection-eu_en]

Feilzer, M. Y. (2009). Doing Mixed Methods Research Pragmatically: Implications for the Rediscovery of Pragmatism as a Research Paradigm. *Journal of Mixed Methods Research*, 4(1), 6 - 16. <https://doi.org/10.1177/1558689809349691>.

Fereday, J. & Muir-Cochrane, E. (2006). Demonstrating Rigor Using Thematic Analysis: A Hybrid Approach of Inductive and Deductive Coding and Theme Development. *International Journal of Qualitative Methods*, 5(1), 80-92. <https://doi.org/10.1177/160940690600500>.

Frankel, L.A., Hughes, S.O., O'Connor, T.M., Power, T.G., Fisher, J.O. & Hazen, N.L. (2012). Parental Influences on Children's Self-Regulation of Energy Intake: Insights from Developmental Literature on Emotion Regulation. *Journal of Obesity*, 2012, 1 - 12. 10.1155/2012/327259.

Frey, N., Fisher, D., & Smith, D. (2019). *All learning is social and emotional: Helping students develop essential skills for the classroom and beyond*. ASCD.

Fox, N. A. & Calkins, S. D. (2003). The Development of Self-Control of Emotion: Intrinsic and Extrinsic Influences. *Motivation and Emotion*, 27(1), 7 - 26. <https://doi.org/10.1023/A:1023622324898>.

Fried, L. (2011). Teaching Teachers about Emotion Regulation in the Classroom. *Australian Journal of Teacher Education*, 36(3), 1 - 11. 10.14221/ajte.2011v36n3.1.

Galea, E. (2023, November 19). Key skills every student needs to achieve balance. *The Sunday Times of Malta*. Retrieved from: <https://timesofmalta.com/article/key-skills-every-student-needs-achieve-balance.1067703>

Galea, E. (2024). Advancing pedagogy through the science of teaching and learning: A vision for educational practitioners. *Psychology of Education Review*. Vol. 48 (1), 58 - 67. <http://dx.doi.org/10.53841/bpsper.2024.48.1.58>

Gogtay, N., Giedd, J.N., Lusk, L., Hayashi, K.M, Greenstein, D., Vaituzis, A.C., Nugent, T.F., Herman, D.H., Clasen, L.S., Toga, A.W., Rapoport, J.L. & Thompson, P.M. (2004). Dynamic mapping of human cortical development during childhood through early adulthood. *NCBI*, 101(21), 8174 - 8179. 10.1073/pnas.0402680101.

Gottman, J. (2011). *Raising an Emotionally Intelligent Child: The Heart of Parenting*. Simon & Schuster Paperbacks.

Graesser, A. C., & D'Mello, S. (2012). Emotions during the learning of difficult material. In *Psychology of learning and motivation*, Vol. 57, pp. 183-225. <https://doi.org/10.1016/B978-0-12-394293-7.00005-4>.

Graziano P. A., Reavis R. D., Keane S. P., Calkins S. D. (2007). The role of emotion regulation in children's early academic success. *Journal of School Psychology*, 45(1), 3 - 19. 10.1016/j.jsp.2006.09.002.

Gregory, G., & Kaufeldt, M. (2015). *The motivated brain: Improving student attention, engagement, and perseverance*. ASCD.

Gross, J. J. (1998). The Emerging Field of Emotion Regulation: An Integrative View. *Review of General Psychology*, 2(3), 271 - 299. <https://doi.org/10.1037/1089-2680.2.3.271>.

Gross, J. J. (2007). *Handbook of Emotion Regulation*. Guilford.

Gross, J. J. (2015). The Extended Process Model of Emotion Regulation: Elaborations, Applications and Future Directions. *Psychological Inquiry*, 26, 130 – 137. <https://doi.org/10.1080/1047840X.2015.989751>.

Gross, J. J. & John, O. P. (2003). Individual differences in two emotion regulation processes: implications for affect, relationships and well-being. *Journal of Personality and Social Psychology*, 85, 348 - 362. <https://doi.org/10.1037/0022-3514.85.2.348>.

Harris, P. L. (1989). *Children and emotion: the development of psychological understanding*. Blackwell.

Hatch, J. A. (2002). *Doing Qualitative Research in Education Settings*. State University of New York Press.

Jones, A. (2010). Affective issues in learning technologies: emotional responses to technology and technology's role in supporting socio-emotional skills. *Journal of Interactive Media in Education*, Vol. 2, No. 9, pp. 1 – 22. <https://doi.org/10.5334/2010-9>.

Jones, S.M. & Bouffard, S. M. (2012). Social and Emotional Learning in Schools: From Programs to Strategies. *Society for Research in Child Development*, Vol. 24(4), pp. 1 – 33. <https://files.eric.ed.gov/fulltext/ED540203.pdf>.

Jones, A. (2014). Emotional Development. In D. Mareschal, B. Butterworth & A. Tolmie (Eds.), *Educational Neuroscience* (pp. 297 - 319). John Wiley & Sons Ltd.

Kochanska, G. & Knaack, A. (2003). Effortful Control as a Personality Characteristic of Young Children: Antecedents, Correlates, and Consequences. *Journal of Personality*, 71(6), 1087 - 1112. 10.1111/1467-6494.7106008.

Kolitz, D. (2018, October 9th). Do Kids Feel Stronger Emotions Than Adults? Retrieved from *Child Development*: <https://gizmodo.com/do-kids-feel-stronger-emotions-than-adults-1828933152>.

Kopp, C. B. (1982). Antecedents of self-regulation: A developmental perspective. *Developmental Psychology*, 18, 199 - 214. <https://doi.org/10.1037/0012-1649.18.2.199>.

Kraiss, J.T., Klooster, P. M. T., Moskowitz, J. T & Bohlmeijer, E.T. (2020). The relationship between emotion regulation and well-being in patients with mental disorders: A meta-analysis. *Compr Psychiatry*, 102, 1-14. 10.1016/j.comppsy.2020.152189.

Kurki, K. (2017). *Young Children's Emotion and Behaviour Regulation in Socio-Emotionally Challenging Situations*. Oulu: University of Oulu, Faculty of Education. Retrieved from <http://jultika.oulu.fi/files/isbn9789526216973.pdf>.

Leisman, G. & Melillo, R. (2012). The Development of the Frontal Lobes in Infancy and Childhood: Asymmetry and the Nature of Temperament and Affect. In A. E. (Ed.), *Frontal Lobe: Anatomy, Functions and Injuries* (pp. 1 - 48). Nova Scientific Publishers.

Lopez-Perez, B., Gummerum, M. Wilson, E. & Dellaria, G. (2016). Studying Children's Intrapersonal Emotion Regulation Strategies from the Process Model of Emotion Regulation. *The Journal of Genetic Psychology*, 178(2), 73 - 88. 10.1080/00221325.2016.1230085.

Luna Scott, C. (2015). THE FUTURES of LEARNING 2: What kind of learning for the 21st century? *UNESCO Education Research and Foresight, Paris*. [ERF Working Papers Series, No. 14].

Macklem, G. L. (2007). *Practitioner's guide to emotion regulation in school-aged children*. Springer Science & Business Media.

Maheshwari, V. (2011, September 25). *The Case study - Research Method In Education*. Retrieved from Philosophical commentary on issues of today: https://rajans.lk/wp-content/uploads/2020/06/The-Case-Study-%C2%AD-Research-Method-in-Education_-Dr.-V.K.-Maheshwari-Ph.D.pdf.

Martin, R.E. & Ochsner, K.N. (2016). The neuroscience of emotion regulation development: implications for education. *Current Opinion in Behavioural Sciences*, 17(1), 142 - 148. 10.1016/j.cobeha.2016.06.006.

McClelland, M., Tominey, S. L., Schmitt, S. A. & Duncan, R. (2017). SEL Interventions in Early Childhood. *The Future of Children*, 27(1). 10.1353/foc.2017.0002.

Mega, C., Ronconi, L., & De Beni, R. (2014). What makes a good student? How emotions, self-regulated learning, and motivation contribute to academic achievement. *Journal of Educational Psychology*, 106(1), 121–131. <https://doi.org/10.1037/a0033546>.

Meyer, D.K. & Turner, J. C. (2007). Scaffolding Emotions in Classrooms. In R. P. A. Schutz, *Emotion In Education* (pp. 243 -258). Elsevier Inc.

Miles, M. B. & Huberman, M. A. (2019). *Qualitative Data Analysis: A Methods Sourcebook*. Sage Thousand Oaks.

Molenaar, I., de Mooij, S., Azevedo, R., Bannert, M., Järvelä, S., & Gašević, D. (2023). Measuring self-regulated learning and the role of AI: Five years of research using

multimodal multichannel data. *Computers in Human Behaviour*, Vol. 139, 107540. <https://doi.org/10.1016/j.chb.2022.107540>.

Morgan, D. L. (2014). Pragmatism as a Paradigm for Social Research. *Qualitative Inquiry*, 20(8), 1045-1053. <https://doi.org/10.1177/1077800413513733>.

Nadelson, L.S., Soto, E., Smith, T., Nekonchuk, S., Ims, J. & Nadelson, S. G. (2021). Teaching Emotion Regulation: K-12 Teachers' Perceptions and Practices across the Curriculum. *Children and Teenagers*, 4(1), 1 - 30. <https://doi.org/10.22158/ct.v4n1p1>.

Neubauer, B. E., Witkop, C. T., & Varpio, L. (2019). How phenomenology can help us learn from the experiences of others. *Perspectives on medical education*. *Perspectives on Medical Education*, 8(2), 90-97. 10.1007/s40037-019-0509-2.

OECD. (2023). Generative AI in the classroom: From hype to reality? Launch meeting of the Schools+ Network 22-23 May 2023, Boulogne (July 20, 2023). Available at: [https://one.oecd.org/document/EDU/EDPC\(2023\)11/en/pdf](https://one.oecd.org/document/EDU/EDPC(2023)11/en/pdf).

Owens, M., Stevenson, J., Hadwin, J. A., & Norgate, R. (2012). Anxiety and depression in academic performance: An exploration of the mediating factors of worry and working memory. *School psychology international*, 33(4), 433-449. <https://doi.org/10.1177/0143034311427433>.

Panfile, T. M. & Laible, D. J. (2012). Attachment Security and Child's Empathy: The Mediating Role of Emotion Regulation. *Merrill-Palmer Quarterly*, 58(1), 436 - 440. 10.1353/mpq.2012.0003.

Pekrun, R. (2014). *Emotions and learning* (Vol. 24, pp. 1-31). Geneva, Switzerland: International Academy of Education (IAE).

Perlman, S. B. & Pelphrey, K. A. (2010). Regulatory brain development: balancing emotion and cognition. *Soc Neurosci*, 5(5 - 6), 533 - 542. 10.1080/17470911003683219.

Pervez, A. & Galea. E. (2024). Primary schools: Spaces for children's social and emotional learning. *Psychology of Education Review*. Vol. 48 (1), 68-76. <https://doi.org/10.53841/bpsper.2024.48.1.68>

Rahman, M. M. (2019). 21st Century Skill 'Problem Solving': Defining the Concept. *Asian Journal of Interdisciplinary Research*, 2(1), 64 - 74. <https://doi.org/10.34256/ajir1917>

Rane, N., Choudhary, S. & Rane, J. (2023). Education 4.0 and 5.0: Integrating Artificial Intelligence (AI) for Personalised and Adaptive Learning (November 2, 2023). Available at SSRN: <https://ssrn.com/abstract=4638365> or <http://dx.doi.org/10.2139/ssrn.4638365>.

Richards, J. M. & Gross, J. J. (1999). Composure at any cost? The cognitive consequences of emotion suppression. *Personality & social psychology bulletin*, 25(8), 1933 - 1044. <https://doi.org/10.1177/01461672992511010>.

Rodway, P. & Schepman, A. (2023). The impact of adopting AI educational technologies on projected course satisfaction in university students. *Computers and Education: Artificial Intelligence*, Vol. 5, pp. 1 – 12. <https://doi.org/10.1016/j.caeai.2023.100150>.

Shonkoff, J. P. & Phillips, D. A. (Eds.). (2000). *From Neurons to Neighborhoods: The Science of Early Childhood Development*. National Academy Press.

Seeley, S. H., Garcia, E. & Mennin, D. S. (2015). Recent Advances in Laboratory Assessment of Emotion Regulation. *Current Opinion in Psychology*, 3, 58 - 63. [10.1016/j.copsyc.2015.02.009](https://doi.org/10.1016/j.copsyc.2015.02.009).

Siggelkow, N. (2007). Persuasion with Case Studies. *Academy of Management Journal*, 50(1), 2- -24. <https://doi.org/10.5465/amj.2007.24160882>.

Silkenbeumer, J.R., Schiller, E.M., Holodynski, M. & Kartner, J. (2016). The Role of Co-Regulation for the development of social-emotional competence. *Journal of Self-Regulation and Regulation*, 2, 11 - 26. <https://doi.org/10.11588/josar.2016.2.34351>.

Singh, S. & Sharma, N. R. (2018). Self-regulation as a correlate of psychological well-being. *Journal of Health and Well-being*, 9(3), 441-444. Retrieved from <https://www.proquest.com/docview/2030127745/fulltextPDF/4C4713B83BE041F5PQ/1?accountid=14511>.

Slade, S. & Griffith, D. (2013). A whole child approach to student success. *KJEP Journal of Educational Policy Special Issue*, pp. 21-35. <http://eng.kedi.re.kr>.

Somerville, M. P., & Whitebread, D. (2019). Emotion regulation and well-being in primary classrooms situated in low-socioeconomic communities. *The British journal of educational psychology*, 89(4), 565–584. <https://doi.org/10.1111/bjep.12222>.

Srivasta, S., Tamir, M., McGonigal, K. M. , John, O.P. & Gross, J.J. (2022). The Social Costs of Emotional Suppression: A Prospective Study of the Transition to College. *Journal of Personality and Social Psychology*, 96(4), 883 - 897. 10.1037/a001475.

Stuss, D. T. & Benson, D. F. (1986). *The frontal lobes*. Raven Press.

Subic-Wrana, C., Beutel, M. E., Brahler, E., Stobel-Richter, Y., Knebel, A. Lane, R. D. & Jor Baune, B. T. (2014). How is emotional awareness related to emotion regulation strategies and self-reported negative affect in the general population? *PloS one*, 9(3). <https://doi.org/10.1371/journal.pone.0091846>.

Tan, J., Mao, J., Jiang, Y., & Gao, M. (2021). The Influence of Academic Emotions on Learning Effects: A Systematic Review. *International journal of environmental research and public health*, Vol. 18(18), 9678. <https://doi.org/10.3390/ijerph18189678>.

Thompson, R. A. (1994). Emotion Regulation: A Theme in Search of Definition. *Monographs of the Society for Research in Child Development*, 59(2/3), 25 - 52. <https://doi.org/10.2307/1166137>.

Uylings, H. (2006). Development of the Human Cortex and the Concept of 'Critical' or 'Sensitive Periods'. *Language Learning*, 56(1), 59- 90. <https://doi.org/10.1111/j.1467-9922.2006.00355.x>.

Zeidner, M. (2014). Anxiety in education. In *International handbook of emotions in education* (pp. 265-288). Routledge.

Zieher, A.K., Bailey, C.S., Cipriano, C., McNaboe, T., Smith, K. & Strambler, M. J. (2024). Considering the “How” of SEL: A framework for the pedagogies of social and emotional learning. *Social and Emotional Learning: Research, Practice, and Policy*, Vol. 3, 100030, pp. 1 – 11. <https://doi.org/10.1016/j.sel.2024.100030>.

Zimmer-Gembeck, M.J. & Skinner, E.A. (2010). Review: The development of coping across childhood and adolescence: An integrative review and critique of research. *International Journal of Behavioural Development*, 35(1), 1 - 17. <https://doi.org/10.1177/0165025410384923>.