Inhale, Exhale, Self-Regulate: Bridging Breathing Practices with Implementation Science

School of Psychological Sciences and Health

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Declaration

This thesis is the result of the author’s original research. It has been composed by the author and has not been previously submitted for examination, which has led to the award of a degree.

Signed: 

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Abstract

This thesis investigates the feasibility, acceptability, and perceived effectiveness of a universal breath-based intervention to support self-regulation in primary school-aged children. The research was driven by an increase in educational psychology consultation requests regarding self-regulation and by inconsistent use of mind-body practices in schools. Despite its importance, self-regulation is often vaguely defined and understood differently across professional groups. Initial focus groups with children, teachers, and educational psychologists revealed a shared focus on feeling calm, but varied recognition of self-regulation's cognitive, emotional, and physiological aspects. At the same time, practices such as mindfulness and yoga were being introduced into classrooms without clear frameworks or evaluation. Drawing on professional experience and embodied practice, this study explores breath as a practical tool for self-regulation. It focuses on how the breath interrupts automatic reactions, creating space to regulate thoughts and emotions, which underpins emotional regulation and a sense of calm. A two-phase mixed-methods design was employed: Phase one involved delivering teacher training for implementation, and Phase two evaluated integration through quantitative calmness ratings and qualitative focus groups. Findings indicated positive responses from children and staff, with teacher confidence, beliefs, and school alignment influencing sustainability. The study highlights the role of educational psychologists in bridging theory and practice through feasible, evidence-based wellbeing interventions within real classrooms.

Abbreviations

ANS	Autonomic Nervous System
CR	Cognitive Regulation
EF	Executive Function
EP	Educational Psychologist
ER	Emotional Regulation
FG	Focus Group(s)
HR	Heart Rate
HRV	Heart Rate Variability
MBM	Mind-Body Medicine
MBP	Mind-Body Practice
MBC	Mind-Body Connection(s)
PATH	Promoting Alternative Thinking Strategies
PNS	Parasympathetic Nervous System
RCT	Randomised Controlled Trial
SR	Self-Regulation

Chapter 1: Introduction

1.1 Overview

This opening chapter presents the motivations for conducting this research, outlines the overall thesis structure, and poses the central research question.

The researcher's experiences as an educational psychologist (EP) shaped this study in response to the rising prominence of self-regulation (SR) challenges in schools. Across all stages, but especially among primary-aged children, there was a notable increase in requests for EP involvement. Both schools and families increasingly sought consultation to support and manage children struggling with regulation. However, despite being more frequently discussed, the understanding of SR varied widely among stakeholders, including EPs, classroom teachers, head teachers, parents, and children. The researcher simultaneously observed a growing integration of mind-body practices (MBPs) in schools, including yoga and mindfulness sessions. However, such practices lacked systematic and consistent planning, assessment, and oversight, with no evidence collation on efficacy or analysis of the factors affecting their long-term sustainability. These gaps in understanding practice shaped the central research question: how can MBPs, specifically breathing exercises, be effectively implemented and maintained in schools, and what impact do they have on children's SR in classroom settings?

Whilst motivated by professional observations, the researcher has had a long-standing personal engagement with MBPs. This informed an interest in examining their implementation more systematically, including the conditions and factors necessary for feasibility and sustainability in schools.

This study aims to explore, through a systematic approach, the nuances of implementing an MBP and its perceived effectiveness in a school setting. It also investigates their alignment with SR and the role of EPs in supporting implementation. The study also recognises that elements of the implementation context, like a calm, predictable environment and supportive adult relationships, may have influenced children's engagement and SR.

1.2 Situating the Study Within Local Authority Contexts

1.2.1 Findings from Initial Focus Groups in Local Authority Y

The study initially gathered secondary data within Local Authority Y. This involved informal focus group (FG) discussions with children, head teachers, class teachers, and EPs to explore what SR meant. Discussions at the beginning of the COVID-19 pandemic revealed diverse understandings of SR among children, teachers, and EPs. Some participants framed SR in terms of cognitive functioning, emphasising attention control, impulse inhibition, and executive functioning (EF). Others highlighted emotional regulation (ER), referring to difficulties with emotions and the capacity to regain control after dysregulation. Despite these differences, a recurring theme emerged about what it felt like to be regulated. Participants consistently described regulation as settled or calm, suggesting a shared experiential understanding that extended beyond cognitive or emotional components (Blair & Raver, 2015). This highlighted the role of bodily awareness in SR, aligning with interoception as a potential underlying mechanism (Craig, 2009).

These discussions occurred during the early stages of the pandemic, a period marked by heightened stress and uncertainty. This may have influenced participants' emphasis on feelings of calm and stability, with a focus on emotional and physiological well-being. Insights from this early phase informed the design of the subsequent investigation.

1.2.2 Local Authority X

The study was conducted in Local Authority X in North Scotland, a predominantly rural region. The council is Scotland's fourth-largest by area and the fifth-largest by population. As of 2023, its education provision serves 20,566 primary school children across 149 schools and 15,869 secondary school pupils in 17 schools.

Although the research setting shifted from Local Authority Y to X, both regions presented a similar picture of increasing referrals to EPs, with SR emerging as a primary concern. In Local Authority X, requests for consultations in 2022-23 revealed that EPs coded 232 out of 500 requests (46%) as involving SR as the primary reason for involvement**,** despite SR representing only one of 20 available coding categories. This pattern highlighted a growing systemic challenge and underscored the need for preventive, school-wide approaches to strengthening children's SR.

1.3 Structure of Thesis

Chapter Two reviews the complexity of SR and its impact on health, education, and beyond. The chapter considers theoretical models, frameworks, and components as it examines the embedding of SR interventions in schools. It highlights the challenges of the teacher's role and the sustainability of education. Among the various dimensions of SR, a key focus was the physiological component.

Chapter Three examines the mind-body connection (MBC) and explores the physiological basis of SR. It examines the connections among SR, physiological homeostasis, and stress, with a focus on the sympathetic nervous system (SNS). By reviewing theoretical frameworks linking physiology to SR, the chapter identifies how these insights inform MBPs and highlights considerations for designing school-based interventions. Implementation science is introduced as a lens for considering how physiology-based interventions could be sustained in schools. A universal approach is emphasised, noting accessibility, fidelity, and acceptability, which led to focusing solely on breath as a physiological component of SR.

Chapter four reviews breath as a fundamental and universally accessible SR mechanism, emphasising its influence on the autonomic nervous system (ANS). Controlled breathing techniques can down-regulate sympathetic activation and promote parasympathetic dominance, which is critical for stress regulation. The chapter assesses the effectiveness of breath-based interventions across various settings, focusing on how they can be translated from theory to long-term practice. The study implemented a breath practice in the classroom with teachers positioned as central to embedding breath as an SR tool.

Chapters five and six outline the ethics and implementation central to the methodology design, with a focus on practical feasibility for classroom integration. A two-phased mixed-method study underpins the research. Teacher training workshops were designed to equip teachers with breath-based exercises, delivered through both theoretical and experiential components. Phase one evaluated the training and teacher readiness for phase two, with an FG to safeguard fidelity and sustained practice. Teachers were engaged throughout the planning and evaluation stages to ensure adaptability.

Only teachers committed to the implementation advanced to phase two. The methodology describes the process of integrating the intervention into the classroom. Data collection assessed both the integration and the immediate and cumulative effects of the breathing exercises on children. Statistical data were collected from a single context due to implementation and contextual factors; findings showed a significant impact on children’s calmness. FG feedback also indicated that most children enjoyed the exercises and appreciated learning about the connection between breath, brain, and body. The evaluation highlights factors affecting implementation, including teacher engagement with training and sustained breath practices. Teachers' confidence, beliefs, and values regarding the intervention’s effectiveness influenced both fidelity and consistency.

Chapter Seven analyses the findings, highlighting the factors that influence the implementation and effectiveness of the breath-based intervention. It considers both calmness ratings alongside FG insights, linking outcomes to elements such as fidelity, teacher confidence, and belief in the practices. Broader challenges are also addressed, including time pressures and the need for interventions to feel relevant and worthwhile to teachers. Teachers valued opportunities for dialogue around SR and expressed interest in deepening their understanding. The chapter sets the stage for the subsequent discussion.

Chapter Eight discusses the results and outlines the implications of the findings for future research and the role of EPs, particularly in training and the implementation of interventions. It emphasises how EPs can support teachers to develop the knowledge and skills needed to embed SR sustainably. The development of self-regulatory skills is presented as critical for both teachers and pupils, as it enables physiological regulation, stress management, and overall well-being. The chapter also considers how EPs can bridge the gap between theory and practice through evidence-based strategies, while addressing practical challenges, such as workload, time pressures, and fidelity.

Chapter 2: The Concept of Self-Regulation

SR is a broad concept that has received significant attention as a critical predictor of a variety of outcomes, including obesity (Evans et al., 2012), school readiness (Blair & Razza, 2007), academic achievement (Duckworth et al., 2010; Elhusseini, 2022), and long-term health and academic success (McClelland et al., 2013; Robson et al., 2020). Researchers have examined SR through various theoretical and empirical lenses (Inzlicht et al., 2021), highlighting its complexity as a multifaceted construct encompassing various and also differently complex skills, including emotional awareness, impulse control, goal setting and cognitive flexibility (Warschburger et al., 2023). As such, SR is increasingly recognised as essential for navigating the complexities of modern life. Baumeister et al. (2006) describe how SR may be one of the most distinctive human traits, influencing a wide range of cognitive, emotional, and behavioural skills. SR has consequently emerged as a central point in discussions on human development and well-being across many disciplines. It is a key topic across psychology, education, neuroscience, and public health, reflecting its broad interdisciplinary relevance.

2.1 Defining SR

In psychology, the challenge of defining SR lies in accounting for its multifaceted nature across the field's models, theories, and perspectives, including cognitive, social-cognitive, and ER. These perspectives offer different conceptualisations of SR, emphasising different aspects and mechanisms.

Traditional definitions frame SR as the ability to control behaviours and emotions (Bandura, 1986). In health psychology Clark et al. (2001) extended this by showing how disease-management strategies are learned through reciprocal processes of observation, judgement, and reaction, illustrating SR as an adaptive process. Understanding SR as complex and dynamic is particularly significant in education, where pupils develop autonomy in managing exam stress, navigating peer relationships, and maintaining health-related routines. Brumariu et al. (2023) highlight the role of emotional competence, Eisenberg et al. (2010) stress motivational beliefs in regulation, and Putwain (2007) examines exam-related stress, all underscoring the importance of SR within school contexts.

2.1.1 Comprehensive Definition

The researcher proposes a working definition of SR that underpins the subsequent exploration of its multifaceted nature. In this research, SR is described as an adaptive process through which individuals adjust their actions and internal states in response to internal cues and external demands to achieve personally relevant goals. SR is viewed as encompassing cognitive, emotional, behavioural, and physiological aspects. This definition draws on various parts of the literature and adopts an integrative perspective of SR as a complex, evolving process. It is consistent with Moilanen (2007) description of SR as the ability to flexibly manage behaviour, attention, emotions, and cognitive strategies in response to direction from internal cues, environmental stimuli, and feedback from others to attain personally relevant goals. Through this lens, SR is foundational to effective learning, well-being, and broader personal development.

2.1.2 Distinguishing SR from Related Constructs

The definition establishes a foundation; various terms, such as EF, effortful control, ER, and self-control, are often used interchangeably or to emphasise specific aspects of SR's broader scope. For example, EF primarily focuses on cognitive skills that govern planning, working memory, and inhibitory control, forming a crucial part of SR but emphasising cognition over other dimensions (Blair & Raver, 2015). Effortful control highlights attentional and inhibitory aspects in managing impulses, tying SR to temperament and self-discipline (Graziano & Derefinko, 2013). ER affects emotional responses and how an individual copes with emotions (Pennequin et al., 2020). Self-control highlights how an individual resists temptations to align behaviour with longer-term goals (Meldrum et al., 2018). Each construct overlaps with SR and highlights that it is a multidimensional construct that includes behavioural, cognitive, and emotional components (Huang et al., 2023).

2.2. Why is it Important?

2.2.1 Health

Inzlicht et al. (2021) describe SR as foundational to personal and societal functioning. Evidence implicates SR in many health behaviours such as healthy eating, physical activity and weight management (Hennessy et al., 2020) shaping individuals' ability to manage their habits, emotions, and impulses, which in turn influence well-being. This extends to outcomes including longevity, criminal behaviour, financial stability, job performance, and relationship satisfaction.

SR has been linked to sustained health improvements and more resilient relationships over time (Baumeister & Vohs, 2016). Individuals with higher self-control are more likely to adopt healthy habits and avoid risky behaviours (Hagger, 2019). For example, a person aiming to improve their diet may set specific goals (e.g., reducing sugar intake), monitor eating patterns, and adjust strategies accordingly. Similarly, self-regulated individuals can manage their emotional responses and control initial reactions (such as anger), choose a more positive response, and focus on understanding a different perspective.

Cross-disciplinary literature shows that SR skills are related to mental health, social-emotional well-being, physical health, and socioeconomic success (Buckner et al., 2009; Moffitt et al., 2011). Baker et al. (2019) argue that SR in adults is not determined by knowledge but by self-regulatory processes, consistent with evidence showing that these processes drive health behaviour change (Hennessy et al., 2020).

The researcher considers self-regulatory processes to be a person's strategies for controlling their thoughts, emotions, and actions to achieve goals. SR is, therefore, not simply about what one knows, but about the cognitive, emotional, and behavioural processes that individuals use to guide their own learning and behaviour in alignment with their individual subjective goals and external demands.

2.2.2 Link with Education

SR is also a predictor of academic achievement, as it involves cognitive processes, including planning, attentional control and metacognition (Panadero, 2017). Consistent with this, studies reveal that children who can demonstrate SR strategies are more likely to achieve higher levels of academic performance across educational settings Dent (2016); (Panadero, 2017; Schneider & Artelt, 2010; Zimmerman, 2008).

McClelland et al. (2006) suggest that children who enter kindergarten with high SR skills also show higher academic achievement in maths and literacy through sixth grade. Veenman (2017) emphasises that children who regulate their learning processes are better equipped to manage challenges, and those who practice SR skills can sustain motivation over time. This raises the possibility that SR interventions may be beneficial tools for improving academic performance.

A meta-analysis of 58 studies involving over 7,000 participants examined the impact of SR interventions on academic achievement (Donker et al., 2014). Explicit SR instruction worked by making processes such as planning and monitoring visible to learners. The study demonstrated that interventions that explicitly taught SR strategies significantly improved children’s achievement. These strategies included goal-setting and self-monitoring. Teaching SR skills (section 2.10) could be a universal support strategy in schools to equip all children with essential skills to manage their learning. This has the potential to promote inclusivity and help close attainment gaps.

Boekaerts and Corno (2005) emphasise that learning to self-regulate enhances ER and strengthens intrinsic motivation. They argue that promoting intrinsic motivation is a core component of SR. Self-regulated learners utilise various ER strategies that help manage academic challenges. For example, when faced with a challenge, learners reevaluate their emotional responses and improve their ability to manage anxiety and maintain focus. The relationship between SR, motivation, and emotional stability highlights the importance of SR in fostering effective learning environments. SR, therefore, shapes classroom behaviour and social interactions, with self-regulated children more likely to exhibit prosocial behaviours such as cooperation, empathy and conflict resolution (McClelland et al., 2007).

SR and co-regulation are distinct yet interconnected processes in educational settings. Co-regulation is a shared regulatory process that occurs in collaborative environments, where one individual guides or models effective strategies and scaffolds another's learning until they develop independence. Through co-regulation, SR skills are supported and gradually developed as teachers model effective strategies and provide scaffolding. Hadwin et al. (2011) described how being self-regulated facilitates success in collaborative learning and coregulation, which are increasingly important in the classroom. Children are better equipped to follow rules, manage emotions, and interact positively. Controlling impulses and following instructions are critical to succeed in the classroom environment. Children must monitor and modify their thoughts, feelings and behaviours to self-regulate in education.

While SR is essential for positive classroom behaviour and social-emotional development, evidence suggests that SR predicts academic performance and mediates the relationship between cognitive abilities and achievement (Alexander, 2018; Blair & Diamond, 2008; Veenman, 2017). SR incorporates how learners plan, monitor and evaluate their own learning. At the same time, cognitive skills are mental capabilities that facilitate learning, including attention, memory, and problem-solving. Therefore, children who can self-regulate their learning more efficiently are more likely to use effective cognitive strategies. For example, allocating attention more effectively, prioritising tasks, monitoring understanding, and adjusting learning strategies ultimately lead to better academic outcomes.

2.2.3 Beyond the Classroom

Early development of SR is strongly linked to long-term well-being, healthier behaviours, and improved life outcomes, including attention, persistence, and effective learning (Blair & Razza, 2007; Pandey et al., 2017). Longitudinal evidence, including the Dunedin study, shows that early dysregulation predicts adult issues like substance dependence, financial and health problems, and criminal behaviour, with childhood self-control being a strong predictor independent of intelligence or social class (Moffitt et al., 2011; Poulton et al., 2015). These findings suggest that enhancing SR in early childhood may be more feasible and impactful than altering socioeconomic conditions (Heckman, 2006). Reflecting its broad relevance across psychology, education, and health, SR has gained substantial scientific attention, with over 10,000 publications in the past 15 years (Murray et al., 2019). This review therefore prioritised systematic and meta-analytic evidence across cognitive, emotional, behavioural, and physiological domains to provide a comprehensive foundation for examining SR within educational psychology.

2.3 SR and Educational Psychology

Given the role of EPs in promoting well-being and learning in Scottish schools (Scottish Government, 2019) and in implementing evidence-based SR interventions, clear evidence-based frameworks are needed to guide implementation and ensure that the intervention aligns with the targeted SR constructs (Blair & Raver, 2015). Therefore, clarifying what is meant by SR was essential before an accurate assessment of the intervention's impact could be made.

Examining several frameworks, it was recognised that educational psychology could benefit from focusing on theory development (Borsboom et al., 2021; Eronen, 2021). In this study, understanding the components of SR, as emphasised by Edossa et al. (2018) was crucial for understanding its complex role in human behaviour and development.

Given the importance of SR, the goal was to clarify what it entails, how to enhance it, and ensure that educational interventions effectively target it. An example illustrates the breadth and interacting components of SR: ER, a key SR dimension, involves managing emotions and physiological responses to stress. An individual may experience anxiety before an exam and practice deep breathing and positive self-talk to calm both their physiological symptoms and maintain emotional composure. This ability to modify emotions and bodily responses reflects SR's role in managing stressful situations and sustaining focus on goals (Gross, 2015; Pennequin et al., 2020). By addressing these cognitive, emotional, behavioural, and physiological aspects, SR supports children's resilience and adaptability in educational settings, enhancing their academic and personal growth.

2.4 Overview of Models and Theories of SR

The study of SR has a long history in research (Howard et al., 2020) yet, clarity and consensus about its components and processes remain limited (Morawska et al., 2019). Whilst lacking a singular definition, SR influences psychology, neuroscience, education, and health, reflecting its influence on human behaviour and functioning, particularly in child development. This lack of agreement makes SR difficult to conceptualise and leads to inconsistent findings (Blandine et al., 2017). Acknowledging the broader concept of regulation when discussing the importance of SR highlights the interconnectedness of regulatory processes. The absence of a shared definition has led theories of SR to emphasise different processes, ranging from cognitive control and motivation to social and physiological influences, making it difficult to determine which components are most central to effective regulation.

This section reviews key theories and models that inform SR. While many theories were established decades ago, understanding continues to evolve. Inzlicht et al. (2021) examined SR models from social psychology, personality psychology, and cognitive neuroscience. Collectively, these perspectives show SR as multidimensional, shaped by interacting factors. Appendix A summarises the most prominent models through different theoretical lenses.

2.4.1 Cognitive Models of SR

Kanfer and Karoly (1972) self-control model remains one of the most influential. It emphasises three components: forethought (commitment to a behaviour), performance (linking intention to action), and self-reflection. The model also considers internal factors, such as cognitive and emotional processes, including self-monitoring, self-evaluation, ER, and intrinsic motivation, as well as external influences, including teacher modelling and the classroom environment. For example, a young person may set a goal to complete an assignment, plan a schedule, and later reflect on their strategies. This model is relevant to school-based SR interventions because it shows how planning, monitoring, and reflection can be taught to manage behaviour.

2.4.2 Social-Cognitive Approaches to SR

Bandura (1986) highlighted the role of social and cognitive factors in shaping SR. Social cognitive theory proposes that SR is determined by personal processes and influenced by environmental and behavioural factors, including social influences and self-efficacy beliefs. Supportive student-teacher relationships and a safe classroom environment are essential. For example, a child's SR is influenced by the teacher's expectations and peer behaviour in the classroom. Observing peers' effective study habits can enhance self-efficacy and motivation to adopt similar strategies.

Zimmerman (1990) shifted educational analysis from viewing student ability and environment as fixed to emphasising learners as active agents. While all learners use regulatory processes, he distinguished self-regulated learners by their awareness of these strategies and their deliberate application to achieve academic goals. For example, a child who performs poorly on a spelling test may adapt their study techniques in response to feedback, thereby strengthening both learning and their sense of control over outcomes. In contrast to Kanfer and Karoly's focus on internal monitoring and reflection, Bandura and Zimmerman emphasise the importance of social context and self-efficacy. While cognitive models suggest that SR develops mainly through individual strategy use, social-cognitive approaches argue that regulation is influenced by interactions with teachers, peers, and environmental feedback. However, social-cognitive approaches might overstate the impact of environmental factors and underemphasize the role of physiological processes and bodily states in supporting SR.

2.4.3 Goal-Oriented Models

Goal-based perspectives focus on how individuals pursue, prioritise, and adapt multiple goals. Kruglanski et al. (2002) explained SR as balancing and adjusting interconnected goals. A young person preparing for exams may devote extra time to their most challenging subject, aligning effort with long-term academic aims. This perspective highlights the planning and prioritising aspects of SR relevant to managing learning demands.

Baumeister et al. (2007) introduced the strength model, which likens SR to muscle strength. When overexerted, self-control depletes a limited resource, leading to impulsivity and decision fatigue. This process, termed ego depletion, impairs subsequent self-control even across unrelated tasks. For example, a young person who sustains self-control while studying may later struggle to resist distractions. Frequent exertion drains capacity, affecting both academic and social functioning. Research across various domains, including eating, spending, and interpersonal behaviour, supports this model. Trait self-control reflects greater resource availability and, in turn, higher regulatory capacity. Motivation, however, can temporarily offset depletion. In classrooms, this suggests that prior demands on self-control shape persistence on demanding tasks.

The strength model conceptualises SR as a limited resource, in contrast to goal-oriented and social-cognitive perspectives that view it as a skill that can be developed and adapted to context. Baumeister et al. argue that repeated demands deplete regulatory capacity, whereas Zimmerman and Bandura suggest that SR can be improved through strategies, self-efficacy, and environmental support. This contrast reflects an ongoing debate in the literature as to whether SR is best understood as a finite capacity or an adaptive competence. However, the strength model has been criticised because later replication studies have produced inconsistent evidence for ego depletion, suggesting that SR may not always operate as a finite resource (Inzlicht et al., 2021).

2.4.4 Self-Determination Theory

Self-determination theory emphasises that SR depends on satisfying innate psychological needs for competence, autonomy and relatedness (Deci, 2000). When these needs are supported, individuals regulate behaviour more effectively, sustain motivation, and respond adaptively to challenges and setbacks. For example, a child learning piano may choose her own songs (autonomy), improve skills through practice (competence), and share progress with supportive others (relatedness). Meeting these needs sustains motivation and engagement. In classrooms, climates that nurture autonomy, competence, and relatedness not only promote motivation but also strengthen students' capacity for SR.

Self-determination theory further differs from the strength model by proposing that SR is sustained not through conserving limited resources, but through supporting autonomy, competence, and relatedness. From this perspective, motivation and social context may replenish or enhance regulatory functioning, rather than SR being inevitably diminished through repeated use.

Although these theories share the assumption that SR involves goal-directed adjustment of behaviour, they differ in the mechanisms they prioritise. Cognitive, social-cognitive, goal-oriented, and motivational models predominantly conceptualise SR as a deliberate, top-down process involving planning, monitoring, reflection, and motivation. In contrast, physiological perspectives emphasise the reciprocal influence of bottom-up bodily states, such as arousal, on regulatory capacity. This distinction is important because it suggests that difficulties in SR may reflect not only ineffective cognitive strategies but also dysregulation of underlying physiological processes. This perspective therefore challenges theories that conceptualise SR solely as a conscious, top-down process, suggesting instead that effective regulation depends on the interaction between cognitive, emotional, and physiological systems. Nevertheless, although self-determination theory explains why motivation influences SR, it provides less detail about the specific cognitive processes underlying regulation.

2.4.5 Physiological Perspective

A physiological perspective complements psychological models by emphasising how SR involves regulating arousal through awareness of both external stimuli and internal bodily response states. Effective regulation requires intentional awareness of arousal and a deliberate, thoughtful response that balances cognition and emotion to act towards a goal (Razza et al., 2015; Willis & Dinehart, 2014; Zelazo & Lyons, 2012). Craig (2009) linked the neural basis of consciousness to awareness of physiological states, leading to a focus on interoception: the perception and interpretation of internal bodily signals. Interoceptive processes, including awareness of breath and bodily rhythms, provide a foundation for understanding how physiological regulation underpins SR.

2.5 Interoception and SR

2.5.1 What is Interoception?

Interoception refers to the perception and interpretation of internal bodily signals such as heartbeat, respiration and visceral sensations. Emma (2022) describe interoception as mindful body awareness. According to Khalsa et al. (2018) it refers collectively to the nervous system's processing of internal bodily stimuli (Figure 1). The brain's awareness of bodily states involves the ongoing interaction of sensory signals with higher-order cognitive representations incorporating goals, personal history, and environmental context. This enables integration of bodily sensations into consciousness, influencing behaviour, emotion, and cognition (Berntson & Khalsa, 2021). Farb et al. (2015) describe interoception as an iterative process in which perception and cognitive appraisal of body states inform response selection. This dynamic interplay drives emotional experiences and regulatory behaviours (Craig, 2009).

While communication from visceral organs to the brain occurs constantly, it shapes behaviour, cognition, and emotions. Berntson and Khalsa (2021) emphasises the importance of neural circuits of interoception for behavioural, cognitive, and ER across conscious and non-conscious processing, highlighting how the body's internal state regulates choices.

2.5.2 The Connection Between Interoception and SR

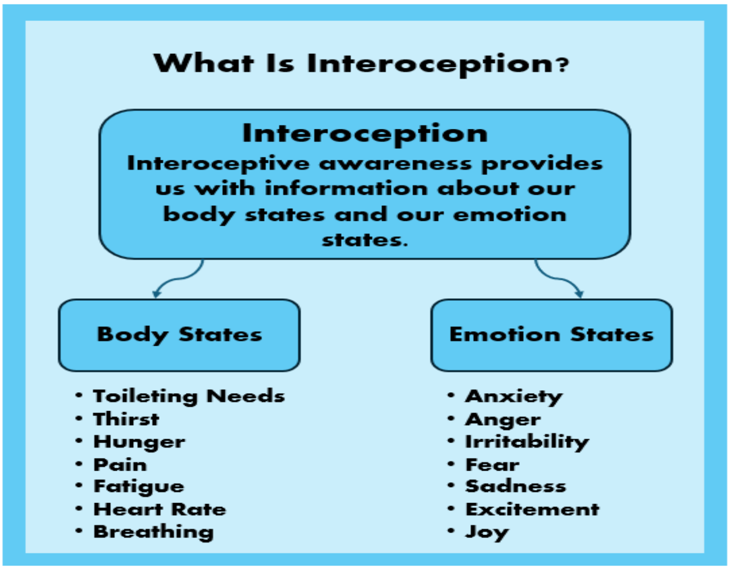
The interconnectedness of SR and interoception reflects how the regulation of internal bodily states influences cognitive, emotional, and behavioural responses to external stimuli. Garfinkel et al. (2015) illustrate how accurate perception of bodily signals, such as heartbeat or respiration (interoceptive accuracy), is associated with better regulation. Therefore, it enables individuals to respond more effectively to physical and emotional cues. Conversely, atypical interoception (inaccurately sensing and interpreting internal bodily signals) is often associated with being more dysregulated and is linked to various mental health issues (Murphy et al., 2017). For example, in health anxiety, changes in heart rate (HR) may be misinterpreted as signs of serious illness. Critchley and Garfinkel (2017) emphasise that interoceptive awareness, which involves understanding and monitoring the internal state, enhances emotional SR skills. Therefore, being aware of internal signals, such as a racing heart or butterflies in the stomach, is key to SR. Accurately understanding what is happening inside our bodies enables us to regulate our responses to situations more effectively. Highlighting these concepts emphasises the potential of interventions to enhance interoceptive skills, thereby promoting SR.

The connection between the brain and the body highlights that the body's physiological state significantly influences its functionality Figure 1. Interventions that enhance interoceptive awareness, such as mindfulness or biofeedback, can support understanding of the internal physiology that affects SR. Mindfulness (explored in section 3.7.1) encourages attention to bodily sensations, fostering ER and enabling individuals to recognise and respond to physiological cues before escalation. Biofeedback techniques provide real-time data on bodily states, such as HR. Critchley (2013) reinforces this connection by explaining how human neuroimaging offers insights into the neural processes underlying perceptions, thoughts, feelings, and actions. The brain not only perceives internal signals but also adjusts them, integrating interoception with SR.

Despite this, there is a tendency to analyse mental processes without considering the body's physiological state. In classrooms, teachers often focus on outward emotions or behaviour rather than physiological drivers. For example, a restless or irritable child may seem inattentive or disruptive, but elevated HR or shallow breathing due to stress can influence behaviour. These internal signals often go unnoticed, while external responses, such as encouraging focus, are prioritised. A key part of SR is developing interoceptive awareness, helping children recognise and regulate internal bodily states.

Figure 1

Understanding Interoception



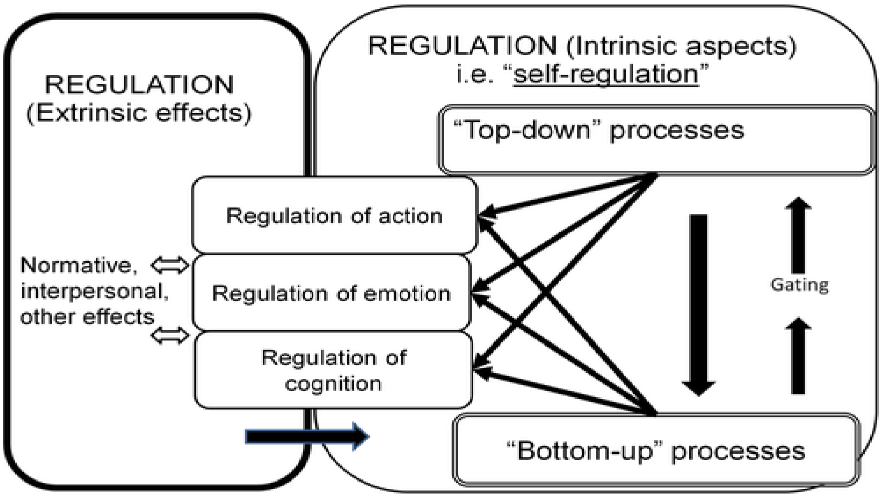
2.6 Models Accounting for Physiology

To capture this integration of body and mind, several models have incorporated physiological components into SR. The model from Nigg (2017) Figure 2 illustrates the continuous interaction between the cognitive and physiological processes of SR. The model incorporates physiological factors into the regulatory description. It describes ongoing and adaptive modulation of internal states (emotion, cognition) or behaviour, mediated by central and peripheral physiology, encompassing cognitive abilities including EF.
Nigg emphasises the significance of both extrinsic regulation (external influences) and SR (intrinsic regulation), which become more pronounced as development progresses.

The model shows how adapting internal states to external demands emphasises physiological factors such as heart rate variability (HRV) and the stress response (Sections 3.4 and 5), in combination with cognitive processes, including goal setting. This perspective aligns with an understanding of regulation that considers the interplay between physiological and cognitive factors in shaping behaviours and responses. Although Nigg's model emphasises the interaction between physiological and cognitive processes, it provides less detail on how these mechanisms operate differently across developmental stages or contexts. For school-based SR interventions, however, this model highlights the importance of targeting both children's internal states and their interactions with external demands.

Figure 2

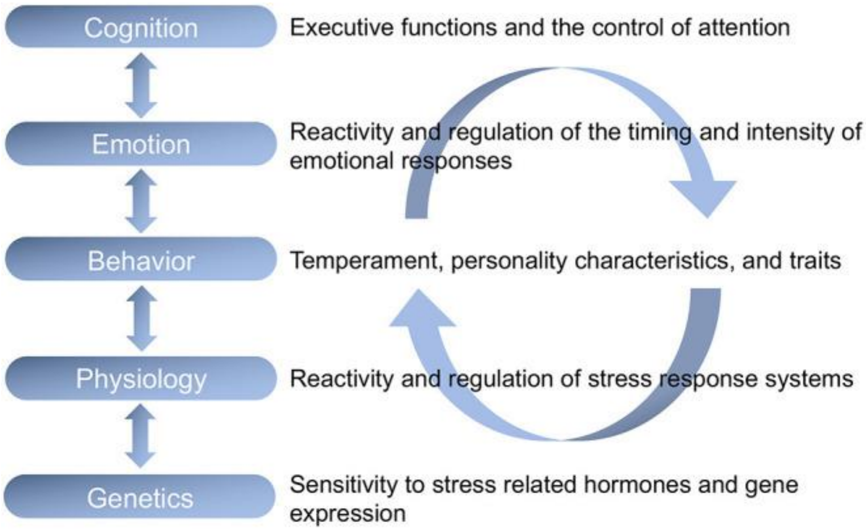
Nigg's (2017) Model of SR



Blair and Ku (2022) Figure 3 state that the hierarchical model of SR integrates cognitive, emotional, behavioural, physiological, and genetic levels. SR is described as top-down and bottom-up, recursive, and highly context-dependent. Top-down regulation begins with higher-order cognitive processes, such as planning and decision-making, which guide physiological responses and behavioural outcomes. Bottom-up regulation occurs when sensory or physiological inputs, such as HR or emotional arousal, shape cognition and behavioural responses. This interaction highlights how SR is context-dependent and adapts in response to both internal and external factors.

Figure 3

Blair and Ku (2022) Hierarchical Model of SR



The model draws upon the psychobiological model of temperament, which emphasises the interplay of biological and environmental factors in temperament emergence (Derryberry & Rothbart, 1988). SR also incorporates Cybernetic theory (Appendix A), which involves setting goals, monitoring progress, and responding to feedback in real time. The continuous feedback process enables adaptability, as individuals modify their actions in real time to stay aligned with their goals. Nevertheless, the hierarchical and multi-level nature of the model may make it difficult to determine which processes are most important to target in practical school-based interventions. This cycle emphasises how goal-oriented processes constantly monitor, adjust, and optimise thoughts, emotions, and behaviours to achieve desired outcomes in a changing environment.

Viewing SR as dynamic and hierarchical is crucial for designing interventions that match developmental stages and individual needs. Building skills to manage impulses, recognise internal states, and respond flexibly to cues emphasises SR's adaptive, context-sensitive nature.

Collectively, these models indicate a shift in the literature from viewing SR mainly as a cognitive and individual phenomenon to understanding it as dynamic, embodied, and contextually situated. This research adopts the latter perspective, as it better accommodates the interaction between cognitive, emotional, behavioural, and physiological processes explored subsequently.

2.7 Development of SR

SR develops through the interaction of neurophysiological maturation, parenting, and peer socialisation (Edossa et al., 2018). Blair and Ku (2022) Figure 3 illustrates individual variability in developmental speed: lower-level emotional, behavioural, and physiological processes develop earlier, whereas higher-level cognitive processes, such as EF, emerge later. Specific skills may mature unevenly, for example, advanced ER developing before full EF. Understanding and supporting children's diverse developmental pathways is therefore essential for well-being. Research shows that social functioning, physical and mental health, and educational and occupational attainment are primarily rooted in the early years (Robson et al., 2020). SR thus supports both immediate well-being and long-term positive outcomes.

From birth, SR develops in a nonlinear, staged-sequenced fashion through a hierarchical cascade process (Nigg, 2017). Infants have minimal capacity for SR and rely on caregivers for coregulation (Eisenberg, 2010). As toddlers, children begin to use self-comforting actions (e.g., thumb sucking) and sensorimotor strategies, but remain heavily dependent on caregiver routines and external soothing (Edossa et al., 2018). Such self-soothing behaviours, including seeking out a familiar person, represent early signs of independent regulation while children continue to rely on caregivers for routines and comfort. Through repeated interactions, such as caregiver responses to distress, children gradually internalise regulation strategies, building SR capacities via co-regulation and modelling (Morawska et al., 2019). As children mature, external prompts are internalised into self-monitoring and control, supported by the development of neural systems (Cox et al., 2010; Masten & Cicchetti, 2010). Adolescents and adults then demonstrate greater independence, applying abstract reasoning and ER to manage stress and respond thoughtfully rather than impulsively, reflecting more adaptive and flexible SR (Huang et al., 2023).

When focusing on internal maturation, the influence of external environments, such as socioeconomic status, cultural norms, or adverse life experiences, on self-regulatory skills can be overlooked. Evidence from low-income families shows that family chaos is negatively associated with children’s SR and contributes to externalising behaviours (Hardaway et al., 2012), demonstrating that SR is shaped not only by internal development but also by environmental conditions. Improvements in early childhood SR are linked with better health, achievement, and educational outcomes across the lifespan (McClelland et al., 2013). Robson et al. (2020) emphasise that early SR is a fundamental aspect of development that confers long-term risks or benefits across learning and well-being. These findings highlight the need for early interventions to strengthen SR by addressing caregiver practices and environmental stressors.

2.8 Environmental and Practical Influences on SR development

Teachers, mentors and caregivers play a central role in nurturing SR by creating structured environments that promote independence. Activities that foster emotional expression and early calming strategies lay the foundation for ER. Consistent routines provide predictability, helping children internalise SR by practising regulation within familiar contexts. Interventions such as role play for preschool and school-aged children show moderate success in enhancing EF, emotional awareness and behavioural regulation (Eisenberg, 2010). However, effectiveness varies with age, intervention type and individual characteristics.

For older children, goal-setting activities support SR by encouraging self-monitoring and managing social-emotional responses. For example, regulating frustration during group conflicts demonstrates ER, reflecting the gradual development of metacognitive and self-regulatory strategies that become more automatic and transferable over time (Huang et al., 2023; Zimmerman, 1990)

Overall, SR develops gradually and multifacetedly, influenced by internal development and external environments, and supportive structures in education and from caregivers are crucial for fostering it across developmental stages. Interventions should be inclusive and responsive to children's varying levels of maturity, enabling them to internalise regulatory techniques and build the skills necessary for life, while accounting for age-related and environmental influences (Pandey et al., 2018).

2.9 Identifying Components of SR

In educational settings, dysregulation is often interpreted as challenging behaviour or children being "naughty" or "unmanageable"; consequently, disengagement in learning can become the norm with repeated suspensions and exclusions (Emma, 2022). Interventions, therefore, should be grounded in theoretical frameworks to ensure that children are supported in developing all facets of SR. Regulation is a construct that refers to internal and transactional processes supporting goal-directed behaviour over time and across changing contexts (Bailey & Jones, 2019). This involves managing and maintaining equilibrium across the physiological, emotional, and cognitive components of SR.

2.9.1 Cognitive Regulation

Cognitive regulation (CR) enables individuals to focus and shift attention, suppress undesirable reactions, and maintain and update information (Gunzenhauser & Saalbach, 2020; Howard & Melhuish, 2017; Huang et al., 2023). EF, a component of CR, includes working memory (holding and manipulating information), cognitive flexibility (adapting to changing tasks), and inhibitory control (suppressing impulsive responses), all of which contribute to SR (McClelland et al., 2007).

Interventions can focus on cognitive strategies such as reframing a challenge, goal setting, planning and metacognition (Dent, 2016; Donker et al., 2014). The extent to which cognitive SR translates into real-world behaviour and achievement is influenced by motivation, support, developmental stage, and individual differences, alongside contextual factors. An exclusive emphasis on cognition, however, risks overlooking SR's complexity and its interactions with physiological mechanisms.

Managing emotional responses in a stressful situation requires balancing cognitive control and emotional awareness. For example, a child who excels at problem-solving may still struggle with SR when frustrated by a peer; without ER strategies, frustration can escalate, hindering their problem-solving. An approach that integrates emotional awareness and coping strategies can help manage frustration and enable problem-solving to be fully applied.

Cognitive SR also interacts with physiology (Craig, 2002). Recognising bodily states and adjusting responses, for example, using deep breathing to manage anxiety, illustrates how cognition and interoception combine to regulate behaviour and decision-making. These interconnections with emotional and physiological regulation highlight the integrated nature of SR.

2.9.2 Emotion Regulation

Emotions are essential, and regulation involves recognising and managing emotional experiences to maintain stability. A prerequisite for successful ER is the awareness of emotional states, which is associated with the awareness of bodily signals, namely interoceptive awareness (Füstös et al., 2013). Variations in internal bodily signals (e.g. HR) and the perception of these changes contribute to emotions (Schultchen et al., 2019). A child who associates an increased HR with anger might react impulsively or withdraw. If they recognise it as a natural response to a challenge, they may reframe their frustration and use SR strategies such as deep breathing to maintain focus and cooperation.

Integrating physiological awareness into SR interventions may help children understand their bodily responses, supporting emotional and cognitive control, and promoting mental and physical well-being. ER interventions include teaching mindfulness, deep breathing, cognitive reframing or stress management (Blair & Diamond, 2008; Gross, 2015; Pandey et al., 2017). A systematic review and meta-analysis by (Leyland et al., 2019) found that a single mindfulness induction in a laboratory setting could enhance the regulation of negative affect, suggesting benefits for SR.

Numerous studies indicate a correlation between interoceptive accuracy and emotional states. Individuals with higher interoceptive accuracy tend to experience emotions more intensely and regulate them more effectively, mainly when internal bodily changes, such as elevated HR or breathing, occur (Critchley & Garfinkel, 2017; Füstös et al., 2013; Herbert et al., 2011).

2.9.3 Behavioural Regulation

BR involves managing internal processes in action and refers to the ability to monitor attention and inhibit behaviour to achieve goals (Blair, 2002). It reflects an individual's capacity to regulate behaviour purposefully and adaptively, drawing upon executive attentional processes such as inhibition, shifting, planning and error monitoring. This is related to effortful control (Edossa et al., 2018) and represents the outward manifestation of EF skills (McClelland et al., 2014). For example, inhibition could involve resisting the temptation to check a phone, and shifting may occur when a child moves from reading to maths. Planning could involve organising a study schedule, while error monitoring involves recognising a mistake, such as miscalculating a sum, and adjusting strategies to correct it.

Behavioural interventions include promoting attention (McClelland et al., 2006; Veenman, 2017). However, focusing solely on BR may overlook the complex interactions among cognitive, emotional, and physiological processes that influence behaviour and adaptation. In classrooms, children face multiple influences, including environment, social interactions, teacher-child relationships, cultural and emotional factors, and physiological responses such as anxiety or fatigue. Difficulties in BR can arise from emotional dysregulation, cognitive challenges, or physiological arousal. Neglecting ER or cognitive planning may reduce the effectiveness of goal-directed behaviour (Füstös et al., 2013)

2.9.4 Physiology in SR

It is essential to examine physiological factors, including arousal levels and interoceptive awareness, in SR. Interventions aimed at helping individuals' awareness and promoting Nigg's (2017) model of SR of physiological regulation could support well-being and adaptive functioning. Physiological regulation involves maintaining a balanced state, characterised by a steady HR and being calm and alert (Porges, 2022). This allows the body to respond and adapt to the environment without excessive stress reactions. For example, a child facing a maths problem may have an elevated HR and feel frustrated. If SR is well developed, they may recognise these bodily signals, take a breath and persist through the problem without being overwhelmed. Conversely, unchecked physiological responses may escalate, leading to avoidance and hindering learning and adaptation.

Elevated arousal, including excitement, may hinder cognitive control and lead to impulsive behaviours. Füstös et al. (2013) demonstrated that individuals with higher interoceptive awareness of bodily states tend to have better ER, facilitating self-control and decision-making. Bodily signals can become distorted by negative emotional states, making it harder to differentiate between genuine physical sensations and those influenced by thought or belief (Paulus & Stein, 2010). Misinterpreting these signals can hinder SR, as managing emotional responses requires accurate perception of bodily cues.

Physiologically driven processes are regulated by the ANS, which manages stress and emotional responses, as described in Porges' Polyvagal theory (Porges, 1996, 2022; Sullivan et al., 2018) (section 3.4.2). Effective SR depends on optimal ANS regulation (Porges, 2003), which involuntarily controls physiological functions, including HR and breathing, and balances arousal through the SNS and the parasympathetic nervous system (PNS). The SNS increases readiness for action during stress ("fight-or-flight"), while the PNS calms the body post-stress. This balance underpins SR (Porges, 2011; Thayer & Lane, 2009).

Understanding physiological regulation is crucial for designing classroom SR interventions, enabling educators to help children recognise and manage bodily responses impacting emotional, cognitive, and behavioural functions.

2.9.5 Integrating Components of SR

The components of SR interact and are shaped by internal and external factors. They are interdependent, each influencing and reinforcing the others to shape a child's ability for SR. Children will enter school with varying skills, including self-control, impulse management, attentional control, and ER. Environmental factors, such as noise, seating arrangements, and peer interactions, also impact a child’s ability to self-regulate.

The models of SR (Nigg, 2017) and (Blair & Ku, 2022) Figures 2 and 3 offer frameworks that emphasise bottom-up (physiological to cognitive) and top-down (cognitive to physiological) processes. Foundational levels, such as ER and physiological regulation, mature before higher-level functions like executive control and attention, and the environment shapes all. Positive interactions with parents and teachers support these processes (Suntheimer & Wolf, 2020). Starting with physiology allows interventions to target ER, followed by cognitive skills, such as attention control and problem-solving.

Interventions that focus on physiological regulation, such as yoga (Section 3.7.2), calm the body’s physiological state (e.g., HR and breath), creating a foundation for effective ER and cognitive control. Individuals who can modulate their physiological states through these techniques often show improved emotional and behavioural regulation, leading to better social, emotional, and academic outcomes (Greenberg et al., 2017; Koncz et al., 2021; Zelazo & Lyons, 2012).

ER can be considered the next layer, building on a well-regulated physiological baseline. Effective ER, including controlling feelings and responses, supports cognitive functions such as attentional control, planning and decision-making (McRae & Gross, 2020). These top-down processes involve prefrontal control over lower brain regions to inhibit impulses and guide behaviour toward goals (Blair & Diamond, 2008).

BR results from the integration of physiological, emotional, and cognitive processes (Nigg, 2017). Physiological regulation influences emotional and cognitive responses, while cognitive strategies can downregulate physiological arousal. For example, Porges (2011) highlights the role of the ANS in supporting ER by influencing HR, emotional responses, and behaviour. EF skills, such as working memory and inhibitory control, further shape emotional and behavioural outcomes under stress (Blair & Ku, 2022).

In summary, SR reflects a dynamic, bidirectional system in which physiological, emotional, and cognitive processes interact continuously, with foundational physiological and ER supporting higher-level cognitive control and EF to enable adaptive behavioural outcomes (Nigg, 2017; Blair & Ku, 2022).

2.10 Integrating Universal Programs to Support SR

Schools are effective settings for delivering mental health prevention programmes that enhance children's emotional outcomes by embedding nurturing practices into daily routines (Fenwick-Smith et al., 2018; Williams et al., 2020). Recognising SR as a key skill for learning and long-term well-being, schools must implement evidence-based interventions universally (Sahranavard et al., 2018).

Evidence highlights the need for universal interventions that equip children with the knowledge and tools to develop SR (Blair & Raver, 2015; Diamond & Lee, 2011; Moffitt et al., 2013; Pandey et al., 2017). A meta-analysis of learning strategy instructions on academic performance (Donker et al., 2014) found that teaching SR strategies improved achievement, particularly when strategies were explicitly taught. A meta-analysis of 150 studies involving 215,212 children found that SR predicts future health, educational and social outcomes, including healthier habits and positive socioeconomic outcomes into adulthood (Jones et al., 2015; Robson et al., 2020).

Programs such as PAX Good Behaviour Game (Barrish et al., 1969; Embry, 2002; Johansson et al., 2020) and Promoting Alternative Thinking Strategies (PATH) (Domitrovich et al., 2007; Greenberg & Kusche, 2006) foster ER through participatory approaches, structured routines and affective awareness. The PAX system encourages ownership of the classroom environment, reinforces inhibitory control, supports ER in managing disappointment, and promotes balanced participation through structured activities. Observations show reduced disruptive behaviours and increased prosocial skills when implemented with fidelity (Johansson et al., 2020). Similarly, PATHS supports children's SR instead of teachers' modification, leading to improved social competence over the year (Hamre et al., 2012).

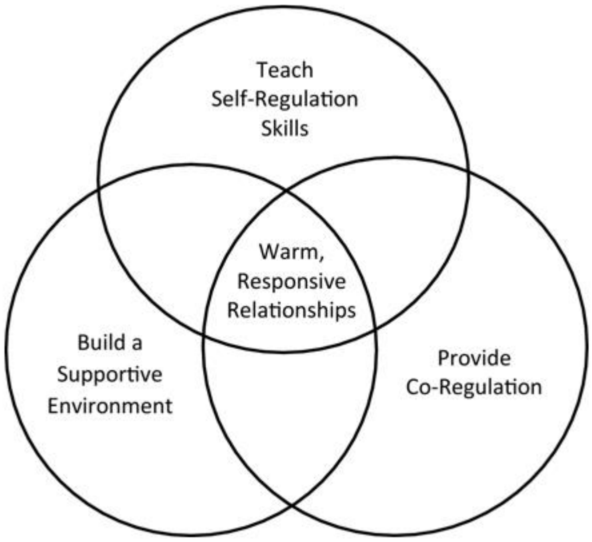
These programs integrate preventive strategies into the classroom routines, offering children opportunities to practice and strengthen SR. Evidence suggests such practices can reduce stress, enhance ER, improve attention and provide children with the tools to navigate challenges effectively (Blair & Raver, 2015; Tang et al., 2015). Preventative models address existing challenges while equipping children to manage future stressors, promoting long-term well-being.

Dodge (2018) emphasis universal interventions in healthcare as cost-efficient measures that ensure every child receives evidence-based preventative support. These principles are transferable to education, highlighting early, preventive measures that enhance SR. The SR Premotion Model (Murray et al., 2019) Figure 4 provides a framework for embedding SR strategies into everyday school life. The model guides prevention scientists, educators, program administrators, and policymakers in enhancing the social-ecological environment to support all children, providing a framework to inform interventions that address multiple developmental levels, including physiological, emotional, and cognitive processes.

While academic achievement remains a primary educational goal, schools must prioritise children's well-being. Childhood SR significantly predicts outcomes in health, mental health, academic achievement and social behaviours (Robson et al., 2020). Teacher-reported assessments often show stronger links with academic performance than parent-reported assessments, possibly due to the structured learning environment (DeCamp, 2025; Torrington et al., 2024). Given SR's influence on life outcomes, effective interventions for childhood and adolescence must be identified (Pandey et al., 2017).

Figure 4

The SR Premotion Model



2.11 Transitioning into the Classroom

Evidence indicates that SR interventions can improve academic performance, social competence skills and reduce behavioural problems with long-term benefits for health and well-being (Pandey et al., 2017). There is a strong case for integrating SR strategies into curricula to optimise learning outcomes at all educational levels.

As social and emotional challenges rise, schools are now widely recognised as critical environments for promoting mental health, well-being, and SR. The World Health Organisation (2020) highlights that schools should act as one of the primary systems addressing these challenges. With access to children during key developmental stages, schools are well-positioned to nurture well-being.

This aligns with Scotland's educational framework, where *Getting it Right for Every Child* (GIRFEC) embeds well-being as central to learning. GIRFEC emphasises universal support and well-being in education. Although national frameworks support SR, classroom implementation remains inconsistent, a challenge further explored in sections 3.8 and 4.6 through an implementation science approach.

Despite these frameworks, mental health, well-being and SR are often sidelined, with academic achievement still seen as the primary measure of success in many educational systems worldwide (OECD, 2020b). It is essential to promote universal interventions that are accessible to all children, regardless of background.

2.12 Translating Evidence into Practice

MBPs have the potential to serve as a bridge between bodily self-awareness and CR and ER skills addressed earlier in this chapter. A key challenge in real-world application was how insights from the SR models of Nigg and Blair & Ku translated into scalable, evidence-based interventions (Fixsen, 2005). To make this manageable, the focus narrowed to a single component of SR: interoceptive awareness. Accurately interpreting interoceptive signals enhances adaptability and supports SR (Farb et al., 2015; Sullivan et al., 2018). Physiological regulation provides a practical, accessible starting point (Blair & Raver, 2012).

A growing body of research shows that these approaches enhance communication between the brain and body, helping children regulate stress responses and support health and well-being (Felver, 2016; Muehsam et al., 2017; Taylor et al., 2010). Teaching children to become more aware of their physiology may help them regulate more effectively in the moment, improving overall SR.

2.12.1 Embedding into the Classroom

Embedding universal interventions within schools creates opportunities to teach SR skills for lifelong learning and overall well-being. Universal interventions, ranging from playgroup games to mindfulness moments, have gained attention (Durlak, 2011; Sklad et al., 2012; Taylor et al., 2017). Whilst some effect sizes for the measured outcomes are small, they reflect the complexity of real-world implementation and can signal meaningful, lasting gains in SR. Small shifts in academic achievement can accumulate over time, producing measurable and meaningful outcomes that nudge children toward a more adaptive trajectory (Funder & Ozer, 2019)

Despite evidence supporting physiologically informed SR interventions such as mindfulness and yoga, practical implementations in schools face challenges, including cost, limited teacher training and resistance to change (Durlak, 2011). It was essential to design an intervention that developed both knowledge and skills in a way accessible to all. Effective implementation required the intervention to be acceptable, feasible and smoothly integrated into existing school routines (Domitrovich et al., 2015). These considerations shaped the design of a simple, daily, classroom-friendly breathing practice.

2.12.2 Role of the Teacher

For universal programmes to be effective, they must integrate easily into teachers' existing routines with minimal additional effort. When teachers view an intervention as manageable and relevant, they are more likely to engage with it and sustain adherence

(Fixsen, 2005; Fixsen et al., 2009). Studies indicate that teacher buy-in significantly increases the likelihood of an intervention's success (Durlak, 2011). Given the importance of maintaining fidelity, it was essential to focus on a manageable and scalable component of SR that could consistently be implemented without overwhelming school staff.

If a practice is acceptable, accessible, practical and aligned with class priorities, the teacher is more likely to embrace it (Domitrovich et al., 2015). The regulation of the physiological state plays a foundational role in shaping emotional and behavioural responses. Developing SR enables children to manage their impulses better, regulate their emotions and adapt to varying situations, contributing to healthier interactions and improved learning outcomes (McClelland & Cameron, 2011).

Teacher training that includes SR strategies improves teacher effectiveness and outcomes for children by enhancing the ability to support learning and adapt to classroom challenges (Rodriguez-Gomez et al., 2024). Providing continuous support and professional development is therefore essential for fostering SR and developing a sustainable, adaptive learning culture (Domitrovich et al., 2015; Rodriguez-Gomez et al., 2024).

2.13 Chapter Summary

This chapter investigated the foundations of SR, reviewing key models, including those of (Blair & Ku, 2022; Nigg, 2017). It became evident that physiological regulation plays a central role in all aspects of SR. Given schools' and particularly teachers' critical role in developing SR skills (Murray et al., 2019) a universal intervention that embeds physiological regulation into daily routines was prioritised. Building on these insights, the next chapter turns to MB approaches targeting physiological processes, providing a theoretical and empirical foundation for intervention design.

Chapter 3: Mind-Body Connections and SR

3.1 Concept of Mind-Body

Educating children about MBCs in schools could promote holistic health and foster habits that integrate physical and mental wellness. Internal bodily states influence behaviour, such as seeking shade in the heat or losing appetite when unwell, illustrating how SR enables adaptation to internal and external demands, thereby maintaining balance and well-being.

The relationship between physiological states and psychological experiences underlies SR. Models by Blair and Ku (2022) and Nigg (2017) shown in Figures 1 and 2 are bottom-up processes driven by physiological mechanisms such as interoception (awareness of bodily states), ANS regulation, and the activity of subcortical brain regions like the limbic system (McRae & Gross, 2020). Physiological processes, such as HR and breathing, mostly precede conscious awareness and provide the basis for ER, particularly when top-down cognitive states are less accessible. Top-down processing in the brain involves regulating thoughts, emotions, and behaviours through higher-order cognitive functions, like intentional mental control to manage emotions by rethinking situations or holding back reactions, mainly governed by the prefrontal cortex (Rahnev, 2017). ER refers to the extrinsic and intrinsic processes that enable monitoring, evaluating and adjusting emotional reactions to achieve desired goals (Gross, 2015).

Building on SR from chapter 2, MB processes demonstrate how physiological regulation supports cognitive and emotional control, shaping behaviour and responses (Füstös et al., 2013; Porges, 2011). Teaching children to connect awareness of emotions, both subjective and expressive, with SR skills can help them manage stressors such as exams or behavioural challenges in schools (Rashedi et al., 2021). A central feature of this chapter is the exploration of MBCs and the reciprocal impact of mental and emotional states on physical health. Integrating MB awareness and practices in schools ensures that children have the tools to enhance their social, emotional, and academic well-being. Understanding the historical and theoretical foundations of the MBC provides context for these processes and informs the development of educational applications.

3.2 Theoretical Perspective

The MBC has been explored extensively in psychological theory. James (1884) proposed that physiological changes precede emotions, implying a direct influence of bodily states on psychological experiences. Cannon (1927) argued that bodily changes do not solely determine emotional experiences, emphasising the complex interaction between physiological responses and cognitive processes. Schachter and Singer (1962) proposed that emotional experiences result from physiological arousal that is interpreted within context. Damasio (1994) highlighted the integration of emotions, bodily states, and cognition in decision-making and social behaviour. Together, these theories have contributed to understanding the role of MB processes in emotion and SR.

Contemporary research further emphasises the bidirectional relationship between physiology and emotion. Psychoneuroimmunology, trauma studies, and gut-brain axis research show how immune function, gut health, and stress influence ER. Chronic stress, for example, can dysregulate slow-acting biological processes, contributing to mood disorders and accelerating ageing (Epel, 2018). Neuroscience, psychology, and medicine highlight the bidirectional links between emotion and physiology, demonstrating how MBCs influence SR. Heightened arousal can dysregulate physiological systems (e.g., HR), impairing ER, behaviour, and decision-making. Conversely, MBPs, such as yoga, can restore balance, calm the body, and enhance SR. Integrating MBPs into education can help children effectively regulate both emotional and physiological states, supporting well-being and learning outcomes. These theoretical and empirical foundations provide a basis for exploring MB interventions and practices in educational settings, highlighting how understanding and regulating physiological and emotional states can enhance SR in children.

3.2.1 How Can Educational Psychology Draw Upon These Theories?

Educational Psychology bridges theory and practice by providing a framework for understanding how cognitive, emotional and social processes influence learning. MB development within educational contexts can be examined using Bronfenbrenner (1979) Ecological Systems Theory, which explains how cognitive, emotional, and physiological processes interact within broader environmental systems. Child development occurs within a network of relationships, with teachers acting as key agents in the classroom. Through interactions, teachers shape the immediate environment, influencing how children regulate emotions, engage with learning, and develop social skills.

MB development aligns with Vygotsky's sociocultural theory, emphasising cognitive development through language and collaborative activities (Vygotsky, 1978). Social interaction and cultural tools play a key role in learning. Teachers nurture cognitive and emotional growth through interactions and guide children through collaborative, interactive learning. Teachers help children develop skills in ER and well-being by providing an embodied approach to learning.

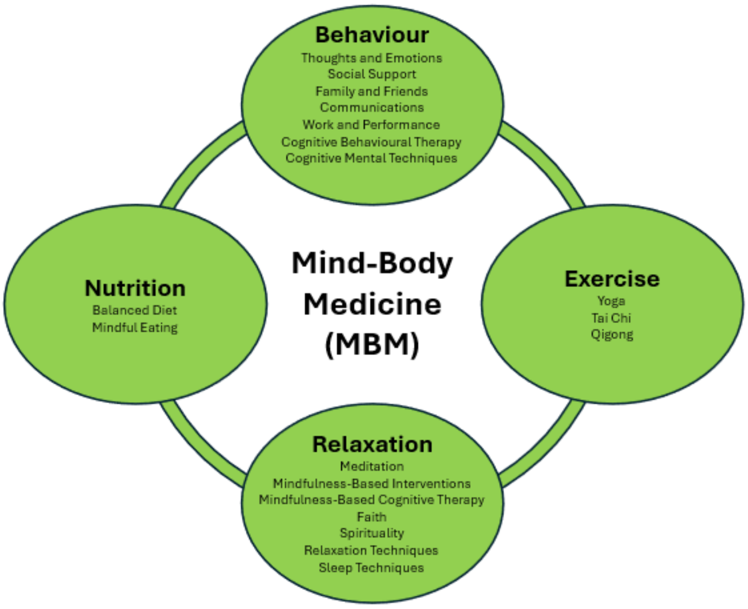
Framing MB development within these perspectives recognises that interconnected systems shape development. Teachers are key mediators, supporting the acquisition of tools and skills necessary for SR. Structured, evidence-based professional learning programs can enhance classroom practice with minimal training (Jennings & Greenberg, 2009). Understanding how MB development can be supported through educational frameworks informs the integration of MBPs and interventions in schools.

3.3 Mind-Body Medicine

Mind-body medicine (MBM), pioneered by cardiologist Herbert Benson, emerged in the 1970s alongside modern meditation research (Benson & Klipper, 1975). MBM explores the interactions among the brain, mind, and behaviour to promote health and well-being. MBM includes mental and behavioural techniques, exercise, relaxation, stress management, and nutrition. MBM recognises a central MB axis, encompassing consciousness, behaviour, and brain-body interactions (Esch & Stefano, 2022). Figure 5 illustrates the MBM framework, showing the four pillars of the BERN model: behaviour, exercise, relaxation, and nutrition, which provide a foundation for understanding SR by emphasising the interplay between physiological and mental processes.

Figure 5

MBM Framework (Esch & Stefano, 2022)



Incorporating MBM into the school curriculum could benefit children's well-being and academic performance. Schools can create supportive environments that promote well-being, health and SR by implementing strategies across the four pillars of the BERN model in everyday life (Esch & Stefano, 2022). Practices such as mindfulness, yoga and stress management techniques are increasingly recognised for their positive impact on ER, cognitive functioning and improving well-being (Creswell & Lindsay, 2014; Flook et al., 2010; Greenberg & Harris, 2012; Zeidan et al., 2010). Simple MBM practices, such as short mindfulness exercises or physical activity breaks, can be incorporated into daily school routines. Interventions such as yoga and mindfulness (see Sections 3.7.1 &2) are particularly effective when integrated into curricula as preventative measures aligned with children's developmental needs (Cozzolino, 2022).

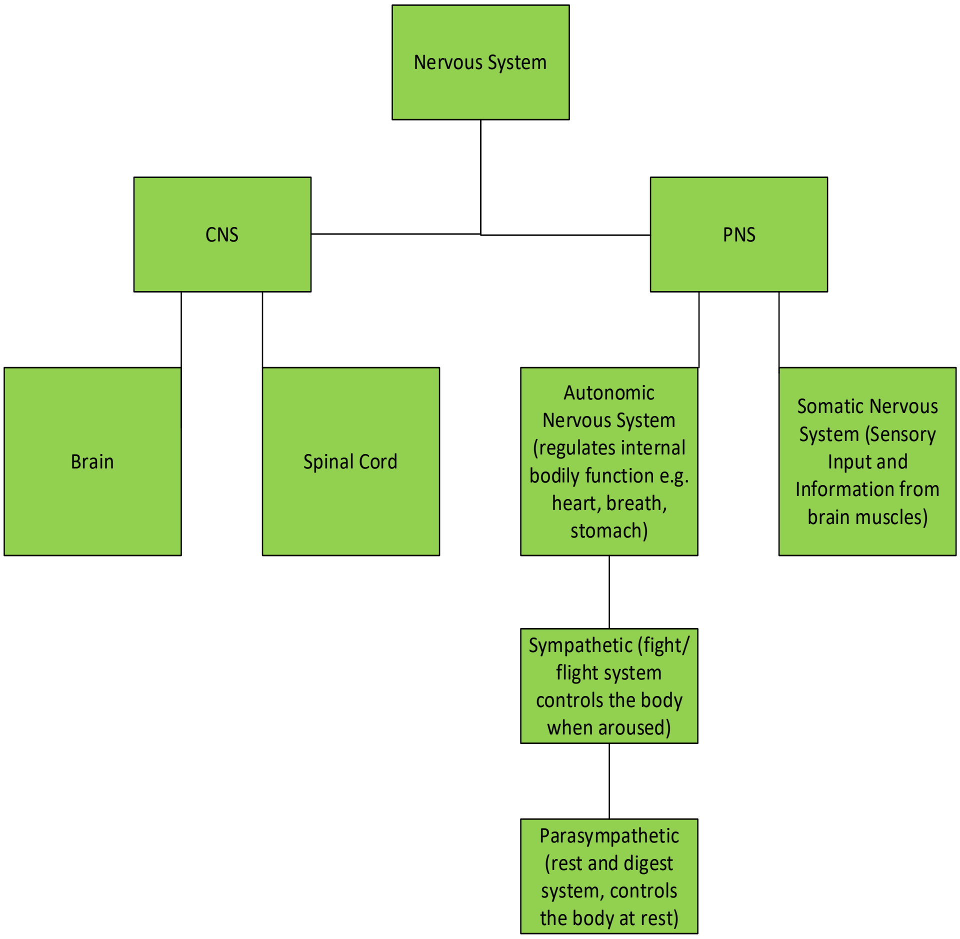
Physical activity interventions such as the Daily Mile in Scottish schools can enhance fitness levels and be implemented into school routines (Chesham et al., 2018). While empirical research supports their effectiveness, longer-term studies with appropriate participant information are required to assess their impact on mental health, well-being, academic performance, and cognitive function (Breslin et al., 2023). Effective implementation requires professional development for teachers to ensure MBM techniques are applied appropriately. Research into the cultural adaptability and sustainable integration of these practices is also necessary to fully realise their educational potential. Integrating MBM in schools highlights how structured MBPs can enhance physiological awareness, laying the groundwork for understanding how the body's internal states support SR.

3.4 Regulating from Within: The Body's Role in SR

SR is grounded in interoceptive processes, the perception and interpretation of internal bodily signals, which shape emotional, cognitive, and behavioural responses (Critchley & Garfinkel, 2017; Farb et al., 2015). Interoception supports domains such as pain, addiction, and ER (Ceunen et al., 2016; Farb et al., 2015; Porges, 2011) and operates through the nervous system (Figure 6).

Figure 6

The Human Nervous System



The ANS (Figure 7) maintains homeostasis and allostasis (Figures 8–9) through coordinated sympathetic and parasympathetic activity (Ernst, 2017; Strigo & Craig, 2016).

Figure 7

The Autonomic Nervous System

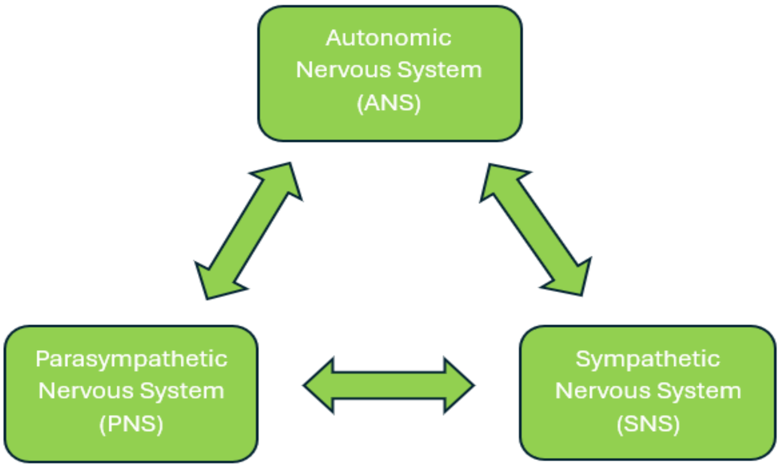


Figure 8

Stress Homeostasis

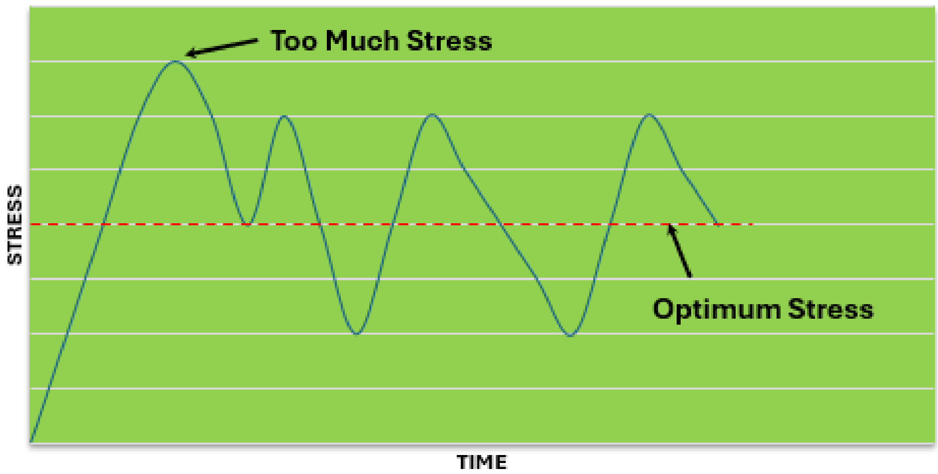
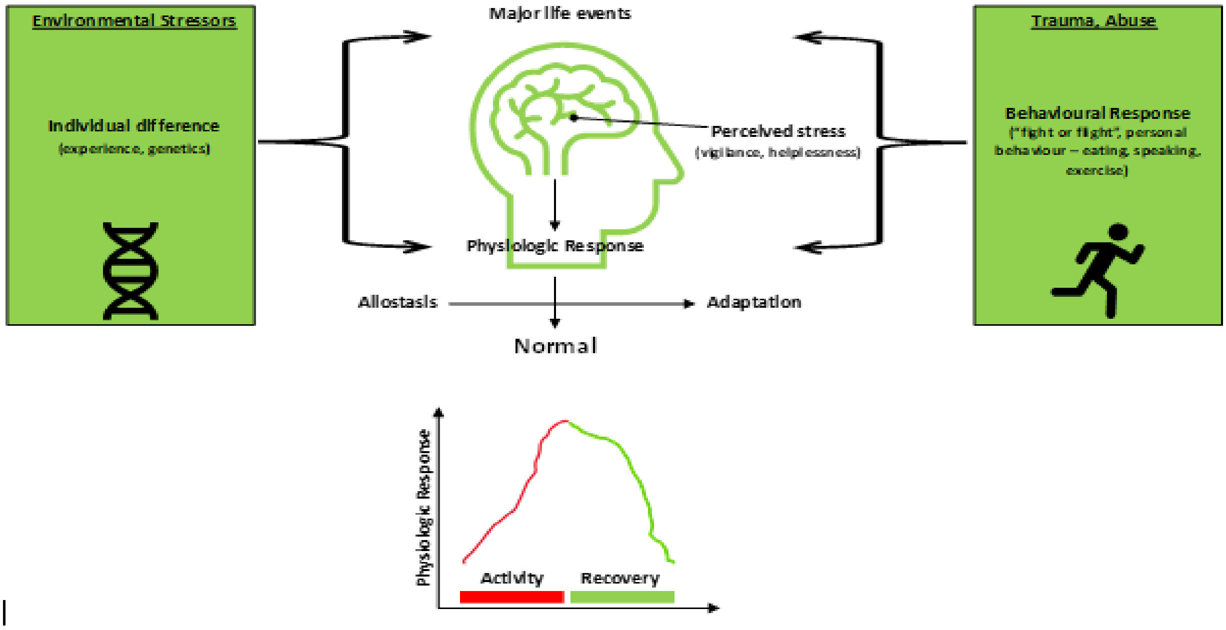


Figure 9

Allostasis load



Hormonal mechanisms, including cortisol and oxytocin, further contribute to adaptive responding, with dysregulation associated with stress and social difficulties (O'Connor et al., 2021; Porges, 2011). Interventions that enhance interoceptive awareness, such as breathing, mindfulness, and movement-based practices, have demonstrated benefits for ER, SR, academic functioning, and behavioural outcomes (Mahler et al., 2024; Schaaf & Nightlinger, 2007; Zamariola et al., 2019).

Polyvagal Theory (Porges, 1996, 2022) complements this framework by explaining how vagal pathways influence behavioural and emotional responses through the detection of safety and threat cues, highlighting the importance of practices that help children recognise and regulate their autonomic state.

3.5 Stress

Stress refers to experiences that are challenging emotionally and physiologically (McEwen, 2007). The body regulates stress response and homeostasis are through two systems: SNS and the hypothalamic–pituitary–adrenocortical (HPA) axis (Rich et al., 2024). These mediators can be both protective and damaging, depending on their duration and intensity (Chin & Kales, 2019). SR maintains stability under stress, but chronic activation and allostatic load cause wear and tear on the brain and body. Prolonged stressors such as trauma or abuse can impair SR by disturbing the balance between emotional and physiological stability.

Good stress, such as the nervousness felt when preparing a talk, activates the stress system in ways that enhance focus, energy, and performance, often leading to a sense of accomplishment. By contrast, “bad stress,” such as ongoing academic pressure and perceived lack of control, often results in irritation, fatigue, and exhaustion. Over time, this contributes to allostatic load, disrupting SR and undermining well-being. Psychological responses may include anger, anxiety, depression, and fatigue, while physiological responses include rapid heartbeat, shortness of breath, insomnia, and headaches. Behavioural effects may include impulsivity, overreaction, or muscle pain from muscle tension (O'Connor et al., 2021).

Chronic stress also accelerates disease processes. Health researchers link stress to slow-acting biological changes that increase vulnerability to diseases of ageing (Epel et al., 2018). Early-life adversity is particularly harmful, contributing to cumulative health risks that may emerge decades later as cognitive decline or physical illness (Shonkoff & Garner, 2012). Educational environments can reduce these risks by embedding stress-management and well-being practices.

Stress is a major contributor to non-communicable diseases. Research shows that chronic stress leads to inflammation and immune dysregulation, contributing to cardiovascular disease, diabetes, and other health problems (Black & Garbutt, 2002). Stress also disrupts the maturation of neural regions underpinning EF, including decision-making (Lupien et al., 2009). Repeated activation amplifies stress responses across the lifespan, with long-term effects on the brain and body (McEwen, 2007). Increased inflammation further raises risks for physical and mental health disorders in later life (Danese & McEwen, 2012). These findings underscore the importance of effective stress-regulation strategies, as adaptability mitigates the wear and tear caused by everyday challenges. Understanding the physiological mechanisms of stress underscores the ANS's central role. The following section explores how ANS activity interacts with SR.

3.5.1 ANS and SR

The ANS regulates the body’s stress response, maintaining homeostasis when threats are detected. Through neural and endocrine mechanisms, the brain communicates bidirectionally with the cardiovascular, immune, and other systems to modulate physiological and behavioural responses (McEwen, 2007). This highlights the central role in SR, particularly ER.

The SNS and PNS branches of the ANS coordinate adaptive responses. The SNS mobilises fight–flight reactions, while the PNS promotes calming and recovery. Effective ER depends on the brain's capacity to adapt and recalibrate perceptual and emotional responses as circumstances change (Thayer, 2012). This capacity develops across childhood as repeated experiences refine the brain's ability to regulate emotional and physical states.

Studies suggest that becoming more aware of physiological responses and employing strategies to modify ANS activity can improve ER and resilience (Lehrer et al., 2020; Streeter et al., 2012; Tang et al., 2015; Zaccaro et al., 2018). SR, therefore, relies on physiological systems to regulate stress and maintain balance. This MBC is particularly relevant for children as they navigate complex cognitive and emotional challenges in school contexts (Shonkoff & Garner, 2012).

Patterns of ANS activity vary across individuals and are closely tied to emotional states. Teaching children to notice their "in-the-moment" physiological responses may strengthen their ability to use SR strategies and manage stress more effectively. The same individual may also respond differently to repeated exposures depending on changes in their autonomic state (Porges, 2022). Understanding physiological shifts can help children recognise emotional triggers and apply strategies that promote daily regulation.

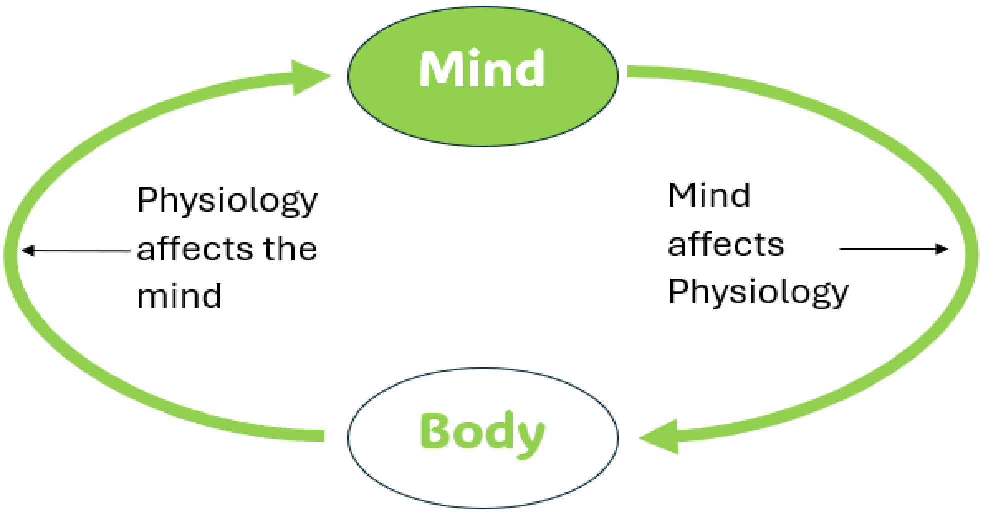
These insights into ANS functioning provide a foundation for exploring MBPs that support SR by actively training the physiological and ER.

3.6 MBPs and SR

MBP enhances the mind's ability to influence bodily functions and symptoms (Grasser & Marusak, 2023; Guendelman et al., 2017; Wahbeh et al., 2008). MBPs are based on the idea that mental states such as thoughts, emotions, and stress can influence physical health and vice versa (Figure 10)

Figure 10

Illustration of the Relationship Between Mind and Body

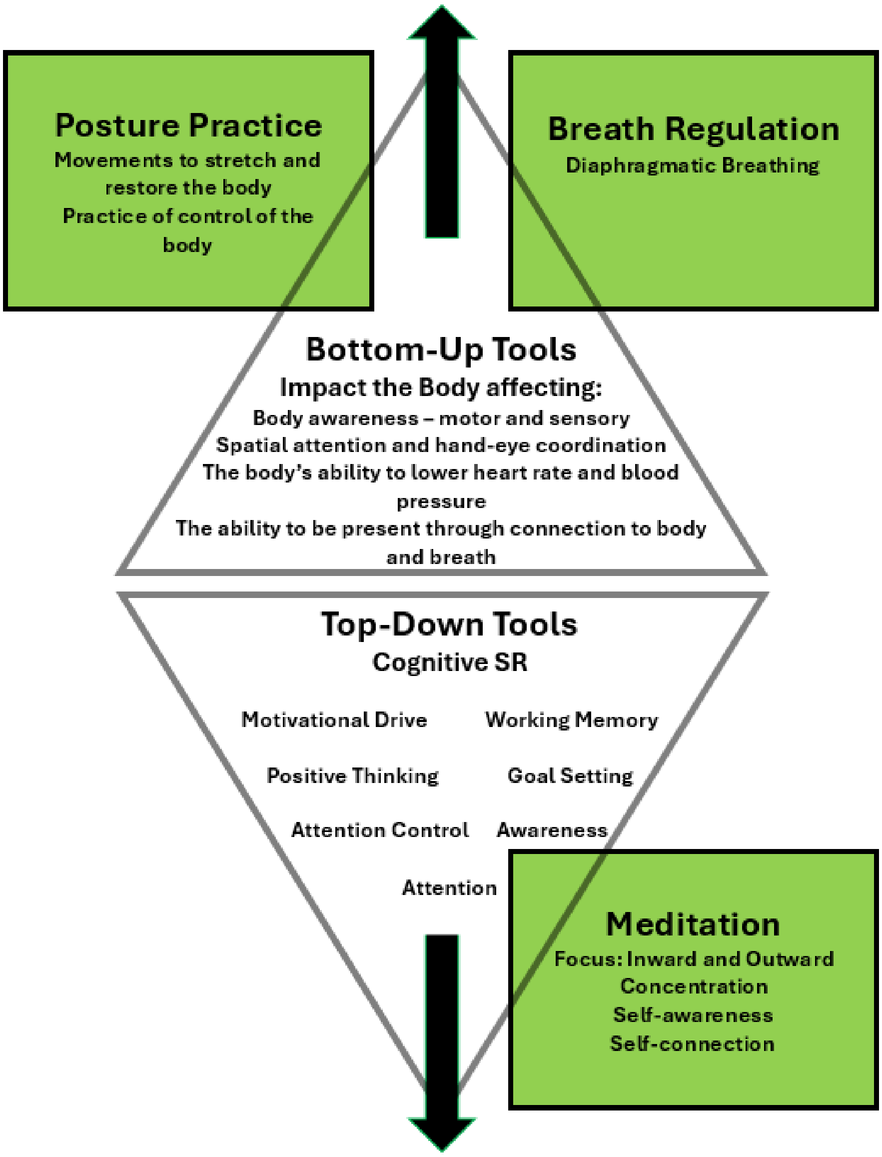


MBPs regulate physiological processes and promote somatic awareness (Farb et al., 2015; Mehling et al., 2011) Figure 11 illustrates how these practices enhance interoception: the ability to sense internal bodily states, which is considered a key factor in resilience. Accurate interoceptive processing supports the rapid restoration of homeostasis following stress (Haase et al., 2016).

The SR process integrates top-down and bottom-up mechanisms, enabling bidirectional communication between the brain and body (Muehsam et al., 2017; Sullivan et al., 2018; Taylor et al., 2010). Top-down regulation involves cognitive control over bodily responses (e.g., deciding to calm down). In contrast, bottom-up processes involve sensory feedback from the body (e.g., recognising tension and responding with rest). Together, these mechanisms enhance awareness of physiological states and the relationship between sensations, emotions, and feelings, while teaching techniques to regulate responses.

Figure 11

Illustration of Mind-Body Practices



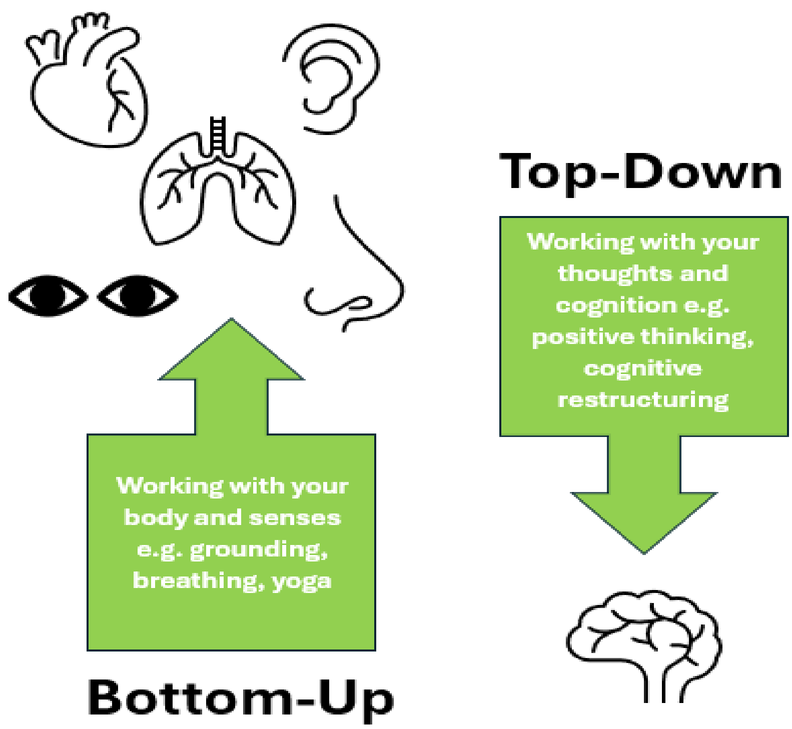
Top-down processes, as shown in Figure 12, originate in higher brain regions, such as the prefrontal cortex, and influence stress systems, including the hypothalamic–pituitary–adrenal (HPA) axis and the SNS.

They regulate the release of cortisol and adrenaline, preparing the body to manage perceived threats and reducing psychological distress. By modulating these systems, top-down control can also affect immune function and inflammation (Muehsam et al., 2017; Taylor et al., 2010).

In contrast, bottom-up processes Figure 12 involve physical practices such as controlled breathing and movement that influence ER and stress responses through physiological triggers. Bottom-up approaches also offer cardiovascular benefits, such as reduced blood pressure and improved circulation, and improve musculoskeletal health, including flexibility, strength, and balance.

Figure 12

Top-down, Bottom-up



MBPs, therefore, support SR by aligning cognitive control with physiological awareness, enabling adaptive responses to stress and promoting overall resilience. The following section explores the specific benefits of MBP in supporting well-being and adaptive functioning.

3.6.1 Benefits of MBP

There is growing evidence in identifying strategies to promote healthy brain ageing and preserve cognitive abilities (World Health Organisation, 2017). MBPs can play a role in maintaining both the brain's structural integrity and functional health (Port et al., 2024).

Neuroimaging studies in young populations indicate that mindfulness meditation is linked to structural and functional changes in neural networks responsible for SR, such as emotional control, attentional focus and self-awareness: the core components outlined in (Nigg, 2017) model of SR (Bauer et al., 2019; Dumontheil, 2023).

Meta-analyses support the effectiveness of MBPs in enhancing both mental and physical health across the general population (American Academy of Pediatrics, 2016; Feruglio et al., 2022; Perrier et al., 2020). Tang et al. (2015) highlight how meditation increases grey matter density in attention, SR and emotional processing regions, such as the anterior cingulate and prefrontal cortex. Similarly, Fox et al. (2014) found that long-term meditators (with an average of approximately eight years) show increased cortical thickness in areas related to interoception and ER. These findings demonstrate that mindfulness and meditation are associated with structural changes linked to SR, including the prefrontal cortex (responsible for EF and attention), the amygdala (ER), and the insula (body awareness).

Li et al. (2022) reported structural changes in the default mode network, critical for self-referential thinking and emotional control, following tai chi practices. Wei et al. (2017) claim that changes occur in networks that help with focus, ER, and decision-making. However, concerns remain regarding publication bias, methodology, and small sample sizes. While the effect sizes for these structural changes are moderate and comparable to those of other behavioural interventions, establishing a direct relationship is challenging. Longitudinal studies with diverse samples and robust control groups are needed to clarify how such neural changes influence cognitive and emotional processes.

MBPs function as lifestyle factors involving habitual behaviours that directly impact physical and mental health by fostering SR and stress management. Shared neurobiological pathways between lifestyle factors and mental health highlight the need for integrated public health approaches that link mind and body. MBPs influence neuroplasticity, stress response, and overall well-being, promoting healthier lifestyle choices (Büssing et al., 2012; Goyal et al., 2014; Tang et al., 2015).

Firth et al. (2020) found that lifestyle interventions, such as exercise, dietary improvements and mindfulness, significantly reduce symptoms of depression, anxiety and stress. Emphasising the importance of nutrition (Jacka, 2017), exercise (Mandolesi et al., 2018), sleep (Vandekerckhove & Wang, 2018) and lifestyle factors such as breath control (Brown & Gerbarg, 2005) in promoting well-being. These findings reinforce the interconnection between bodily experiences and cognitive processes. Therefore, MBPs should be considered within prevention and treatment strategies for both mental and physical health. However, the interaction is more complex, as biases in study selection and interpretation, as well as unaccounted factors such as socioeconomic status, access to healthcare, or pre-existing mental health conditions, may influence both lifestyle choices and mental health outcomes.

Strehli et al. (2021) conducted a systematic review and meta-analysis on the effects of MB physical activity in educational settings across all year groups. Results showed that such interventions significantly reduced HR, cortisol levels, and systolic and diastolic blood pressure, with effects most pronounced in older students. The study suggested that MB physical activity may enhance physiological health, especially in higher education contexts, though higher-quality research remains necessary. Ee et al. (2020) similarly, found that MBPs, such as yoga and mindfulness, show promising though preliminary benefits for reducing depressive and anxiety symptoms and supporting behavioural adherence (calorie restriction, increasing physical activity). These approaches are low-risk and may serve as valuable adjuncts for individuals managing both mental and physical co-morbidities.

Developing knowledge of these lifestyle factors through education can promote holistic health strategies integrating mental and physical well-being. Educating individuals on MBC, alongside socioeconomic and environmental factors, can empower healthier lifestyle choices and improve mental health outcomes (Sharma & Rush, 2014). Together, these findings position MBPs as practical, evidence-informed approaches that support mental and physical health, paving the way for their application as structured interventions, as discussed next.

3.7 MB Practice as an Intervention

A Mind-Body Intervention (MBI) includes a practice that targets the interaction between the brain, psychological state, body and behaviour, aiming to influence physical functioning through mental processes and vice versa (Guendelman et al., 2017). Such practices address the connections between the mind, body, brain and behaviour, but are not typically included in conventional medical treatments (Gellis, 2017).

Standard MB practices include yoga, dance and movement therapy, art therapy, tai chi, deep breathing exercises, and mindfulness-based meditation. Among these, yoga and mindfulness are the most researched and consistently associated with positive mental and physical health outcomes (Muehsam et al., 2017).

Together, these interventions foster SR by enhancing awareness of internal states, supporting ER, and strengthening adaptive responses to stress. The following sections discuss two key MBIs: mindfulness and yoga, and their application in education.

3.7.1 Mindfulness

3.7.1.1 Origins and Principles*.* Although the origins of mindfulness are rooted in Buddhist philosophy, its practice has expanded globally across various cultures and disciplines. One of the earliest examples of a formalised intervention is Mindfulness-based stress reduction (MBSR), developed by (Kabat-Zinn, 2003) to help individuals manage illness, pain and stress.

Mindfulness involves focusing on the present moment with acceptance and non-judgment (Lux et al., 2020). It can be cultivated through techniques such as breathing exercises, movement, art production, and yoga. Research on MBSR shows consistent benefits, including reduced anxiety and depression, improved ER, better sleep, and enhanced quality of life (Chen et al., 2020; Davidson et al., 2003; Goldin & Gross, 2010; Larouche et al., 2015). Mindfulness supports SR by promoting attentional control, emotional awareness, and flexible cognitive responses, key components for adaptive functioning.

3.7.1.2 Child-Adapted Practices in Schools. The public interest and implementation of Mindfulness in schools has grown in recent years (Emerson et al., 2020). Its appeal lies in its perceived potential to improve pupils' emotional well-being, attention, and behaviour (Zenner et al., 2014). Mindfulness techniques for children often include mindful breathing, body scans, guided imagery, mindful colouring, and sensory grounding. These approaches use simple, playful, and interactive language to help children connect with the present moment (Greenberg & Harris, 2012; Lux et al., 2020).

However, while promising, research with children and adolescents remains limited. Studies vary in design, duration, and delivery, making it difficult to draw firm conclusions (Caldwell et al., 2019; Zoogman et al., 2015). Methodological inconsistencies exist in research, and adaptations for school settings vary. The implementation of MBIs in school is progressing faster than evidence base supports, often driven by anecdotal success and external pressures to promote pupil well-being (Greenberg & Harris, 2012).

Developing age-appropriate mindfulness programmes is crucial for supporting SR skills, such as attention regulation and emotional awareness, in classroom settings.

3.7.1.3 Evidence for Impact on SR and Wellbeing*.* Dunning (2019) conducted a meta-analysis of 33 randomised controlled trials (N=3,666). The findings indicated small but positive effects across mindfulness, EF, attention, depression, anxiety/stress, and negative behaviours, with effect sizes ranging from d = 0.16 to 0.30. All studies used active controls, involving relaxation training. Participants in the control groups showed no significant improvements across these outcome measures. Benefits were most consistent for mindfulness (d = 0.42), depression (d = 0.47), and anxiety/stress (d = 0.18).

Phan et al. (2022) evaluated 77 studies (N = 12,358) across five continents using a coding system to rate the quality of evidence from randomised controlled trials (RCTs) with low bias (1++) to expert opinions (4) and assigning letter grades for evidence quality. Standardising evaluation criteria ensured consistent comparisons and clarified the roles of the intervention components. The highest-quality evidence indicated that mindfulness improved prosocial behaviour, resilience, EF, and attention, while reducing anxiety, attention problems/ADHD behaviours, and conduct issues. However, effects on well-being and depression were mixed.

Other meta-analyses report similar findings. Zenner et al. (2014) and Felver (2016) observed improvements in SR, emotional resilience, cognitive performance, and academic achievement. Maynard et al. (2017) also reported small but significant effects on cognitive and socio-economic outcomes, though behavioural and academic gains were less consistent.

Collectively, these studies suggest that mindfulness can support SR development by strengthening attention, ER, and behavioural control: skills essential for effective learning and classroom engagement.

3.7.1.4 Limitations and Implementation Challenges. Despite encouraging evidence, caution is needed in interpreting results. Effect sizes are small, and methodological inconsistencies persist. Many studies lack long-term follow-up, standardised measures, or fidelity in implementation (Emerson et al., 2020).

Maynard et al. (2017) highlighted that the effectiveness of school-based mindfulness interventions depends heavily on teacher training and program fidelity. Insufficient preparation or organisational support can reduce sustainability and impact. Feasibility studies are needed to assess contextual factors influencing delivery and outcomes. Future research should employ rigorous randomised controlled designs with active controls, multi-method assessments, and follow-up evaluations (Phan et al., 2022).

Standardising evaluation criteria will help identify which mindfulness components are most effective and for whom.

While MBIs improve ER and focus, the scale and sustainability of their effects remain underexplored. Practical implementation requires interventions that are accessible, scalable, and aligned with implementation science principles, which emphasise adapting evidence-based practices to real-world contexts for maximum impact (Glasgow et al., 2012).

Mindfulness, therefore, lays a foundation for SR development in educational settings, supporting attention, ER, and resilience: essential skills for learning and adaptation. The next section explores yoga as another extensively studied MB practice with complementary benefits for SR and well-being.

3.7.2 Yoga

3.7.2.1 Origins and Principles. Yoga is an ancient discipline designed to balance and heal the individual's physical, mental, emotional, and spiritual dimensions. Originating in India, it has been practised for centuries and is now widely adopted in Western societies (Sengupta, 2012). Stress is a major contributor to ill health (Khajuria et al., 2023) It is especially prevalent in Western Culture (see section 3.5). Consequently, yoga is often used for stress management and overall well-being.

Systematic reviews demonstrate that yoga reduces stress and exerts measurable biological effects (Khajuria et al., 2023; Zok et al., 2024). Decreased cortisol levels are significant because prolonged cortisol elevation is linked to depression.

Yoga unites *asana* (physical postures) and *pranayama* (breath control) to balance mind and body (Das et al., 2022; Iyengar, 1993). Research indicates improvements in ER, reduced anxiety and enhanced cognitive functioning. Several studies report increased vagal tone following yoga practice (T. Field, 2016) reflecting PNS activation. This activation underpins stress regulation and supports SR by promoting calm, focused states.

***3.7.2.2 Child-Adapted Practices in Schools*.** Yoga has gained attention as an intervention for supporting well-being in education (Khunti et al., 2023; Mind & Life Education Research Network; Davidson, 2012). Benefits observed in adults, such as ER, attention, and stress reduction, may also apply to children and young people (Saxena et al., 2020).

School-based programs adapt yoga's physical and breathing components into age-appropriate sessions integrated into the school day. For example, Ferreira-Vorkapic et al.

(2015) reviewed nine RCTs (with a control group that had either an active control or no intervention) from 1982 to 2014. The study found consistent reductions in anxiety and improvements in mood and self-esteem among children participating in yoga-based programs, although variations in intervention type and duration limited comparability. Similarly, Butzer et al. (2015) conducted a 10-week classroom program involving a weekly 30-minute session led by a yoga instructor. Results showed significantly reduced cortisol and improved behaviour. However, the authors noted the cost implications of specialist instruction. Conversely, Shreve et al. (2021) demonstrated that brief daily practices of around ten minutes, implemented by trained teachers, improved mind-body awareness and ER while decreasing anxiety, highlighting a feasible and scalable model for schools.

3.7.2.3 Evidence for Impact on SR and Well-Being. Yoga contributes to SR by linking physiological and psychological processes. Enhanced vagal tone and PNS activation promote stress recovery and emotional stability, enabling attentional control and adaptive behaviour: core components of SR (Blair & Ku, 2022; Nigg, 2017).

Research demonstrates that yoga improves attentional regulation, cognitive efficiency, and emotional balance (Khalsa & Lapidus, 2016; Serwacki & Cook-Cottone, 2012). Physiological changes, such as stress reduction and improved ER, directly influence children's ability to manage demands.

Yoga interventions may benefit children with attention-deficit/hyperactivity disorder (ADHD) by enhancing attention, working memory, and inhibitory control: core components of EF that support SR and adaptive social engagement. Empirical evidence underscores these effects, highlighting yoga's potential to strengthen EF in children with ADHD (Chimiklis et al., 2018; Polderman et al., 2010).

Overall, evidence supports yoga as a mechanism for enhancing both ER and CR, reinforcing the importance of bodily awareness and controlled breathing in maintaining psychological balance in educational settings.

3.7.2.4 Limitations and Implementation Challenges. Despite promising findings, methodological limitations constrain the evidence base. Many studies rely on small samples, short intervention durations, or lack active control groups, making it challenging to isolate yoga's specific effects. Variability in yoga style, instructor training, and delivery format also affects comparability and reproducibility.

Standardised protocols and rigorous teacher training are essential for fidelity and sustainability, yet practical challenges such as scheduling, teacher readiness, and specialist costs can limit large-scale implementation (Butzer et al., 2015; Khalsa & Butzer, 2016).

Future research should employ longitudinal designs and consistent measurement tools to assess both immediate and sustained effects on SR. Integrating yoga within broader social-emotional learning frameworks may enhance its relevance and feasibility in school systems. Building on yoga and mindfulness, Section 3.7.3 examines breath as a shared mechanism, highlighting its physiological and psychological contributions.

3.7.3 Breath

Breath regulation is central to yoga and mindfulness, supporting SR and emotional balance by activating the PNS, lowering stress, HR, and cortisol (Gerbarg et al., 2019; Jerath et al., 2015). Deep breathing lowers HR and cortisol, supporting ER and SR (Zaccaro et al., 2018). This physiological shift supports a calm state that encourages adaptive behaviour. Chapter 4 examines the role of the breath in SR in greater detail, exploring its physiological and psychological impacts.

3.7.4 Participation in MBP

Participation in yoga and mindfulness has increased globally, reflecting growing recognition of their physical, emotional and social benefits (Clarke et al., 2015; Cramer et al., 2016). However, country-level data vary and are often outdated or limited in describing educational use. In the UK, adult participation remains modest, though recent surveys show a gradual rise (Cartwright & Doronda, 2023; Ding & Stamatakis, 2014).

Practitioners typically report higher well-being, healthier behaviours, and lower stress compared with population norms (Cartwright & Doronda, 2023; Cramer et al., 2016; Penman et al., 2012). Among children, MBPs are increasingly used in clinical and educational contexts to reduce stress and promote ER (Black et al., 2015). These trends suggest growing acceptance of MBPs but underscore the need for rigorous, school-based research examining outcomes and implementation processes.

3.7.5 Other MBPs

Beyond yoga and mindfulness, practices such as Tai Chi and Qigong show potential benefits for balance, emotional well-being, and physical health (T Field, 2016; Wang et al., 2019). Evidence, however, remains limited by small sample sizes, self-report bias, and inconsistent methodologies. These limitations constrain generalisability and comparability across studies, highlighting the need for more robust, standardised research.

3.7.6 Summary of MBPS

SR relies on physiological systems that manage stress and maintain homeostasis (Shonkoff & Garner, 2012). MBPs can strengthen these systems, enhancing emotional and cognitive functioning in children, equipping children with lifelong tools to manage stress (Saxena et al., 2020).

Evidence suggests MBPs improve attention, self-control, and ER, though overall effects remain modest and context specific (Phan et al., 2022; Zenner et al., 2014). Teacher-led delivery supports both educator resilience and programme fidelity (Schonert-Reichl, 2017).

Standardised protocols and comprehensive teacher training are essential for sustaining fidelity and long-term impact (Khalsa & Butzer, 2016). Importantly, children are recognised as experts in their own experiences and prioritising their perspectives is critical for evaluating intervention effectiveness (Lundy, 2007) this study prioritised the child's voice in evaluating effectiveness.

Implementation is central to MBP's success in schools, as program quality directly influences effectiveness and long-term sustainability (Durlak, 2008). The following section examines how evidence translates into practice through the implementation of MBPs in school settings.

3.8 Evidence to Practice: Implementing MBP in Schools

As outlined in sections 2.12 and 2.13, translating evidence-based MBPs and SR interventions into schools remains challenging. Insufficient training, inconsistent delivery, and limited ongoing support constrain effectiveness (Durlak, 2008; Lyon et al., 2019). Contextual fit, limited resources, and staff training and readiness complicate successful implementation (Fixsen, 2005).

These challenges highlight the need for implementation science, which examines and optimises the delivery, fidelity, and sustainability of interventions in educational settings. The following section introduces implementation science and its relevance to this study.

3.8.1 What is Implementation Science and Why is it Important?

Implementation is a dynamic, context-specific process that delivers a program as intended, ensuring fidelity, sustainability and scalability in real-world practice (Durlak, 2015; Fixsen, 2005; Moullin et al., 2020). Fixsen (2005) describes an intervention as a set of activities to implement a known programme.

Implementation Science provides a framework to bridge research and practice by defining measurable elements that evaluate and adapt interventions in education (Fixsen, 2005). This complements section 2.13, which explored how manageable components of SR can be translated into feasible interventions (Jones et al., 2014; Murray et al., 2022).

Among these elements, fidelity is critical to evaluating whether an intervention is delivered as intended and retains its essential components (Durlak, 2008; Fixsen, 2005). Section 4.10.2 outlines how fidelity principles were applied in this study.

Implementation Science extends beyond evidence-based content such as literacy or inclusion programmes. Effectiveness depends not only on what is implemented but also on how, requiring identification of barriers and facilitators to success (Durlak, 2015). Professional development and coaching provide practical strategies for sustaining interventions (Durlak, 2008; Fixsen, 2005). To determine impact, both the intervention and its implementation must be evaluated together (Kelly & Perkins, 2012).

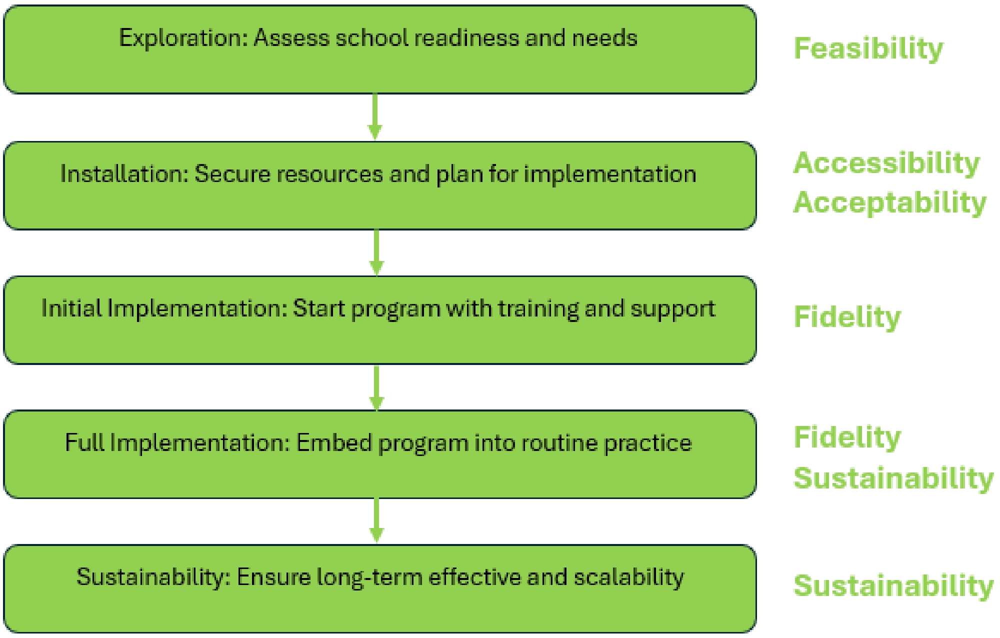
Successful implementation also requires readiness for change. Organisational support, practical training, adequate resources, and stakeholder engagement are essential for maintenance (Moir, 2018). Human-service programmes rely on practitioners' expertise, consistency, and relationships with participants (Fixsen et al., 2009), emphasising the need for ongoing training and support.

The Fixsen and Blase implementation framework (Fixsen et al., 2009) identifies the key components of successful implementation and the integration of processes, systems, and stakeholders, see Figure 13. This framework provides the foundation for the next section, which examines how training and coaching support fidelity and sustainability in school-based MBPs.

Figure 13

Fixsen and Blase Implementation Science Framework with Drivers

3.8.2 Training and Coaching



MBIs improve children's physical and psychological outcomes (Khalsa & Butzer, 2016). However, most teachers lack formal training. The complex nature of MBPs, including postures, movements, breathing, and meditation, complicates implementation. Accessible professional development and coaching are vital to support adoption, fidelity, and quality delivery (Greenberg et al., 2017).

3.8.2.1 Teacher Training and Sustainability. Beyond budget limitations, sustainability and scalability are also concerns (Domitrovich et al., 2015; Fixsen et al., 2009). As highlighted in section 2.12.2, teacher buy-in and integration into existing routines are key to adoption and sustained use. Embedding interventions into daily routines may reduce financial and logistical challenges while promoting long-term impact (Felver, 2016; Flook et al., 2015; Khalsa & Butzer, 2016).

Training alone does not guarantee adherence. Ongoing coaching is key for sustained implementation and has improved fidelity in school-based mental health interventions (Fixsen et al., 2009; Moir, 2018; Smith et al., 2018). However, mixed findings suggest the relationship between fidelity and outcomes is context-dependent (Baffsky et al., 2023). Coaching appears more effective at enhancing adoption than at enhancing fidelity. In this study, the researcher also examined how coaching sessions influence implementation outcomes and intervention effectiveness. The following section explores accessibility and acceptability as key factors for successful implementation.

3.8.3 Accessibility and Acceptability in Implementation

Identifying a core component of the practice is essential for an MBP to be effective in schools. Limited time, resources, and teacher expertise make focused interventions more feasible. Research shows that interventions are more likely to be adopted when they are practical, time-efficient and easy to integrate (Domitrovich et al., 2015; Durlak, 2008).

Teacher buy-in is essential for acceptability (section 12.2). Practices perceived as imposed or low priority are unlikely to be sustained. Similarly, interventions must accommodate children's diverse cultural and developmental needs to be universally accessible (Fixsen et al., 2009).

Breath-focused practices meet the criteria due to simplicity, minimal time requirements, and lack of equipment. Breathing requires no specialised skills or resources, making it accessible and universally applicable (Domitrovich et al., 2015).

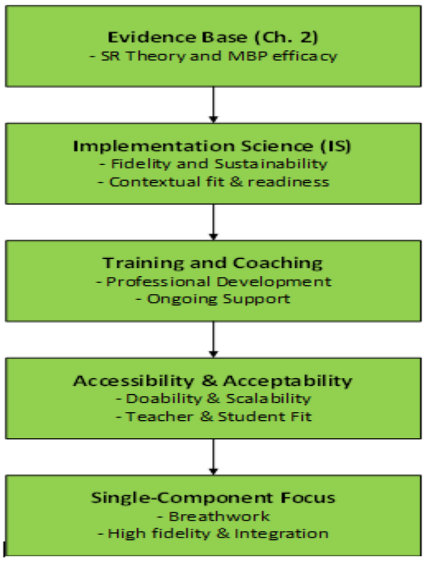
Breathwork offers a practical, scalable intervention. Its adoption, along with the evaluation of teacher and child perceptions, informs the identification of a single MBP component for high-fidelity implementation.

3.9 Identifying a Single Component of MBP for High-Fidelity Implementation

The study focuses on physiological regulation by using breath as a practical means to improve SR (Brown & Gerbarg, 2005; Jerath et al., 2015). Breath regulation supports attention and well-being and connects bodily states with emotional, behavioural, and cognitive outcomes (Blair & Ku, 2022; Fincham et al., 2023). While other MBP components, such as mindful movement, body scans, or guided imagery, could have been emphasised, breath was selected for its direct link to physiological regulation, ease of classroom integration, and capacity to influence attention, emotion, and behaviour. Focusing on a single component of MBP was intended to enhance fidelity and enable integration into classroom routines with minimal disruption. Figure 14 illustrates how implementation science informs the translation of evidence-based MBPs into educational contexts, progressing from theoretical foundations to focused, high-fidelity application.

Figure 14

Translating Evidence to Practice for School-Based MBPs



3.10 Chapter Summary

This chapter examined the role of MBCs in SR, drawing on historical and contemporary theories to explore how the ANS mediates stress responses and SR. Dynamic interactions between top-down (controlled) and bottom-up (automatic) processes suggest that targeting both can enhance SR (Zelazo & Lyons, 2012).

Integrating MBPs, specifically breathwork, offers a simple, scalable approach for education settings. Breathwork is accessible, can align with teachers' routines, and supports ER through its physiological benefits (Brown & Gerbarg, 2005; Fincham et al., 2023; Jerath et al., 2015).

Blair and Raver (2015) emphasise how biological processes and environmental factors shape SR. The SR Model (Murray et al., 2019) highlights the importance of embedding these skills within the school context. Ensuring practices are doable, accessible, and acceptable is crucial for sustained implementation and teacher engagement.

Focusing on breath provides a practical bridge between complex MBPs and classroom realities, helping evaluate how training quality and contextual factors affect fidelity and outcomes. The next chapter builds on this foundation by examining breath as a central mechanism within MBPs and its application, whilst addressing its practical application in an educational setting.

Chapter 4: Breath

Breath emerges as a conductor of the body's rhythms and a catalyst for shifts in mental and emotional states. Positioned between mind and body, it coordinates physiological and psychological processes that shape human experience. From the ancient traditions of yogic pranayama philosophies to modern science, conscious breathing influences attention, ER and autonomic function. It goes beyond simple inhalation and exhalation to operate as an integrative MBP (Brown & Gerbarg, 2005; Zaccaro et al., 2018).

"Take a deep breath" is often the first guidance offered by adults to an upset child as a way to calm physiological arousal before addressing emotional causes or solutions (Obradović et al., 2021). While deep breathing is helpful, evidence suggests that slow exhalation may be more effective in activating the vagus nerve and enhancing parasympathetic tone (Lehrer et al., 2020; Zaccaro et al., 2018). Breathing practices that target autonomic regulation, therefore, hold promise for early intervention, as they promote physiological calm that supports SR.

This study investigates whether breath exercises in classrooms serve as a mechanism to support calm states as rated by the children. Beyond immediate calming, it also considers whether such practices can develop SR tools to help children navigate emotional challenges.

4.1 What is Breath and Why is it Important?

Breathing sustains life and well-being, playing a role in survival and regulatory function (McFall & Jolivette, 2024; Sellakumar, 2015). It operates under both autonomic and voluntary control, maintaining physiological balance and supporting adaptive responses to environmental demands.

The brainstem regulates breathing to sustain metabolic balance and physiological stability (Ikeda et al., 2017). Without it, we would cease to exist. Without this automatic control, survival would be impossible: we can live for days without food or water but only minutes without air.

Airflow in and out of our lungs delivers oxygen throughout the body, removing carbon dioxide and other waste products. Respiration also changes in response to emotions, such as sadness, happiness, anxiety or fear (Homma & Masaoka, 2008). For example, anxiety can trigger rapid breathing, while calm states slow the respiratory rate. Therefore, breathing maintains physiological homeostasis and closely mirrors emotional experience.

This connection between respiration and ER provides grounds for understanding breath as an autonomic function, discussed next.

4.2 Breath as an Autonomic Function

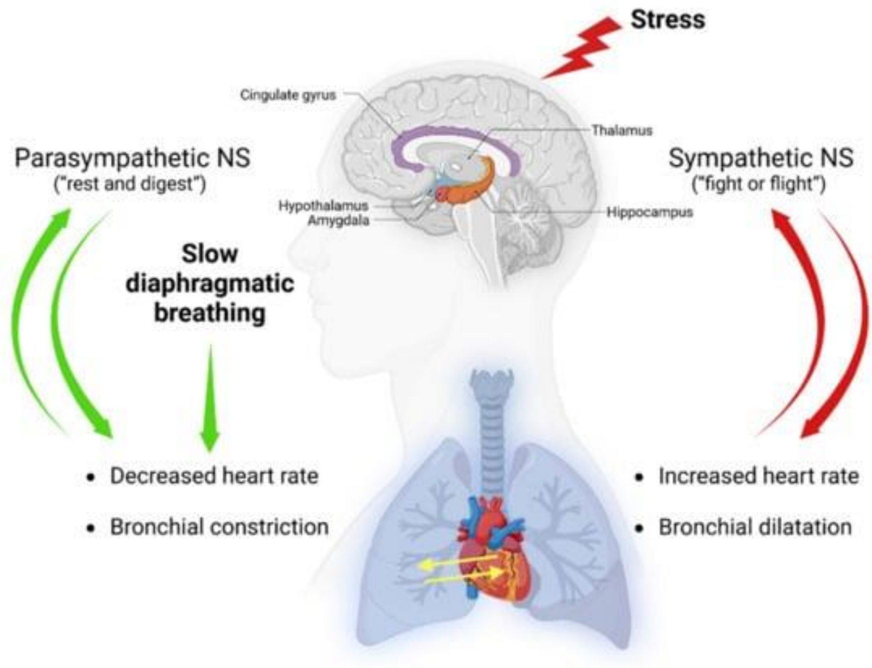
The NS's calming part, the PNS, plays a key role in stress recovery and returning the body to baseline (Figure 15). It facilitates recovery, promotes cellular repair, restores balance, reduces HR, and supports digestion and immune function (Porges, 2011).

The activity of this system can be measured through HRV, the natural variations in time intervals between heartbeats, which reflect autonomic regulation (Strigo & Craig, 2016). Higher HRV indicates a healthy ANS, whereas lower HRV may signal stress. Changing breathing patterns directly alters HRV, reflecting shifts in SNS and PSN balance (see Table 5, which illustrates autonomic feedback loops).

Breathing is unique because it bridges voluntary and autonomic control and is the only autonomic function that can be consciously regulated (Streeter et al., 2012). It also links cognitive and emotional processes, such as attention, memory, and mood through the ANS (Ma et al., 2017; Zaccaro et al., 2018). Slow breathing reduces breathing rate, enhances parasympathetic activity and reduces sympathetic drive, promoting relaxation and improving ER (Strigo & Craig, 2016). In contrast, shallow breathing is associated with stress and poorer regulation (Ma et al., 2017; Zaccaro et al., 2018).

Figure 15

ANS and Breathing



Voluntary control over breathing enables targeted modulation of stress responses through the ANS and interoceptive systems (see Section 2.51). Altering breath patterns can change how the brain perceives and responds to stress, as respiratory signals are prioritised and closely monitored within the body's regulatory hierarchy (McFall & Jolivette, 2024).

Children's ANS is still developing, partly due to immaturity in regulatory mechanisms (Guyer et al., 2008). Consequently, children experience quicker shifts between calm and stressed states, leading to greater fluctuations in HR, breathing and emotional states (Porges, 2007). This heightened sensitivity means some children may need support in regulating these, such as controlled breathing, in managing their emotional and physiological states in the classroom (Flook et al., 2010).

Breath techniques support SR in adults and children by reducing negative affect, lowering stress, and enhancing attention and cognitive focus (Ma et al., 2017). Yogic breathing studies show effects on autonomic functions such as HR, blood pressure, and skin conductance (Saoji et al., 2019). Specific techniques like slow, deep breathing enhance parasympathetic activity ER (Ma et al., 2017). Others, such as alternative nostril breathing, balance sympathetic and parasympathetic systems, reducing stress and supporting cognitive performance (Saoji et al., 2019).

In summary, breathing directly influences autonomic balance and ER, providing a physiological basis for the next section, which explores what occurs when we consciously control our breath.

4.3 What Happens When We Control Our Breath?

4.3.1 HRV and Breathing

The sympathetic and parasympathetic branches of the ANS exert opposing effects on physiological function, see Table 1. During stress, sympathetic activation triggers the "fight-or-flight" response, increasing HR and alertness. Conversely, the PNS responsible for "rest and digest" states reduces HR through vagal activity, promoting calm recovery.

Respiratory sinus arrhythmia (RSA) reflects parasympathetic influence on HR and represents the natural synchronisation of HRV with respiration (Beauchaine & Thayer, 2015). RSA serves as a biomarker to assess the effects of controlled breathing on physiological arousal. The brain prioritises vagus nerve signals on breathing, enabling voluntary control to influence autonomic balance (Brown & Gerbarg, 2017; Jerath et al., 2015).

HRV is widely recognised as a reliable indicator of autonomic flexibility and physiological resilience, reflecting the capacity of the body to adapt to internal and external demands (Laborde et al., 2017). Slow, steady breathing enhances parasympathetic activation and cardiovascular adaptability, thereby supporting ER and overall self-regulatory capacity. Higher HRV has been consistently associated with improved stress responsiveness, cognitive performance, and longevity (An et al., 2019; Laborde et al., 2017). Low HRV, meaning minimal variation in HR during breathing, can negatively affect cognition, emotions, and the body's stress response mechanisms. Goessl et al. (2017) found that HRV biofeedback significantly reduced self-reported stress and anxiety, while low HRV coherence was linked to physical and mental problems (Sack et al., 2004). Together, these findings highlight the role of breathing in regulating HRV and emotional states.

Table 1

The Interplay between the SNS and PNS

Function	Sympathetic Nervous System (SNS)	Parasympathetic Nervous System (PNS)
Primary Role	"Fight or flight" – activates the stress response.	"Rest and digest" – promote relaxation and recovery.
Heart Rate	Increases heart rate and blood pressure	Decreases heart rate and blood pressure.
Breathing	Shallow, rapid breathing (increased respiratory rate).	Slow, deep breathing (slower, relaxed respiratory rate).
Cognitive Focus	Heightened alertness and increased attention.	Calmer, clearer thinking, improved focus.
Stress Response	Prepares the body for immediate action (stress).	Reduces stress and promotes relaxation.
Blood Flow	Diverts blood to muscles and vital organs	Increases blood flow to digestive and restorative systems
Digestive System	Inhibits digestion (slows down digestive processes).	Stimulates digestion and promotes nutrient absorption

Breathing slowly reduces physiological stress as measured by HRV, cortisol and self-report indices (Fincham et al., 2023; Jerath et al., 2015). This shift in ANS balance is attributed to decreased sympathetic and increased parasympathetic activity (Birdee et al., 2023). These mechanisms explain the stress-reducing benefits of breathwork, which enhances vagal tone and counters high sympathetic arousal (Bentley et al., 2023).

Consciously regulated breathing can quickly induce, mobilising energy, while increasing focus and activating the social engagement system (Brown & Gerbarg, 2017). In adults, a slow breathing rate of 5-6 breaths per minute improves HRV within minutes (Szulczewski & Rynkiewicz, 2018). Physiology changes appear rapidly, while cognitive and emotional improvements typically develop with regular practice. A meta-analysis by Steffen et al. (2021) confirmed that slow voluntary breathing over extended periods significantly reduces stress and anxiety. Regular practice also improves attention, ER and social engagement (Goessl et al., 2017; Zeidan et al., 2010). In children, effects may occur more rapidly because of their developing ANS and greater physiological responsiveness. In summary, HRV provides a measurable link between breath control and autonomic regulation. These physiological effects underpin the mechanisms by which breathing practices support SR, forming the basis for the interventions described in Section 4.6.

4.4 What Are Breathing Practices?

"Breath", "breathwork", and "Breath control" are similar but not identical. Breath refers to the physiology of respiration. Breath control refers to the voluntary regulation of breathing patterns in clinical or performance contexts, such as sports or anxiety reduction. Breathwork encompasses intentional practices drawn from traditional and therapeutic disciplines to influence mental, emotional, and physical states (Brown et al., 2013; Jerath et al., 2006).

Although breathing is fundamentally autonomic, it can be consciously controlled. Breath control and breathwork involve altering breathing frequency, depth, inhalation–exhalation ratio, or the location of movement (e.g., chest vs. abdomen) (Fincham et al., 2023). Each parameter produces specific physiological effects: slow breathing (around 5/6 breaths per minute) increases vagal activity and HRV, supporting calm and adaptive stress responses (Gerbarg et al., 2019; Laborde et al., 2017). Diaphragmatic breathing has been shown to reduce cortisol, enhancing relaxation (Chen et al., 2017), while extended exhalation patterns, such as 4:6 inhale-to-exhale, decrease SNS activity (Zaccaro et al., 2018).

Breathing practice has been defined as an integrative MB training for managing stress and psychosomatic conditions (Ma et al., 2017). Intentional breath regulation can both induce calm and mobilise energy, increase attentional capacity, and activate the social engagement system (Brown & Gerbarg, 2017).

Controlling the breath to restore health has been practised for thousands of years in Eastern cultures (Russo et al., 2017). Across traditions, breath-related techniques are often combined with chanting or movement to train arousal regulation and support well-being. Tibetan Buddhism uses controlled breathing and chanting, such as *Om Mani Padme Hum*, to sustain attention and reduce emotional reactivity (Amihai & Kozhevnikov, 2014). Similarly, in psychedelic-assisted therapies, breath regulation is employed to manage affective arousal and deepen introspection (Watts & Luoma, 2020). These approaches align with meditation's cognitive and emotional mechanisms, offering complementary perspectives on breath as a self-regulatory tool (Zaccaro et al., 2018).

Together, these diverse traditions and modern methods emphasise breath as a link between body and mind, providing both physical and mental ways for SR. The following sections look at how MBPs incorporate these principles through systematic breath-based practices.

4.4.1 Yoga and Breathing

All yoga programs combine breath practices (pranayama) with postures (asanas). Introduced to the West in the late 1800s, yoga gained popularity in the mid-1900s as a holistic approach to health and SR (Russo et al., 2017; Tolbaños & Menon, 2021). Pranayama directly influences the ANS, which governs involuntary functions such as HR and digestion (Saoji et al., 2019; Streeter et al., 2012). Table 2 illustrates how pranayama modulates physiological arousal by altering parasympathetic activation and HRV.

Different techniques vary in speed, depth, and breathing route. Slow-paced breathing, alternate nostril breathing (Nadi Shodhana), and extended exhalation practices boost parasympathetic activity and HRV, both markers of ER and autonomic flexibility. (Brown & Gerbarg, 2017; Streeter et al., 2012).

Table 2

Pranayama Techniques and Their Effects on ANS

Technique	Description	Effect on ANS
Nadi Shodhana	Alternate nostril breathing	↑PNS activity ↑HRV
Bhramari	Humming during slow exhalation	↓HR, Vagal Stimulation
Kapala Bhati	Rapid forceful exhales	↑SNS arousal
Sama Vritti	Equal length inhale and exhale	Autonomic balance, calming

Saoji et al. (2019) conducted a review of experimental, clinical, and case studies demonstrating pranayama's influence on neurocognitive, psychophysiological, respiratory, and metabolic systems. Evidence suggests pranayama can regulate autonomic function in both healthy and clinical populations. However, the findings are constrained by small sample sizes, inconsistent protocols, and limited physiological measures. Despite these limitations, cumulative evidence supports pranayama's regulatory potential on the ANS. Larger, well-controlled studies are needed to isolate specific mechanisms, evaluate technique-specific effects, and examine outcomes across diverse populations. In summary, yogic breathing offers a structured approach to cultivating autonomic balance and ER.

4.4.2 Mindfulness and Breathing

Mindfulness programs often incorporate slow-paced breathing to cultivate focused attention and enhance children's SR skills. Mindful breathing typically involves sustained attention on the breath, with adaptations that support developmental and regulatory goals. Anchor breath directs attention to bodily sensations during breathing, fostering interoceptive awareness by helping children connect internal states with physical feelings (Flook et al., 2010). In contrast, belly breathing engages the diaphragm to induce calm. Children inhale through the nose as the belly rises, and exhale slowly as it falls. These techniques support ER by encouraging reflection on bodily and emotional states and are easily integrated into classroom routines. McFall and Jolivette (2024) identify mindful breathing as a low-cost strategy requiring minimal time, often three minutes or less, and no specialist training.

Despite its popularity, evidence remains inconsistent due to variation in intervention length, delivery, and measurement approaches. A review by Obradović et al. (2021) summarised findings from diverse mindfulness programs (Bakosh et al., 2016; Black & Fernando, 2014; Sibinga et al., 2016; Van de Weijer-Bergsma et al., 2014; Zelazo et al., 2018). Although many studies report positive outcomes, methodological issues persist, including small sample sizes, limited follow-up, reliance on self-reports, and the absence of control groups. Implementation fidelity also varies, with inconsistencies in training and adherence. Furthermore, many studies focus on lower socio-economic groups, limiting generalisability. The use of inconsistent assessment tools further constrains comparison across studies.

A recent review by Sop and Hançer (2024), covering 17 studies from 2010 to 2022, found that mindfulness interventions improved empathy, social behaviour, and executive functioning in children aged 3–7 years. However, breathing practices were often embedded within broader programs rather than studied independently, making it difficult to isolate their specific effects.

Further research should determine whether breath-focused components independently drive these outcomes. Including children's perspectives will also help evaluate acceptability and refine program design. These insights underline the value of breath-focused practices within mindfulness approaches and provide a foundation for exploring standalone breathing exercises.

4.4.3 Just Breathing Exercises

In Western culture, controlled breathing techniques have evolved independently of yoga, mindfulness or religious associations. They are now primarily used for therapeutic purposes, particularly relaxation, stress reduction and wellness. Breathing exercises are easily taught to both trainers and practitioners and are adaptable to various settings (Fincham et al., 2023).

Public Health bodies, such as the NHS, already recommend deep breathing for stress, anxiety, and panic symptoms. However, translating Eastern breathing practices to Western contexts raises questions about their sustained effectiveness and cultural relevance.

Cavanagh et al. (2014) reported that low-intensity mindfulness and acceptance-based interventions, including self-help formats, offer small to medium psychological benefits. Yet, participant engagement and long-term outcomes remain inconsistent. Sun (2014) argues that the widespread popularisation of mindfulness has made it more accessible, but often at the cost of simplification and disconnection from its Buddhist roots.

Debates about cultural appropriation and ethical integrity should be taken into account in research. Examining factors that support successful adaptation, such as cultural acceptability, implementation fidelity, delivery format, and long-term outcomes, is crucial for practical implementation in educational environments. Whether Eastern breathing practices can be genuinely integrated into Western contexts while maintaining their effectiveness remains an open question. The following section reviews empirical evidence on controlled breathing techniques, exploring their physiological mechanisms and psychological benefits.

4.4.4 Evidence for Breathing Practices

Breathing practices such as cyclic sighing, box breathing, diaphragmatic breathing, and cyclic hyperventilation have demonstrated improvements in sustained attention, mood, anxiety reduction and various benefits to physiological parameters such as arousal and lower cortisol levels (Balban et al., 2023; Chen et al., 2017; Ma et al., 2017; Russo et al., 2017). These interventions vary in their mechanisms and focus, as summarised in Table 3, which outlines their key characteristics, physiological effects, and associated outcomes.

Table 3

Overview of Breathing Techniques and Their Outcomes

Breathing Technique	Description	Physiological impact	Outcomes	References
Slow Breathing	Focus on slow, deep breaths	↑PNS activity ↑HRV	↓anxiety, HR, cortisol levels and improved ER	(Jerath et al., 2015b; Zaccaro et al., 2018a)
Cyclic Hyperventilation	Controlled rapid breathing for brief periods	↑oxygen availability, ↑HR	↑mental clarity, readiness for physical activity, improves stress resilience	(Fincham et al., 2023a)
Box breathing	Structured pattern e.g. 4 second inhale 4, hold, 4 exhale, 4 hold	↓ANS, stabilizes HR	↑attention ↓anxiety, ↑relaxation	(Ma et al., 2017a)
Cyclic sighing	Focus on exhale	Release tension ↑PNS activity	Promotes relaxation and lowers stress levels	(Balban et al., 2023)
Diaphragm Breathing	Engaging full lung capacity	↑lung capacity stabilises HR	↑relaxation, ER focus ↓arousal	(Marc A Russo et al., 2017)

Slow-paced breathing is often used for relaxation, whereas rapid breathing can also offer benefits by inducing stress responses. Such temporary arousal may enhance resilience and improve physical readiness, especially in sports contexts (Fincham et al., 2023). Among these, slow breathing is the most extensively studied for improving physical and mental health, particularly in alleviating symptoms of SNS dominance (Fincham et al., 2023; Jerath et al., 2015). Relaxed states, induced through slow breathing, are associated with reductions in HR, blood pressure, respiratory rate, muscle tension, and skin conductance, reflecting decreased physiological arousal and enhanced relaxation (Lehrer et al., 2020).

Masaoka and Homma (2004) found faster breathing, correlated with perceived threat and limbic activation, especially in highly anxious individuals. Clinical studies further report benefits for anxiety, depression, trauma, addiction, obsessive-compulsive disorder, and attention deficits (Brown & Gerbarg, 2005; Brown et al., 2013; Dhawan, 2015; Gerbarg et al., 2019).

A meta-analysis by Fincham et al. (2023) reviewed 1,325 studies, 12 of which were RCTs. Breathwork showed small to moderate effects in reducing self-reported stress compared with controls. Similar improvements were observed in anxiety and depressive symptoms. However, methodological variation and short-term designs limit generalisability.

Zaccaro et al. (2018) reported consistent outcomes, showing that slow breathing enhances HRV, increases calmness, and reduces anxiety and arousal, supporting improved autonomic balance. Neurophysiological findings indicated increased alpha brainwave activity (linked to relaxation) and decreased theta activity (associated with drowsiness). Brain imaging revealed activation of regions involved in emotional and bodily regulation, while participants reported greater comfort and relaxation and fewer symptoms of distress.

A scoping review by (Banushi et al., 2023) further supports the clinical utility of breathwork, highlighting its accessibility and ease of implementation. Kim et al. (2015) examined nonspecific therapeutic factors, such as expectancy of improvement and treatment credibility, in two breathing therapies for anxiety and panic attacks. Despite opposing breathing instructions, both groups improved equally. The patient-rated therapeutic alliance was predictive of improvement at one month, while confidence in treatment effectiveness predicted progress at six months. These findings highlight the significance of nonspecific factors in treatment outcomes.

Together, these findings provide empirical support for controlled breathing as a clinically valuable intervention, while also identifying methodological and contextual challenges, which are explored in the next section.

4.4.5 A Summary of Adult Breathwork Promises and Challenges

Breathing interventions influence emotion and cognition through interaction with the ANS, which regulates physiological arousal and affects brain function (Ma et al., 2017).

Breathwork is a promising, low-cost, and scalable intervention; however, methodological issues, including small sample sizes and lack of control groups, limit the validity of clinical studies. A focus on clinical utility may also overlook nuances in technique, dosage, and individual responsiveness.

Although accessible, breathwork's effectiveness depends on consistent practice and contextual integration, factors often neglected due to its apparent simplicity. Adherence may also be constrained by a "belief gap," particularly in populations unfamiliar with MBPs.

In schools, successful implementation relies on teacher engagement, embedding practices, and a classroom culture that supports SR. Integrating breathwork into a busy curriculum requires deliberate planning, and organisational support is crucial for the success of the intervention. As Section 3.8.1 notes, applying Implementation Science principles helps address motivational and contextual factors vital for sustainability. The next section examines how these principles apply to class settings, reviewing evidence and adaptations of breathing interventions in education.

4.4.6 Breathing Interventions with Children

Whether part of yoga or not, breathing exercises are recognised for their positive effects on ER and stress management. Unlike adults, children experience more frequent shifts in arousal and mood, which affect learning and social interactions. Evidence suggests simple breathing practices improve SR, reduce anxiety, and enhance attention (Meiklejohn et al., 2013).

Obradović et al. (2021) studied a brief deep breathing intervention on children's physiological arousal in naturalistic settings. A racially diverse sample of 342 children (mean age 7.48) was randomly allocated to a treatment group, watching an animated video, practising deep breathing, or a control group that viewed an informational video. RSA and HR were measured at baseline and during the one-minute video. Results showed increased RSA and decreased HR in the treatment group, especially during the second half of the video, which included more breath practice. RSA fully mediated HR effects, indicating a measurable physiological shift. Notably, these effects occurred with minimal engagement, demonstrating the potential of brief, accessible videos to reduce physiological arousal in everyday classroom contexts.

While these short-term effects demonstrate feasibility, questions remain about sustainability. Do such physiological changes persist, and do they translate into lasting SR outcomes? Without longitudinal evidence, the long-term significance of these effects remains uncertain (Creswell & Plano Clark, 2017; Goyal et al., 2014). Repeated exposure, however, may strengthen SR and support academic engagement and emotional development (Diamond & Lee, 2011; Zelazo & Lyons, 2012). There were no behavioural indicators, limiting ecological validity. Physiological changes do not confirm improved well-being or learning. The sample was racially diverse, and contextual factors such as socio-economic status, classroom climate, and teacher involvement may influence uptake and outcomes (Blair & Raver, 2015). Despite these limitations, the study's accessible, scalable design shows that conscious breath regulation can lower physiological arousal. These findings underscore the potential and practical challenges of introducing breathwork in childhood settings, leading into the next section on the classroom.

4.5 Breath-based Interventions and Classroom Implementation

Building on findings in section 2.12.2, Pandey et al. (2017) reviewed 49 universal interventions with over 23,000 participants to offer insight into school-based strategies to improve SR. Mindfulness and yoga (which incorporate breathing techniques) have the potential to improve SR, particularly in younger children. However, their complexity hinders uptake because of specialised training requirements, time, and ongoing costs (Rashedi et al., 2020).

In contrast, breath-only interventions may be more feasible, requiring minimal training, no equipment, and little space, facilitating classroom integration. This simplicity aligns with recommendations for reducing complexity in classroom well-being interventions to facilitate effective implementation (Comer & Barlow, 2014).

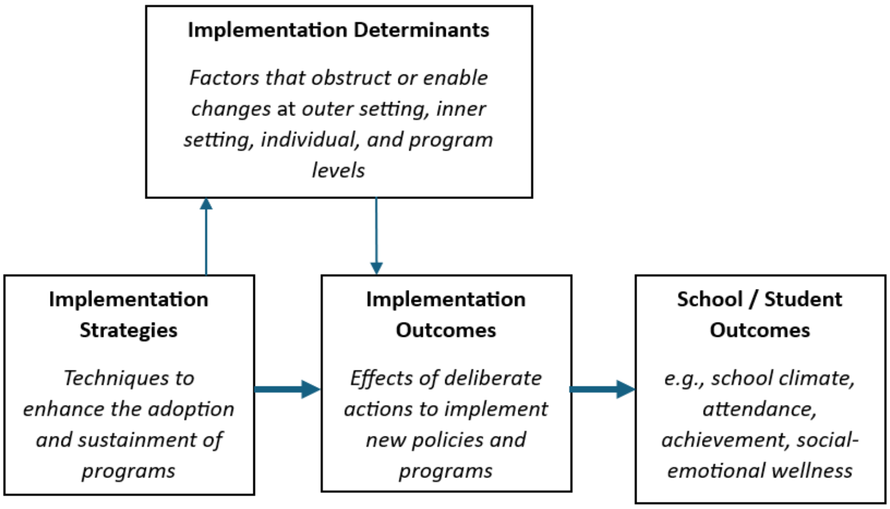
Common implementation barriers include time limitations, insufficient teacher training, and curriculum integration concerns (Weare & Nind, 2011). Nevertheless, short teacher-led sessions can be effectively implemented with minimal disruptions (Felver, 2016), suggesting breath practices are feasible.

To structure this pilot, the EPIS (Exploration, Preparation, Implementation and Sustainment) framework by (Lyon & Bruns, 2019). See Figure 16. EPIS provided an approach to address feasibility, acceptability, determinants, strategies, and outcomes relevant to teachers and pupils.

This study, therefore, focuses solely on breathing interventions to maximise feasibility and teacher-led scalability, enabling routine classroom practice that targets individual SR and broader well-being. The following section examines specific implementation determinants that influence the adoption, fidelity, and sustainability of breath-based interventions in schools.

Figure 16

EPIS (Exploration, Preparation, Implementation, Sustainment)



4.6 Implementation Determinants of Breathing Intervention

Building on the implementation and contextual factors discussed in sections 2.12, 2.12.2 and the implementation science framework outlined in section 3.9), several key determinants influenced the feasibility of a breath intervention.

4.6.1 Time Constraints

Time limitations are a significant barrier identified in section 2.12.2. Shorter practices (e.g. 5-10 minutes) are more feasible and fit within a busy school day (Mendelson et al., 2010). Embedding practices into existing routines enhances participation and sustainability (Weare & Nind, 2011). This reinforces the importance of integrating SR practices into classroom structures, as discussed in section 2.13.1). Similarly, Crescentini (2016) found shorter, targeted interventions (e.g. mindful breathing) received positive feedback from both children and teachers. These findings highlight the need to design time-efficient practices that link to curriculum integration.

4.6.2 Integration into Curriculum

Integrating short breathing sessions into classroom routines enhances implementation. This aligns with section 2.13.1, which emphasises using predictable classroom transitions as anchors for SR practices, and with section 3.9.1, which identifies perceived curriculum fit as a key factor supporting feasibility. Cook-Cottone (2017) similarly emphasises embedding mindfulness and yoga practices within classroom structures to improve feasibility and acceptability. Evidence from school-based programmes of six to eight weeks supports this design, showing that shorter, structured interventions are both manageable and effective (Amundsen et al., 2020; Britton et al., 2014; Crescentini, 2016; Yoo et al., 2016). This determinant is explored further in Section 4.9, which considers adaptation to school contexts. The following section examines teacher training and skills as essential to implementation fidelity.

4.6.3 Skills and Training

As outlined in section 3.9.2, teacher-led interventions require structured training to ensure fidelity, consistency and effectiveness (Domitrovich et al., 2008; Lyon & Koerner, 2016; Meiklejohn et al., 2013). To meet these needs, the training workshops combined a theoretical understanding of SR through an MBC lens with practical breathwork. Follow-up coaching, discussed later in section 4.9.1, supported ongoing reflection, adaptation, and engagement.

4.6.4 Accessibility and Teacher Usability

The perceived ease of use and alignment with existing routines are critical to teacher engagement with the intervention (Cook-Cottone, 2017; Lyon & Bruns, 2019). As noted in sections 2.13.1 and 4.8.1, embedding practices into daily routine enhances feasibility, reduces disruption and supports consistent classroom use. This aligns with Section 3.9.1, where contextual fit and usability were key enablers of sustained intervention delivery.

In this study, teachers' comfort with breathing practices and openness to new approaches were crucial for successful implementation (Domitrovich et al., 2008; Meiklejohn et al., 2013). Attending to staff readiness and incorporating teacher feedback during the design phase aimed to enhance the usability, practicality, and overall feasibility. These factors closely relate to the ongoing coaching and support strategies outlined in Section 4.9.

4.7 Implementation Strategies

Building on the theoretical bases from sections 3.9 and 3.10, specific strategies were employed to enhance the adoption, fidelity, and sustainability of the breathing intervention.

4.7.1 Addressing Training Needs

Supporting teacher confidence is crucial for successful classroom interventions (Domitrovich et al., 2008). Experiential and concise training formats increase engagement and capacity (section 3.9.2). Addressing both the rationale (“why”) and practical application ("how") of mindfulness-based practices, such as breathwork, has been linked to greater teacher confidence and integration in classrooms (Meiklejohn et al., 2013).

This study employed a two-phase methodology (chapter 5): an initial workshop that combined theoretical understanding and experiential learning, followed by coaching to support reflection and integration. Training included MBC perspectives on SR, alongside practical experience of breath-based exercises (see Appendix J). This approach reflects implementation science principles that highlight the importance of ongoing supports beyond initial training (Fixsen et al., 2005; see also section 3.10).

Follow-up coaching, via drop-in sessions and guided reflections, helped embed the intervention in real-time classroom contexts. These supports enabled teachers to adapt strategies to fit their settings, promoting ownership and fidelity (Forman et al., 2013; Lyon & Bruns, 2019). Teachers were also invited to co-design classroom routines that incorporated the breath exercises, thereby enhancing contextual relevance and usability. This participatory approach builds on Section 2.13.2, which identifies teacher motivation and perceived usefulness as central to implementation success.

4.7.2 Adapting to School Contexts

To maximise accessibility and contextual fit, the intervention was simplified to focus solely on breath-based practices, avoiding more complex mindfulness or yoga components (Brown & Gerbarg, 2005; Jerath et al., 2015a; Russo et al., 2017). This focus supported universal accessibility and alignment with school routines.

Consistent with the emphasis on contextual fit discussed in section 2.12.1 and the EPIS framework from section 3.10, the design aimed to ensure the intervention could be embedded naturally into the school day. Exercises were scheduled during transition periods, such as before or after breaks, to normalise practice without disrupting learning (Cook-Cottone, 2017; Mendelson et al., 2010).

Collaborative and participatory approaches, including teacher involvement in co-design, were used to tailor the intervention to classroom contexts and teacher preferences (Fixsen, 2005). Such collaboration enhanced ownership, motivation, and relevance factors identified as essential for sustained implementation and long-term feasibility.

4.8 Implementation Outcomes

Section 3.8.1 highlighted that implementation science is a framework for evaluating the delivery and sustainability of evidence-based practices in real-world settings (Fixsen, 2005; Moullin et al., 2020). Building on this, the current section examines four key implementation outcomes: adoption, fidelity, acceptability, and sustainability to evaluate delivery and identify barriers and facilitators during the pilot. These indicators guide the refinement of interventions and assess their long-term feasibility in educational settings (Fixsen, 2005; Lyon & Bruns, 2019).

4.8.1 Adoption

Adoption refers to the extent to which teachers integrated the breathing intervention into their classrooms. High adoption indicates feasibility, willingness, and perceived value. Interventions co-designed with teachers are more likely to align with their needs, fostering ownership, buy-in, and long-term commitment (Domitrovich et al., 2008; Durlak, 2008; Fixsen, 2005).

This study used a post-training FG to negotiate feasibility and tailor implementation. Psychological factors, including attitudes, perceived likelihood of success, social norms, and self-efficacy, influence adoption (Holmes et al., 2022). A voluntary opt-in approach during recruitment and classroom implementation supported meaningful engagement (Beauchemin et al., 2008).

4.8.2 Fidelity

Fidelity, a core implementation outcome in section 3.10, assesses whether essential components were maintained throughout delivery (Fixsen, 2005; Moullin et al., 2020).

Fidelity was monitored through teachers' logs, informal observations, coaching sessions and FGs. These mechanisms captured day-to-day engagement and provided feedback to refine intervention delivery. Structured tools and feedback loops supported ongoing adaptation and quality maintenance (Durlak, 2008; Zenner et al., 2014).

4.8.3 Acceptability

Acceptability refers to how well participants receive an intervention. Feedback mechanisms, including surveys, interviews and FGs, are used to assess perceptions and refine program delivery (Fixsen, 2005). Teacher perceptions, shaped by contextual fit and perceived usefulness (section 2.13.2), were assessed through these mechanisms. Children's perspectives were also captured through focus groups to understand how they experienced practices. Including both teacher and child feedback supported iterative refinement of content, delivery, and future implementation.

4.8.4 Sustainability

Sustainability is the extent to which the intervention can continue without external support or resources. It is typically evaluated through follow-up measures to examine its integration into school routines (Fixsen, 2005). Due to time constraints, this pilot did not assess sustainability, though anecdotal feedback from post-intervention FGs provided some insight. Future research should include longer-term follow-up to examine sustained use and integration into schools, ideally supported by the EP as part of wider implementation support.

4.9 Teacher and Children Outcomes

This study evaluated the breath exercises by gathering perspectives from both teachers and children, exploring whether the benefits, such as physiological arousal and improved mood (Balban et al., 2023), translated into enhanced SR and calmness for children in a classroom. The methodology (see Chapters 5 and 6) incorporated feedback loops for iterative refinement, to enhance engagement and inform future implementation.

Guided by the Lundy model (Lundy, 2007) and Unicef (1989) principles of children's participation, this study actively incorporated children's perspectives. Teachers received practical strategies to facilitate breath exercises, such as "hands on the belly" and counting during inhalation/exhalation (Appendix K), supporting interoceptive awareness. Coaching sessions enabled reflection on implementation and children's responses. Researcher-facilitated post-intervention FGs captured children's feedback, highlighting perceived changes in calmness and SR to inform future refinement.

Teacher engagement, skill development, confidence, and readiness were assessed through pre- and post-training questionnaires. Post-workshop FGs supported reflection and planning for classroom integration, enhancing acceptability and long-term engagement (Cook-Cottone, 2017). Ongoing coaching reinforced real-time implementation and strengthened teacher confidence, key mechanisms underpinning successful intervention delivery (Domitrovich et al., 2008; Fixsen, 2005).

4.10 Chapter Summary

The chapter builds on the theoretical foundations of SR and MBC, describing SR as an integrative process involving physiological, emotional, behavioural, and cognitive components. Breathwork was identified as a targeted, evidence-informed SR tool operating at a physiological level.

The intervention streamlined breath exercises to efficiently regulate physiological arousal within school constraints, including limited time and resources (Rashedi et al., 2020). Breath awareness intended to promote calmness without explicitly teaching mindfulness, making it free, easy to teach, and accessible (Khng, 2017). Children were guided to observe natural inhalation and exhalation rhythms, supporting ER and a sense of calm.

The chapter demonstrates how breath exercises can be applied practically in real-world classrooms while maintaining theoretical grounding. The next chapter presents the methodology, detailing study design, data collection, and evaluation procedures to assess implementation fidelity and meaningful outcomes for teachers and children.

Implementation science principles framed the pilot study, highlighting relationships between determinants, strategies, and outcomes (Fixsen, 2005; Lyon & Bruns, 2019). The study considered teacher and child perspectives to examine feasibility, accessibility, fidelity, and preliminary effectiveness. Using structured feedback loops, the intervention was iteratively refined to enhance engagement and classroom integration.

The chapter demonstrates how breath exercises can be applied practically in real-world classrooms while maintaining theoretical grounding. The findings and insights from this chapter directly inform the study's methodology, which is presented in chapter 5**.** Specifically, they shaped the study design, participant recruitment, data collection methods, and evaluation procedures to assess implementation fidelity, teacher engagement, and meaningful outcomes for children.

4.11 From Theory to Practice: The Breath-Based Intervention

The physiological mechanisms described in this chapter guided a breath-based intervention designed to be simple, accessible, and suitable for primary-aged children. Instead of replicating structured adult breathwork protocols, the intervention adapted these principles into a natural, embodied classroom practice.

The intervention focused on gently slowing and stabilising the breath to support autonomic regulation. Unlike structured adult breathwork protocols such as coherence (Brown & Gerbarg, 2005), the approach avoided ratioed breathing, patterned sequencing, or pranayama techniques. Instead, it emphasised natural, accessible breath settling, encouraging children to notice their breathing, soften and slow it slightly, and maintain a steady rhythm. This aligns with core principles of autonomic regulation, whereby modest reductions in breathing rate, without technical instruction, can support parasympathetic activation and physiological calming suitable for children.

Teachers guided pupils through brief exercises (about 3–5 minutes), encouraging a relaxed posture, breath awareness, and a gentle slowing of the exhale without using formal breath counts. The goal was to offer an embodied entry point into SR that was inclusive, universally accessible, and not mentally taxing. This highlights the importance of simplicity, feasibility, and minimal training in school environments, supported by evidence that slower, steadier breathing can influence autonomic balance and support emotional settling and well-being.

Where full delivery was not possible, a minimum of once daily was considered sufficient to maintain intervention integrity, provided the core elements of teacher modelling, breath awareness, and a settled environment were preserved. As this was a feasibility study, the intervention was intentionally designed to allow limited adaptation to the classroom context while preserving a small number of core components considered essential for fidelity.

Minimum fidelity criteria:

• Dedicated, uninterrupted practice time

• A quiet, settled environment

• Teacher modelling of slow, steady breathing

• Delivery at least three times daily at predictable transition points or, where timetabling constraints apply, a minimum of once daily

Acceptable adaptations:

• A visual prompt or anchor card (e.g., a simple breathing visual on the board)

• A verbal cue or consistent phrase to signal the start of practice

• Children placing hands on their bellies to anchor breath awareness

• Eyes open or softly down for children uncomfortable closing their eyes

• A brief body check-in beforehand (e.g., "notice how you're sitting")

• Shortened duration (1–2 minutes) when time is limited.

Suggested teacher script (P4–7):

OK, class, let's take a moment. Sit comfortably with your feet flat and your hands in your lap, or place one hand gently on your tummy if you prefer. Close your eyes if you'd like to, or just look down quietly. If it helps, glance at the breathing guide on the board. Now, breathe in slowly through the nose (if possible). and breathe out gently. Let's do that again: in slowly... and out slowly. Notice if you can feel your tummy rise as you breathe in and fall as you breathe out.

This script reflects the intervention's core principles: calm posture, breath awareness, and a gentle extended exhale. Teachers were encouraged to use natural language and adapt phrasing to suit their class, provided the physiological intent: slowing and steadying the breath was maintained. Delivery was expected to take no longer than 3–5 minutes and required no materials or preparation.

Chapter 5: Methodology

5.1 Introduction

This chapter outlines the methodological framework and rationale for the pilot study exploring the effectiveness and implementation of a breathwork intervention in primary classrooms. Informed by implementation science, a sequential mixed-methods design was selected to capture both quantifiable outcomes and participants' experiences (Damschroder, 2009; Fixsen, 2005). This approach enabled exploration of what worked, how, and under what conditions breath exercises could be effectively integrated into classroom routines. The design aligns with best practices in implementation research, where mixed methods illuminate both outcomes and underlying processes (Palinkas et al., 2011).

A pilot study was chosen to assess early-stage feasibility, contextual fit, and acceptability, dimensions often overlooked when MBPs are introduced as discrete, decontextualised programs. Such interventions frequently fail to align with classroom routines, teacher beliefs, and school culture, which limits long-term sustainability (Bowen et al., 2009; Roeser et al., 2012; Waters et al., 2015). The design consists of two interdependent phases:

- Phase one focused on teacher training and exploring the acceptability, feasibility, and readiness for implementation. Quantitative measures assessed changes in teachers' knowledge and confidence. A post-training FG enabled co-evaluation of content and delivery, informed the classroom intervention design, and provided deeper insight into feasibility. This co-design approach addressed the common disconnect between intervention design and real-world school settings (Forman et al., 2013; Lyon et al., 2018). Teachers voluntarily opted into the training and subsequent phase two implementation.
- Phase two piloted the classroom intervention, examining both effectiveness and implementation. Effectiveness was explored through indicators of SR, including perceived calmness. Implementation was examined through ongoing coaching and end-of-intervention FGs with teachers and children. Discussions identified key components, areas for adaptation, and how fidelity, feasibility, and contextual fit influenced delivery. They also highlighted interpersonal factors such as engagement and individual practice that shaped implementation.

The sequential design allowed insights from phase one, such as expected barriers, teacher priorities, and fidelity concerns, to guide the direct implementation of Phase two, thereby strengthening ecological validity and implementation readiness (Domitrovich et al., 2008; Proctor et al., 2011). This pilot addressed a methodological gap in school-based MBPs, which are frequently delivered as isolated add-ons that overlook adherence, integration, and teacher alignment, factors that limit sustainability (Dariotis et al., 2017; Fixsen, 2005; Mendelson et al., 2013).

Breathwork was chosen as a scalable, flexible practice to support the MBC through bottom-up physiological regulation. By focusing on interoceptive awareness, the exercises aimed to improve down-regulation of arousal as a foundation for SR. To assess implementation fidelity and experiential relevance, children's self-reports of perceived calmness and engagement were collected.

The study contributes to implementation science by challenging the assumption that the success of school-based interventions depends solely on the integrity of the core components. Evidence indicates that contextual adaptability, ecological fit and implementation support are equally vital for sustained use (Aarons et al., 2012; Domitrovich et al., 2008; Durlak, 2008). Implementation was understood as a complex, staged process (Fixsen, 2005). The pilot examined both structural elements (training, scheduling, buy-in) and experiential aspects (children's subjective responses) to explore how teacher engagement and readiness influenced effective, sustainable delivery.

Ethical protocols guided all aspects of the study, including informed consent, voluntary participation, and anonymity. Reflexivity and design transparency were maintained throughout both phases, with the researcher providing responsive support to participating teachers.

5.2 Research Paradigm

The study is grounded in Critical Realism, a philosophical framework that distinguishes between observable events and the deeper mechanisms shaping them (Bhaskar, 2013). Within this study, teacher behaviours (e.g., engagement with breathwork, classroom management) and classroom dynamics (e.g., children's engagement, classroom atmosphere) are understood as being influenced by underlying systemic and motivational mechanisms, such as school culture, teachers' beliefs and commitment. For example, while teachers' fidelity in implementing breath exercises can be measured quantitatively, their uptake and consistency may depend on less visible factors, including perceived value, belief in efficacy, and prioritisation within classroom routines. These generative mechanisms operate within broader structures, such as organisational support and professional autonomy (Bhaskar, 2013; Fletcher, 2017).

Critical Realism is well-suited to exploring school-based interventions, recognising that outcomes emerge from interactions between individual agency and structural conditions, rather than from isolated variables (Danermark, 2002). Unlike positivism, which seeks universal laws and isolates variables, this paradigm identifies patterns within specific contexts, reflecting variation in teachers' beliefs, motivation, and school culture.

Epistemologically, Critical Realism supports a mixed-methods approach. It accepts a reality independent of perception yet recognises that understanding is socially and contextually constructed. Examining tendencies across contexts enables inferences about causal mechanisms (Danermark, 2002). This study integrates quantitative data (on fidelity and calmness outcomes) with qualitative insights (from teachers' and children's experiences) to explain how and why the intervention works.

Critical Realism's layered ontology distinguishes the empirical (observed), the actual (what occurs), and the real (underlying mechanisms), allowing a comprehensive exploration (Bhaskar, 2013). However, applying these layers poses challenges (Fletcher, 2017). Each research question aligns with a layer to ensure clarity and coherence. For example, the empirical layer focuses on effectiveness (e.g., children's calmness), while the real layer explores teacher factors such as confidence and beliefs. This framework enables assessment of the feasibility of breathwork and the factors that support its integration.

5.3 Overview of Design

5.3.1 Pilot Study

This study used a pilot design to assess the feasibility, acceptability, and effectiveness of a classroom-based breathwork intervention to support SR. Pilot studies help identify implementation issues and refine both the intervention and study procedures before larger-scale research (Thabane et al., 2010). Given that teachers' beliefs, curriculum demands and readiness vary considerably, an exploratory pilot stage was essential.

The pilot evaluated logistical feasibility (such as scheduling), acceptability (like perceptions of teachers and children), and implementation factors (including teacher engagement, routines, and fidelity) (Durlak, 2008; Moore et al., 2015). Teachers play a central role in modelling and delivering the intervention, so steps were taken to support their investment.

The study examined both process and effectiveness. Intervention outcomes depend not only on the intervention itself but also on contextual factors such as teacher readiness and classroom conditions (Blase, 2012; Durlak, 2008; Fixsen, 2005). A mixed-methods design was therefore adopted to explore what worked, how, and why in context, consistent with a Critical Realist perspective (Fletcher, 2017). The pilot aimed to evaluate the effectiveness of breath exercises on children's SR, assess their suitability and fit within daily routines and identify barriers to broader adoption.

5.3.2 Rationale for Design

Pilot studies evaluate both intervention feasibility and research procedures (Van Teijlingen & Hundley, 2002). This study used a two-phase design. Phase one (Preparation) explored teacher training, acceptability, feasibility, and readiness. Phase two (Implementation) examined classroom use, outcomes and delivery context.

This sequential structure reflects the interdependence of efficacy and implementation (Durlak, 2008; Fixsen, 2005). It also supports iterative refinement and captures variability in teacher engagement and contextual influences. Findings from phase one directly informed phase two, consistent with Creswell (2015) sequential exploratory approach and contemporary guidance on developing and evaluating complex interventions (Skivington et al., 2021).

A concurrent design (e.g., RCT) may offer stronger internal validity but is less suited to capturing the contextual dynamics central to early-stage implementation research (Bonell et al., 2012; Marchal et al., 2013). A realist-informed, context-sensitive design was therefore selected to prioritise feasibility and ecological validity.

Teacher participation was voluntary, reflecting ethical guidance (Appendix B-F) and acknowledging potential selection bias. This variability aligns with realist expectations that interventions interact with context in different ways (Pawson, 2013). Teacher feedback guided iterative refinement, addressing challenges such as workload and confidence (Domitrovich et al., 2008; Miller, 2019).

5.3.3.1 Phase One. Focused on enhancing teachers' understanding of breath exercises, including SR, MBC, and the physiological functions of breathing. Teacher confidence and readiness to deliver the intervention were evaluated to identify knowledge or skill gaps that might affect intervention fidelity or outcomes. An FG post-workshop examined classroom feasibility and collaboratively developed a plan to integrate the exercises into the school day. Contextual barriers, such as workload or timing constraints, were recognised and addressed. Preliminary data on initial teacher responses were also collected, supporting refinement before wider implementation. Participation in phase two was voluntary and depended on readiness and contextual appropriateness, ensuring that teachers progressing to phase two were prepared and willing, thereby minimising risks to fidelity while upholding ethical standards.

5.3.3.2 Phase Two. Phase two evaluated the intervention in practice, as teachers integrated breath exercises into their daily routines. Implementation support was targeted at teachers who reported lower confidence during phase one. This phase measured outcomes and processes: children's self-reported emotional states were collected at three time points, while teachers recorded implementation details (frequency and timing) and made informal classroom observations. This approach assessed effectiveness and examined real-world functioning, adaptations, support needs, and contextual barriers encountered. Data from phase two informed future adaptations and potential scalability. The two-phase structure addressed preparation (training, adaptation, feasibility) and real-world implementation (delivery, fidelity, context responsiveness), clarifying how the intervention interacts with classroom environments and demonstrating the influence of teacher experiences on feasibility and acceptability.

5.4 Alignment with Implementation Science

The design is grounded in the principles of implementation science, which highlight what works and how interventions are carried out within real-world systems. Implementation involves putting an intervention into practice in ways that remain true to its design while responding to local contexts (Fixsen, 2005). Implementation is central to translating evidence-based interventions into sustained change in educational settings**.** As Cook and Odom (2013) emphasised, "Implementation is the critical link between research and practice. In the absence of implementation, even the most effective intervention will not yield desired outcomes" (p.138).

While effectiveness remains central, successful implementation also depends on delivery. Common barriers include limited organisational support, insufficient training, inadequate planning and funding (Collier-Meek et al., 2016; Forman et al., 2009; Langley et al., 2010; Powell et al., 2017). In this study, anticipated barriers included variability in teacher confidence, time constraints, competing classroom priorities and differing perceptions of the exercise's value. Since the breath exercises were based on SR and embodied awareness, they may conflict with some teachers' beliefs. Teachers' prior experiences, motivation, and openness to MBC strategies were recognised as key factors influencing engagement and fidelity (Domitrovich et al., 2008).

To mitigate these issues, the study incorporated a voluntary sign-up process, structured training, and co-designed implementation planning. These strategies simplified delivery, fostered teacher ownership, and supported contextual alignment.

Frameworks such as those by Fixsen (2005) outline key components for successful implementation: effective practices, enabling contexts, and stakeholder readiness**.** The intervention aligned with these principles, prioritising feasibility and sustainability in real-world classrooms. Teacher co-design to ensure contextual fit and integration within typical classroom routines. Ongoing training and support were provided, with progress monitored to identify and respond to challenges, ensuring the design remained feasible, iteratively refined and contextually supported (Domitrovich et al., 2008; Fixsen et al., 2016).

The study drew upon the integrated theory of change (Hernandez & Hodges, 2003) Clarifying both the intervention's functional components and stakeholders' actions. Equal emphasis was placed on evaluating both effectiveness and implementation processes. The two-phase approach enabled examination of how intervention components (e.g., training knowledge, delivery timing) interacted with contextual variables such as teacher capacity, beliefs, and classroom culture. As (Lyon et al., 2019) note the characteristics of interventions remain unexplored; this study, therefore, examined how implementation conditions activate mechanisms that drive intervention success.

Implementation science recognises that outcomes like fidelity are intrinsically linked to the intervention itself. Consistent delivery of evidence-based interventions increases the likelihood of intended outcomes (Collier-Meek et al., 2019; Fixsen, 2005). Accordingly, this study examined implementation fidelity: the extent to which the breathing exercises were delivered as intended.

To support high-fidelity implementation, a clear plan outlining the timing and frequency of delivery was co-designed with teaching staff during the FG in phase one. This collaborative process ensured contextual acceptability and addressed key fidelity dimensions: adherence, dosage and quality of delivery (Carroll et al., 2007). Engaging teachers in phase one, to define the content and structure of delivery aligned with principles from both process models and determinant frameworks in implementation science (Damschroder, 2009).

In phase two, fidelity was monitored through checklists that tracked adherence to the agreed-upon delivery plan. These low-burden tools provided real-time assessment, complemented by a phase two FG to reflect on implementation, identify challenges and gather feedback.

As a pilot study, understanding implementation processes across settings was key for evaluating fidelity and informing context-sensitive adaptations for wider rollout. The participatory approach aimed to support consistent delivery and long-term feasibility. Evaluation considered alignment with intended design and how teacher engagement, interpersonal dynamics and contextual mechanisms influenced outcomes.

5.4.1 Implementation Stages and Corresponding Data

The implementation process followed three sequential stages derived from the Active Implementation Framework (Fixsen, 2005) as shown in Figure 17. This design linked each stage to specific data collection for teachers and children, offering insight into feasibility, acceptability, and initial effectiveness to guide adaptations.

While Fixsen's framework provides structure, it underrepresents contextual, motivational, and sociocultural dynamics (Greenhalgh et al., 2004). To address this, the study incorporated co-design and teacher agency, positioning implementation as a context-sensitive and mechanism-driven. A Critical Realist perspective, guided understanding, suggesting implementation depends on activating latent mechanisms under specific conditions.

5.4.1.1 Exploration Phase. Secondary data indicated increased demand for support on SR, and interest in mindfulness and yoga in schools. The offer was extended to a large group of schools to gauge interest in the intervention, providing a preliminary measure of readiness and contextual fit**.** Teachers who engaged readily indicated potential enablers, such as staff openness and school interest. These informal indicators informed early implementation decisions.

5.4.1.2 Installation Phase One. Teacher training workshops were the core installation activity. These workshops incorporated SR theory, MBC integration, and breathwork alongside implementation support through structured practice, practical modelling, and reflection. Pre- and post-questionnaires assessed the workshop's effectiveness and preparedness. A co-design FG offered qualitative insights into teachers' views on feasibility, readiness, and contextual relevance, recognised as key factors for sustainable implementation (Penuel et al., 2017). Collaborative discussion, refined delivery elements such as the timing, frequency, and integration within the school day, ensuring that implementation was co-constructed. Kolb (1984) Experiential learning theory underpinned the workshop structure. Teachers participated in concrete experiences (e.g., breathwork), reflective observation, integrated learning, and planned implementation. This cycle fostered cognitive, affective, and behavioural engagement while promoting generative mechanisms such as ownership, trust, and contextual fit, all of which are key to understanding intervention success in school contexts.

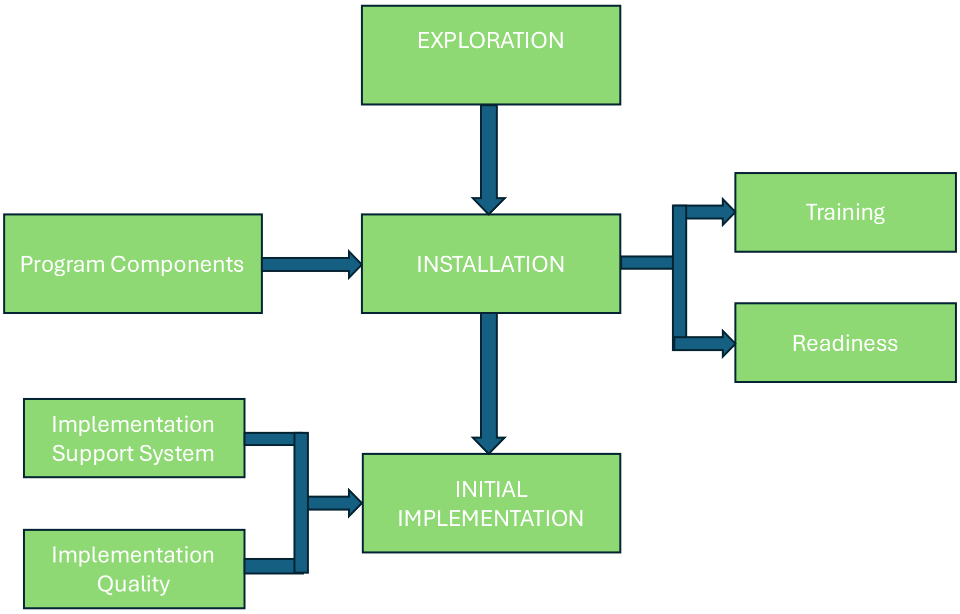
5.4.1.3 Initial Implementation: Phase Two Real-World Testing. Following the training, teachers voluntarily implemented the pilot in their classrooms. Individuals approached the practices differently: some were promotion-focused, seeking growth and development, while others were prevention-focused, attending to risk and responsibility (Higgins & Spiegel, 2004). The experiential format enabled meaningful engagement, contextual testing, and evaluation of personal and pedagogical relevance.

Coaching and drop-in supports were provided. Teachers recorded delivery frequency, observations, and reflections in diaries. Children documented emotional states at three pre-determined points. These data facilitated both formative and summative evaluation of feasibility, acceptability, and preliminary impact.

Insights from phase one on teacher confidence and preparedness informed planning for phase two. The sequential design enabled iterative refinement, responsiveness to local conditions and improved feasibility (Tashakkori & Teddlie, 2010).

Figure 17

Active Implementation Framework



The staged design structured the intervention and supported inductive understanding (Fixsen, 2005). By embedding co-design and decision points, motivation and contextual alignment were key variables. Motivation is particularly critical when interventions require personal and affective engagement (Alberts et al., 2024).

This study evaluated "what works" and "what matters" to teachers, in what context, and why. Using a Critical Realist lens, mechanisms (e.g., teacher autonomy, perceived relevance, experiential engagement) were activated under specific conditions, explaining uptake and sustainability (Domitrovich et al., 2008; Pawson, 2013). Co-design and FG feedback were essential to uncover and sustain these mechanisms. This approach enabled a move beyond procedural compliance toward understanding *how* and *why* the intervention functions in practice within complex educational environments.

The staged implementation strategy enabled iterative development, responsiveness to feedback, and contextual fit. By tracing interactions between fidelity, ownership, and relevance, the study explored conditions necessary for meaningful, sustainable implementation (Carroll et al., 2007; Fixsen, 2005).

5.5 Mixed Methodology

5.5.1 Overarching Methodology

The study employed a convergent parallel mixed-methods design, collecting quantitative and qualitative data with equal priority (Creswell & Plano Clark, 2017). This approach systematically integrated both forms of data at the collection and interpretation stages, ensuring methodological rigour through complementary procedures and analytical techniques (Johnson et al., 2007). Adopting a convergent parallel design allowed both phases of the research to follow the same overarching methodological principles while addressing distinct objectives: Phase one examined teacher-related factors such as knowledge, confidence, and readiness, whereas phase two focused on classroom implementation, fidelity, and pupil outcomes.

The design was suited to a pilot study in which the methodology was tested. Quantitative and qualitative data were analysed separately, then compared and merged to produce an integrated interpretation of the findings. By combining both data types, the pilot study identified potential methodological limitations while leveraging the strengths of each approach. This iterative process supported the systematic integration of complementary data strands across both phases, providing a robust foundation for evaluating outcomes and implementation processes prior to full-scale delivery.

Mixed-methods research mitigates the limitations of single-method designs by uniting measurable outcomes with contextual and experiential insights. This study followed established mixed-methods principles (Creswell & Plano Clark, 2017), including the purposeful integration of quantitative and qualitative approaches and a clear rationale for combining them to generate insights beyond those possible with a single method.

Integration was central to the study, recognising that an MBP might not be suitable for all individuals uniformly. By collecting and analysing both quantitative and qualitative data separately and then merging the results, the study achieved an integrated interpretation that reflected both implementation patterns and context-specific nuances. This approach provided a solid foundation for assessing both outcomes and implementation processes before large-scale deployment.

In the pilot phase, the convergent parallel design also supported the identification of potential methodological limitations while ensuring that each phase addressed its specific objectives: teacher-focused evaluation in phase one and classroom-focused evaluation in phase two.

The study is divided into two phases, each detailing specific methods to enable a thorough exploration of the research objectives. This promotes methodological transparency and supports in-depth exploration of implementation processes and outcome measures across phases. The questions are designed to capture the empirical effects of breathing exercises in the classroom and to explore the underlying mechanisms that influence teacher adoption and classroom integration. Each phase applies a mixed-methods approach while maintaining coherence with the overarching framework.

1. Does teacher training on breathing exercises influence the fidelity, acceptability, and feasibility of their implementation in the classroom?

This question explores how capacity-building, especially training, influences classroom practice. It highlights a challenge: knowledge and intent alone do not ensure lasting change. From an EP view, it examines the trainer's role and how training leads to meaningful, lasting change. Instead of assuming that knowledge transfer ensures implementation, it explores relational, contextual, and systemic processes that embed practices. Data include teacher reflections, feedback, implementation tracking, and observations, analysing how practices are adopted and adapted over time.

2. To what extent do breathing exercises support children's SR by promoting calm states in the classroom?

This question reflects the study's theoretical grounding in the MBC, with calmness serving as an observable and experienced indicator of self-regulatory capacity. It draws on children's perspectives and teacher-reported observations, allowing an understanding of how embodied practices operate in real-time classroom settings.

3. What immediate effects are noticed following the breath exercises?

This question focuses on the immediate, observable effects of the intervention, distinct from its longer-term or broader classroom impacts. It examines perceived immediate changes following the breathing exercises, drawing upon children's self-reported experiences.

4. What key factors influence the successful implementation and sustainability of breathing exercises as a classroom intervention?

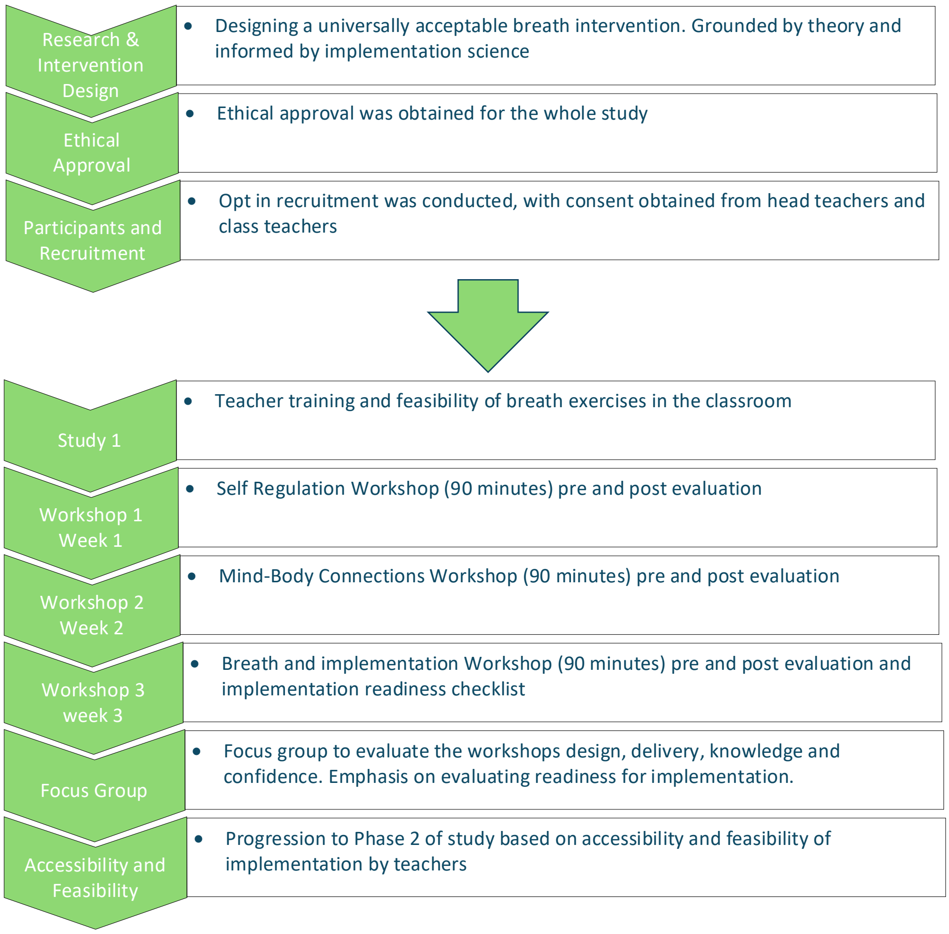
This implementation science-based question explores how contextual, relational, and organisational factors influence intervention fidelity and long-term integration. It uses multiple data sources: teacher reflections, classroom observations, and child feedback for a multi-perspective view. The analysis identifies mechanisms and conditions affecting sustained use in real classrooms. Quantitative and qualitative findings were merged through comparison to highlight patterns, convergences, and divergences.

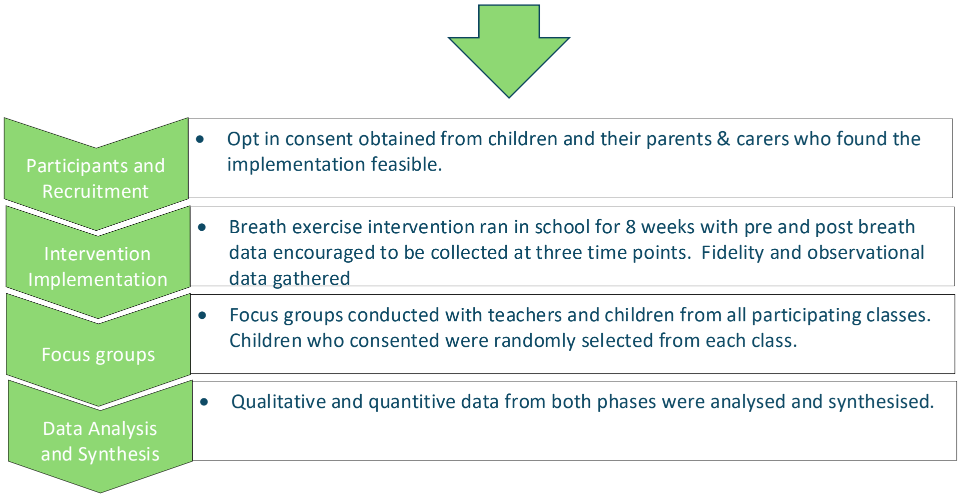
5.6 Intervention Procedure

The pilot intervention process is outlined in Figure 18. After developing the workshops, phase one focused on evaluating the training's effectiveness, acceptability, and readiness for implementation. Teachers who agreed to participate and adhere to the protocol in phase one affirmed their commitment, ensuring motivated and well-prepared participants. This approach aligns with implementation science principles, highlighting practitioner readiness and voluntary participation as critical for maintaining fidelity (Fixsen et al., 2005). Those who continued advanced to phase two, an 8-week intervention during which they conducted breathing exercises daily in the classroom. Quantitative and qualitative data were analysed and subsequently synthesised to address the research questions.

Figure 18

Intervention Procedure





5.7 Intervention Design

5.7.1 Designing a Universally Accessible Intervention

The workshops (Appendix H-J) were designed to embed low-burden practices like breath exercises to enable consistent and scalable integration into classroom routines across diverse contexts (Durlak, 2008). They were central to the design and implementation of the intervention, serving as a mechanism for translating theoretical knowledge into practice. The workshops drew on models of professional learning emphasising experiential engagement, contextual responsiveness, and iterative sense-making (Opfer & Pedder, 2011).

The sessions prompted teachers to reflect on the connection between breathwork and SR, emphasising embodied calmness as a component of children's regulatory capacity. Recognising that knowledge transfer alone does not ensure practice change, the intervention considered individual, relational, and structural factors, such as time availability, support, and competing priorities. To address these, the workshops were intentionally experiential, allowing teachers to engage in reflection and practice directly. This promoted understanding, personal relevance, and acceptability, which are essential for maintaining genuine use.

Attention was also given to the communicative framing of the intervention. Concepts were introduced using developmentally appropriate language and visual tools, ensuring accessibility for younger learners and reinforcing the intervention's relevance to existing educational goals, such as emotional literacy and classroom climate. Practical and feasible implementation was prioritised. The design acknowledged that effectiveness depends on underlying mechanisms and specific contextual arrangements. This framing facilitated a shift from surface-level effectiveness to deeper processes through which practices are adopted, adapted, or resisted within real-world settings. The design recognised that effectiveness relies on underlying mechanisms and specific contextual factors, enabling a move from superficial results to understanding how practices are adopted, adapted, or resisted in real-world settings.

5.7.2 Workshop Design and Structure

The workshops (Appendix H-J) consisted of three weekly 90-minute sessions held at a central location after school. This format was tested to assess its feasibility and the workload it demands. Each session included collaborative discussions, reflection opportunities, and practical activities. It aligned with the principles of effective professional learning, emphasising sustained duration, active participation, and contextual relevance (Desimone, 2009). While delivery was in-person throughout, online options were available.

The workshop series followed a progressive learning sequence to support teachers' capacity-building through experiential learning. Sessions began with a broad conceptual understanding of SR, gradually narrowing to physiological aspects. Interoception was used to connect body awareness to SR by developing knowledge of physiology and the MBC. The final workshop translated strategies into classroom practice, demonstrating how breath exercises could support SR. This session emphasised practical implementation while recognising that successful integration depends as much on scheduling and fit as on content knowledge.

Teachers participated in experiential practice, emphasising classroom application. This demonstrated the principle of experiential learning, where doing improves understanding, and active involvement boosts knowledge transfer (Opfer & Pedder, 2011) The exercises were designed to be time-efficient, straightforward, and easily incorporated into daily routines, balancing workload management with fidelity. Structured guidance and classroom-ready resources, such as child-accessible visual aids and explanatory materials (Appendix K), supported delivery while encouraging adaptation rather than strict fidelity. Flexibility was presented to achieve contextual fit and sustainability. The workshops were outlined as follows (Appendix H-J): SR, MBC and Breath and classroom implementation.

5.7.3 Translation into the Classroom

The post-training FG served as a methodological function by enabling iterative adaptation within an implementation strategy grounded in teacher-led refinement

(Damschroder, 2009; Proctor et al., 2011). The FG provided a forum for teachers to identify barriers and collaboratively co-construct contextually feasible delivery routines. This included determining practical, effective times for classroom implementation and ensuring the intervention could be embedded in everyday practice.

5.7.4 Additional Planning Considerations for the Training and Intervention Design

The teacher training component was intentionally designed to ensure that teachers developed a coherent, practical understanding of the intervention before delivering it in classrooms. The sequence of workshops was arranged to build knowledge progressively, starting with the theoretical foundations of SR, then exploring MBC, and culminating in breath-based practices central to this study. This structure allowed teachers to move from conceptual understanding to embodied experience in a way that was accessible, realistic, and aligned with classroom practice.

During the SR workshop, key definitions, theories, and models of SR were explored. Teachers were introduced to frameworks outlined in Chapter 2, with discussions centred on how these processes appear in classroom settings. Planning for this workshop emphasised simplicity and relevance, recognising that teachers needed a shared language for SR before understanding how a physiological strategy, such as breathing, could help. Attention was given to physiology as a basis for SR, based on evidence that autonomic regulation underpins emotional and behavioural control. This enabled teachers to see breath-based strategies within a broader, evidence-informed understanding of SR.

The MBC workshop (Chapter 3) expanded on this by introducing core concepts, including HR changes, autonomic arousal, and the fundamental roles of the SNS and PNS. Teachers were supported in recognising their own physiological responses and relating these experiences to children’s in-the-moment regulation. Planning for this workshop ensured explanations remained developmentally appropriate while still introducing HR, interoception, and a brief discussion of HRV as indicators of physiological state. These ideas bridged theory and the embodied breath practices delivered in the final workshop.

The breath workshop introduced the simplified breathing practice used in the study. Planning prioritised a child-appropriate approach, focusing on gently slowing and stabilising the breath rather than complex breathing protocols. Teachers practised the routine themselves, considered the practicality of delivery, and explored ways to scaffold children’s engagement through prompts and sensory cues. This experiential component was essential for developing self-efficacy, as teachers needed to feel confident modelling the practice authentically.

Throughout the planning phase, co-design was regarded as essential. Teachers' perspectives influenced decisions on timing, language, transitions, and how the practice could be incorporated into existing routines. The researcher ensured that key fidelity requirements were maintained while teachers shaped the practice's appearance and feel in their own contexts. The Phase One FG functioned as a final step in this planning process, allowing teachers to consolidate workshop learning, confirm practical delivery decisions, and jointly refine the implementation plan before starting Phase Two.

The planning process served both as preparation for implementation and as a means to improve fidelity, motivation, and contextual fit. By intentionally sequencing the workshops, incorporating experiential learning, and grounding discussions in familiar classroom examples, the design increased the chances that teachers would understand, value, and continue the practice once it was implemented.

5.8 Ethical Approval

This study adhered to the British Psychological Society's Code of Ethics (BPS, 2009). Ethical approval for the pilot study was obtained from the University of Strathclyde's Psychology Ethics Committee and the Local Authority X Psychological Service Ethics Committee. Aligned with the study's Critical Realism paradigm and its methodological basis in Implementation Science, ethical considerations were integrated into the research design and implementation, recognising the contextual realities of conducting research in real-world education settings (McEvoy & Richards, 2006).

The intervention's phased structure addressed both ethical and methodological challenges associated with whole-class interventions. Ethical procedures were integrated at each stage of the study, including participant recruitment, engagement and data collection. Teacher consent (Appendix C) was obtained prior to phase one training; only teachers who found the intervention acceptable and feasible proceeded to phase two. Consent was then sought to involve the children in their class (Appendix D-G). This phased approach reflects an ethically responsive strategy, prioritising feasibility and acceptability within the host system and reducing the risk of tokenistic implementation (Damschroder, 2009; Proctor et al., 2011).

The decision not to randomise participants was both methodological and ethical. Considering the nature of the study and the necessity for authentic whole-class delivery, it was crucial to collaborate with teachers who demonstrated buy-in, as it is a key component of successful implementation (Aarons et al., 2012).

Throughout the study, ethical considerations involved obtaining informed consent, maintaining confidentiality, ensuring anonymity, and respecting the right to withdraw at any stage. These standards were consistently upheld.

5.9 Participation and Recruitment

The study is located within Local Authority X in northeastern Scotland, a region characterised by predominantly agricultural rural areas and a population distributed across small towns, villages, and farming communities. Although it constitutes 8% of Scotland's landmass and ranks sixth largest in population, the authority includes numerous small rural schools and many composite classes. Contextualising the study within a rural Scottish local authority allows consideration of factors (Bronfenbrenner, 1979) that may influence the implementation of interventions, such as small composite classes and limited resources. These contextual factors influenced participant selection. The intervention was designed to be universally accessible, accommodating composite classes and the diverse ages and developmental stages typical of rural schools (Page, 2006).

While most of the population lives in towns and villages, the authority's rural character is highlighted by its division into three distinct areas. The authority oversees 149 primary schools, 17 secondary schools, and three specialist education settings.

5.9.1 Age Selection

The Primary 4–7 age group was selected as the target population for two main reasons. Firstly, whole-class universal interventions are more established in primary settings, improving feasibility and alignment with routine practice. Secondly, composite class structures in rural schools (e.g., P1–3, P4–7) required an intervention flexible enough to accommodate developmental variation. Children in P4–7 demonstrate increasing cognitive control and emotional self-awareness, which support engagement with SR strategies (Blair & Raver, 2015; Diamond & Lee, 2011).

Consultation with EPs further supported this focus, as SR was the most frequently coded reason for involvement among children at this stage. Therefore, the intervention was designed to support implementation within multi-age classrooms, ensuring accessibility across a broad developmental range and responsiveness to rural educational contexts.

5.10 Chapter Summary

This chapter detailed the methodological foundations of the study, based on a sequential, mixed-methods pilot design within a Critical Realist framework. It justified the two-stage approach: teacher preparation followed by classroom implementation, to assess feasibility, acceptability, fidelity, and early indications of effectiveness. The use of implementation science as a framework was described, emphasising the importance of organisational fit, practitioner readiness, and iterative refinement. Recruitment within a rural Scottish local authority, ethical procedures, and the focus on P4–7 composite classes were outlined. The intervention design comprised three-session workshops, co-design, and coaching support for teachers during implementation. The following chapters detail the methods, analyses, and findings for each phase of the study, starting with Phase 1: teacher preparation, followed by Phase 2: classroom implementation.

Chapter 6: Phase One Methodology and Results

6.1 Introduction

Phase one assessed the feasibility, acceptability, and readiness for implementing the breath practice intervention in classrooms. Teacher workshops functioned both as capacity-building sessions and as a means of collecting data on implementation drivers and barriers. The workshops aimed to improve understanding of SR, MBC, and breathwork while exploring teachers' perceptions, confidence, and willingness to adopt the approach practices.

6.2 Rationale

The aim for phase one was to pilot the workshops designed by the researcher and assess contextual readiness prior to implementation (Damschroder, 2009; Fixsen, 2005). This included logistical constraints, teachers' beliefs, and competing priorities. Early exploration of implementation drivers such as professional learning, routine integration and teacher engagement was essential because these factors directly influence fidelity and sustainability (Fixsen, 2005).

The workshops, therefore, had both pedagogical and evaluative functions. They developed teacher capacity while collecting data on acceptability, feasibility and confidence, informing refinements for Phase two.

6.2.1 Key Component of Phase One

6.2.1.1. Workshop Readiness to Implement. A central aim was to determine whether workshops effectively communicated the rationale for using breathwork to support SR. Linking SR to MBC and ANS functioning helped make abstract concepts clearer (Zaccaro et al., 2018). FG responses indicated improved clarity and perceived relevance. Step-by-step demonstrations supported immediate classroom application.

6.2.1.2 Experiential Learning. Teachers engaged in breath exercises themselves to develop embodied understanding. Experiential approaches help bridge knowledge and practice, enabling teachers to evaluate feasibility and authenticity (Harris et al., 2016). This aligns with implementation frameworks, highlighting the importance of individual beliefs and experience in adoption (Damschroder, 2009).

6.2.1.3 Knowledge and Confidence of Delivery. Workshops were scaffolded to build theoretical understanding and practical skills. Pre- and post-workshop Likert questionnaires assessed perceived knowledge and confidence. Readiness was further evaluated at the final session. FG data enriched the quantitative measures. This combined approach reflects implementation science principles that emphasise readiness, motivation, and fidelity (Carroll et al., 2007; Domitrovich et al., 2008).

6.2.1.4. Feasibility and Readiness for Implementation. Feasibility was examined through factors such as time constraints, curriculum pressures and classroom management demands. Co-designing the delivery plan enhanced contextual fit while maintaining adherence to core components (Fixsen, 2005). The mixed-methods design captured both practical and perceptual dimensions influencing readiness and feasibility.

6.3 Mixed Methods Methodology

Phase one used a convergent mixed-methods design, integrating quantitative measures (knowledge, confidence, readiness scales) with qualitative FG data. This approach generated a comprehensive understanding of teacher readiness and perceptions, consistent with implementation science principles of contextual fit, motivation and fidelity (Carroll et al., 2007; Domitrovich et al., 2008). Teachers demonstrating sustained interest and readiness, as indicated by these mixed measures, were invited to participate in phase two.

6.3.1. Research Questions

1. To what extent did the workshops enhance teachers' knowledge and understanding of SR and MBC, including breathwork techniques?
2. What contextual, personal, or systemic factors influenced teachers' perceived readiness to implement breathwork in classroom practice?

6.4 Measures and Analyses

6.4.1 Pre- and Post-Workshop Questionnaires

The workshops aimed to progressively build teachers' knowledge and skills, with each session designed to build on the previous one. Quantitative data were collected to assess the impact of the workshops on participants' knowledge, confidence, and readiness to apply the learning. Likert-scale questionnaires were used to measure perceptions, as they are appropriate for assessing subjective perceptions and professional learning outcomes (Krosnick et al., 2009). The questionnaires were administered before and after each workshop (Table 4, Appendix L).

This approach was informed by Moir (2018) who advocates for pre-training questionnaires to establish a baseline understanding and encourage reflexive engagement. Parallel pre- and post-workshop forms allowed comparison of perceived changes in knowledge and confidence, supporting evaluation of both content acquisition and application readiness. The questionnaires were designed to measure five key constructs aligned with the workshop content and intended outcomes.

Table 4

Example questionnaire items by construct and time point

Construct	Time Point	Example Item
Knowledge and understanding	Pre Training Post Training	I have a good understanding of The training improved my understanding.
Confidence	Pre Training Post Training	I feel confident in my ability to apply I feel confident in my ability to apply.
Motivation	Pre Training Post Training	I am motivated to learn about The training increased my motivation.
Perceived relevance	Pre Training Post Training	I believe SR/MBC/ B is relevant to my work The training helped me see the relevance of SR/MBC/B to teaching.
Prior training / CPD	Pre Training Post Training	Received training related to SR, MBC and B The training enhanced previous learning.

Each workshop questionnaire used a five-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree), with a neutral midpoint. Likert scales are widely used in educational and social research due to their practicality, ease of interpretation, and ability to produce ordinal-level data for descriptive and inferential analysis (Joshi et al., 2015). Participants responded to five statements per workshop, designed to measure the constructs outlined in Table 4. Items were phrased consistently to enable cross-workshop and pre-post comparisons, with post-training versions reworded to reflect perceived development (e.g., “The training improved my understanding of…”). Content validity was enhanced by linking each item to the learning objectives and the broader intervention aims.

The pre- and post-questionnaires were explicitly developed for this study rather than adapted from validated instruments, to reflect the workshop content and intended outcomes. Given the pilot nature of this study, the focus was on obtaining context-specific and practice-relevant insights rather than generalisable results. In implementation science, alignment between evaluation tools and intervention components is essential for assessing change (Fixsen, 2005).

Existing professional tools measure constructs such as knowledge, confidence, and motivation, (Guskey, 2002; Kennedy, 2016). However, do not address the combined focus or delivery style of this intervention. Developing a custom instrument ensured contextual sensitivity and relevance to the training content. Practical considerations, including minimising completion time, also informed the design.

As practical training should foster changes in practice and build efficacy and readiness (Desimone, 2009). A post-workshop FG (Appendix M) explored how teachers' reflections on preparation and implementation bridge the gap between knowledge acquisition and the classroom application.

To support rigour and internal coherence, the development of the questionnaire followed key steps:

- Construct mapping: items were linked to three professional learning constructs: knowledge and understanding, confidence in application, and motivation/readiness to implement.
- Aligned with learning outcomes: each question reflected the workshop objectives and targeted perceived shifts in knowledge and confidence.
- Consistency: item phrasing was consistent across workshops for comparability.
- Peer feedback: draft items were reviewed for clarity, appropriateness and relevance.

The researcher developed the questions, which were not psychometrically validated using methods such as factor analysis or Cronbach's alpha. Instead, they served as exploratory tools to gauge perceived changes in practitioner learning within the intervention setting. Therefore, the results should be interpreted cautiously.

While Likert scales provide efficient, low-cost data collection, they present several methodological issues. The scales are unidimensional, capturing only a single aspect, such as the teacher's knowledge of SR, and do not reflect the complexity of understanding SR. Additionally, Likert data are ordinal, meaning that the intervals between categories (e.g., agree and "strongly agree") are unequal, and perceived intensity may differ across respondents. Using ordinal data as if they were interval data without proper validation can lead to measurement errors (Byrne, 2010; Joshi et al., 2015).

Response bias also warrants consideration: participants might overuse neutral or extreme options, and responses could reflect social desirability rather than genuine perceptions. Despite these issues, Likert scales remain valuable for detecting attitudinal patterns and indicative changes in confidence and readiness. Therefore, mean scores were interpreted with caution, given the exploratory and small-scale nature of this pilot study.

6.4.2 Quantitative Data Analyses

The Likert-scale questionnaire data were examined using descriptive statistics, including means and standard deviations, to compare scores before and after the workshop and to evaluate perceived readiness. This analysis provided insights into trends in change and helped assess training effectiveness.

A descriptive approach was selected due to the small sample size, which limited the potential for inference analysis. The data offered tentative insights into perceived changes in knowledge, confidence, and motivation, and were interpreted alongside qualitative findings to develop a more comprehensive understanding of teacher readiness.

6.4.3 Qualitative Data Collection

6.4.3.1. FG. FGs enable the exploration of collective perspectives, attitudes, and experiences, offering opportunities to clarify both shape and divergent views (Gill & Baillie, 2018; Gray, 2021). They are distinct from general discussions in purpose, composition, and procedures (Krueger & Casey, 2015) and are particularly effective in eliciting participants' priorities and collective reasoning (Smithson, 2008).

An FG was chosen instead of individual interviews because the collective dynamic allowed teachers to share experiences, compare perspectives, and co-construct meaning, generating richer insights into workshop impact and readiness (Krueger & Casey, 2015). This approach was also time-efficient, enabling simultaneous data collection from multiple participants, a practical consideration given the small sample size (Guest et al., 2017). However, group-based methods are not without limitations. Group dynamics can lead to conformity effects, where dominant voices influence discussion and discourage alternative perspectives (Sim & Waterfield, 2019).

These dynamics were recognised during analysis and factored into the interpretation of the results. To mitigate potential risks, ethical safeguards were put in place, particularly given that confidentiality cannot be fully assured in a group setting (see Appendix C). Participants were reminded of confidentiality boundaries, and the researcher provided post-session support options for those wishing to discuss concerns privately. This approach fostered an ethically sound and supportive environment for the research.

Since three teachers from the same school participated, there was potential for both conformity and enhanced collective reflection. The shared environment fostered more practical, grounded discussions, as teachers connected the workshop content directly to their everyday classroom experiences. Consequently, the researcher concluded that an FG remained the most appropriate method for capturing teachers' perspectives on the workshop's relevance and their readiness to implement what they learned.

One FG was held, involving five of the seven teachers who completed all workshops. Due to the small sample size, data sufficiency was evaluated based on thematic coverage rather than complete saturation, ensuring enough depth and variation to achieve the research objectives (Braun & Clarke, 2021). The discussion was audio-recorded and supplemented by the researcher's field notes. Data were transcribed verbatim, with minor corrections for clarity and anonymisation of all names and identifiers.

The transcribed data were then prepared for inductive, reflexive thematic analysis. This approach aligned with the study's critical realist perspective, recognising that participants' reflections include both subjective interpretations and underlying structural influences shaping their experiences. The FG setting aimed to identify both individual and shared meanings related to readiness and perceptions of the intervention. Overall, the FG provided rich, detailed data that complemented the quantitative results, offering a nuanced understanding of teacher readiness, perceived feasibility, and the practical relevance of the workshop content.

The FG was conducted after the final workshop in phase one and before the intervention was implemented. It consisted of five teachers, who had completed all three workshops. The session lasted approximately 50 minutes and was facilitated by the researcher with an EP acting as a non-participant co-observer to enhance procedural rigour. Both facilitators took observational notes to supplement the audio-recorded discussion and document any emergent patterns.

The primary aim of the FG was to supplement questionnaire data, evaluate the workshops, and assess participants' readiness to implement the intervention. It also supported collaborative adjustments to workshop components, ensuring they matched teachers' abilities and the realities of classroom environments. This aligns with (Smithson, 2008) emphasis on the value of FG in enhancing interventions and gathering participant-led feedback.

The researcher gathered feedback on the suitability of the workshop duration, the intervals between sessions, and the advantages of small group formats. Logistical aspects were also assessed, such as whether the timing and structure supported ongoing engagement and practical application. Additionally, the FG investigated participants' opinions on the practicality of the workshop activities, the clarity of the instructional materials, and whether the format provided sufficient opportunities for practice and reflection.

The FG was conducted two weeks after the completion of the third workshop (which was delayed due to weather conditions). The teachers were asked open-ended questions based on the following themes:

- Evaluation of the intervention workshop content, delivery, duration and timing
- Suggestions for improving workshop delivery and training effectiveness
- Readiness to implement breath exercises within the school context
- Any other considerations affecting feasibility or engagement

The thematic areas covered in the FG were intentionally aligned with phase one research questions, specifically exploring teachers' readiness to implement the intervention and evaluating the perceived feasibility and appropriateness of the workshop content and delivery. This alignment ensured the intervention was practical and manageable within everyday classroom activities and informed phase two.

Although the analysis was inductive, FG prompts were designed to elicit data relevant to the study's overarching aim. The FG functioned as both an evaluative and a developmental tool, guiding refinements to the intervention design prior to implementation. The perceived strengths of FG methodology are the possibility for research participants to develop ideas collectively, bringing forward their own priorities and perspectives.

6.4.4 Qualitative Data Analyses

The FG transcriptions were thematically analysed independently by the researcher and a colleague, an EP from the local authority. Thematic analysis involves systematically identifying and interpreting patterns within qualitative data (Braun & Clarke, 2006). A reflexive thematic approach was utilised, enabling iterative engagement with the data and recognising researcher subjectivity (Byrne, 2022). Reflexive thematic analysis was chosen after reviewing alternative qualitative analytic methods to ensure methodological appropriateness, for its alignment with the study's interpretivist stance and its accommodation of researcher positionality.

Thematic analysis is a research method utilised to identify and interpret patterns or themes within a data set (Naeem et al., 2023). It involves systematic coding to develop themes (Braun, 2022). The analysis examined both the implementation process and the data it generated. In qualitative research, thematic analysis can provide essential process and evaluation data, identifying facilitators and barriers to implementation (Kegler et al., 2018).

For phase one, it was employed to explore the knowledge and understanding gained from the workshops and to assess teachers' readiness to proceed to phase two of the intervention. The analysis complemented the quantitative questionnaire data, which provided insight into how the workshops prepared the participants for implementation. By identifying indicators of readiness and potential challenges, this phase provided insights to inform and refine phase two.

The thematic analysis addressed phase one research questions 1 and 2: (1) exploring the extent to which the workshops enhanced teachers' knowledge and understanding of SR and MBC, and (2) the contextual, personal and systemic factors influencing teachers' perceived readiness to implement breath exercises in classroom practice.

The analysis was primarily inductive, generating themes directly from teachers' experiences without imposing pre-existing frameworks (Flick, 2018), consistent with Adu (2021), view of thematic analysis as a data-driven process aimed at addressing the research questions. Neutrality was recognised as challenging, and the researcher's professional background as an EP and yoga instructor, including prior experience with breathwork and MB approaches, was acknowledged as shaping the interpretative lens. Ongoing reflexivity was maintained to ensure that interpretations were grounded in participants' accounts rather than influenced by prior expectations or professional commitments.

The six-phase model of thematic analysis proposed by Braun and Clarke (2006) provided a structured framework for systematic qualitative analysis.

1. Data familiarisation
2. Generating initial codes
3. Searching for themes
4. Reviewing themes
5. Defining and naming themes
6. Producing the report.

Reflexivity was an ongoing and integral aspect of the analysis. The researcher actively engaged with their positionality, acknowledging how personal experiences, professional beliefs, and relationships within the local authority context shaped their interpretations. In line with reflexive thematic analysis, coding and theme development were understood as interpretative processes influenced by the researcher's standpoint (Byrne, 2022). This involved critically examining potential biases, prior experiences, and interactions with the data, while consciously reflecting on how familiarity with MB approaches, including breathwork, could shape interpretative decisions.

To support this process, a second EP, experienced in qualitative methodologies but independent of the intervention, served as a critical peer. Their role was to challenge the researcher's interpretations during coding and offer an independent perspective on the data. Both EPs came together during the theme review (stage 5), where minimal differences in theme labelling emerged and were resolved through collaborative discussion. The researcher retained final responsibility for interpreting and naming themes. The codes reflected the researcher's active role in constructing meaning from the data.

By adopting a reflexive approach, the researchers actively considered their own influence on the research process. They critically explored biases, assumptions, and interactions with the data, improving rigour and depth. This was an important aspect as a practising EP within the local authority during the pilot study. The second EP was confident and experienced in qualitative methodologies, offered a level of challenge, and contributed an additional perspective to the process. The researchers met at stage 5 to discuss the generated themes, during which only minimal differences were identified.

This was a consensual coding process rather than a statistical intercoder reliability exercise. The two researchers compared their codes and reached an agreement through discussion, refining themes collaboratively. No formal measure of agreement was calculated, in line with reflexive thematic analysis principles, which prioritise meaning-making over reliability metrics (Braun & and Clarke, 2021)

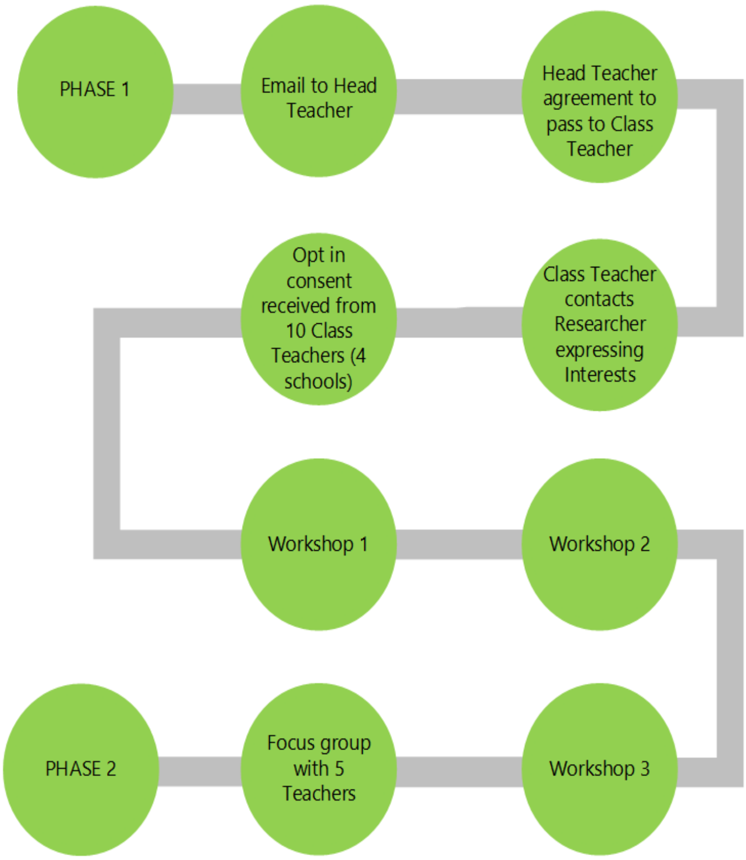
While reflexive thematic analysis naturally aligns with interpretivist or constructionist paradigms, it can be utilised within a critical realist framework by recognising both the existence of underlying mechanisms and the interpretative nature of data analysis. (Braun & and Clarke, 2021; Fletcher, 2017). Themes were understood as researcher-constructed representations of participants' accounts, which may point to deeper structures influencing implementation.

Although software such as NVivo can support large-scale qualitative data analysis(Lungu, 2022). This phase's small dataset and immersive approach made manual methods (pen, paper and sticky notes) more suitable. Manual analysis facilitated immersive engagement with the data.

6.5 Intervention Procedure

Figure 19

An Overview of Phase One



6.6 Ethical Approval

Ethical approval for the full pilot study, including phase one, was granted by the University of Strathclyde Psychology Ethics Committee and the Local Authority X Psychological Service Ethics Committee (section 5.8). All procedures followed the British Psychological Society's Code of Human Research Ethics (BPS, 2009).

As detailed in chapter 5, ethical principles were informed by the study's Critical Realist orientation and its grounding in implementation science (McEvoy & Richards, 2006). For phase one, this meant ensuring that teachers could participate voluntarily in ways compatible with their professional responsibilities.

Gatekeeper permission was obtained via headteachers before teacher recruitment. Teachers received information sheets and gave informed consent prior to attending the workshops and the post-training FG. Confidentiality, anonymity, and the right to withdraw were made clear throughout, consistent with iterative ethical practice in applied settings (Guillemin & Gillam, 2004).

Participation in phase one did not require teachers to advance to phase two, emphasising the significance of acceptability and readiness in implementation. No pupil data were collected during this phase.

6.7 Participation and Recruitment

6.7.1 Inclusion and Exclusion Criteria

Participants qualified for inclusion if they satisfied the following criteria:

- Qualified class teachers currently employed by the Local Authority X, where the researcher was professionally based.
- Class teachers of primary pupils in years 4-7, whether in straight-year or composite classes. This group was selected based on the structure of small rural schools, where P4–7 composite classes are standard, and aligns with mainstream inclusion practices and the practicality of teaching whole classes. This age range also corresponds to a developmental period often marked by emerging SR challenges in school, making it a relevant focus for the intervention.
- Available and willing to participate in the entire training programme (three workshops) and related data collection activities.

Teachers were excluded if:

- Their head teacher declined to support the research.
- They were engaged in temporary, peripatetic, or ASN support roles without primary responsibility for a single class.

This purposive sampling approach was appropriate given the real-world educational setting and the study’s grounding in implementation science, which prioritises feasibility and context-driven engagement (Damschroder et al., 2009).

Among the small rural schools involved, 10 teachers initially expressed interest, and 7 consented and attended the training session. All participating teachers taught composite classes in small schools with between 1 and 4 classes, with teaching experience ranging from early career to over 15 years. The training was conducted over three weeks. Severe snow conditions led to rescheduling the final workshop to December, and a follow-up FG was held two weeks later to accommodate safe travel. As a result, the time between the first workshop and the FG was six weeks. Five out of seven teachers attended the FG, which lasted 45 minutes instead of the planned hour. Weather and rural travel constraints limited attendance but were considered part of the contextual realities rather than methodological flaws, aligning with the study’s pragmatic and context-responsive approach.

6.7.2 Recruitment Process

Recruitment followed a gatekeeper-mediated process, consistent with ethical guidelines for research in hierarchical institutions such as schools (Busher & James, 2012; Tangen, 2008). The researcher initially contacted headteachers at schools with established professional relationships (Appendix B) and provided detailed information about the study's purpose, scope, and ethical approval.

Recruitment occurred only with headteacher approval, who then shared the invitation with eligible teachers, keeping oversight and voluntary participation. Interested teachers contacted the researcher directly, maintaining their autonomy to participate.

Following initial contact, teachers received detailed participant information sheets and consent forms (Appendices C and D). They were offered a two-week consideration period, during which teachers could ask questions before giving informed consent. The researcher emphasised that participation in the training and data collection did not require later implementation of the breathing intervention, a point reiterated during each workshop.

6.7.3 Participation and Attrition

Three teachers who initially expressed interest did not return consent forms. Informal feedback suggested this was due to scheduling conflicts, a challenge in school-based research (Cohen et al., 2017). The rural geography of participating schools and the timing of the intervention during winter also created logistical constraints that may have affected participation. Although an online option was available, teachers expressed a clear preference for in-person workshops.

Of the seven teachers who attended all three workshops, five participated in the post-training FG. Non-attendance was attributed to severe weather and related travel safety concerns. One teacher had to leave early due to deteriorating road conditions and was unable to join online, while another was absent due to illness.

In response to these circumstances, the FG was shortened to 45 minutes to ensure safe travel. While not ideal, this adaptation reflected ethical responsiveness and a commitment to participant well-being in real-world research settings (Guillemin & Gillam, 2004).

Table 5

Participant Flow

Recruitment stage	Number of teachers
Head Teachers contacted	13
Teachers invited via the head teacher's approval	10
Expressed interest and sent information	10
Provided consent	7
Attended all three workshops	7
Attended the focus group post-training	5

6.7.4 Ethical Considerations in Recruitment

The recruitment process respected both procedural and relational ethics. The researcher involved head teachers as gatekeepers to ensure the study aligned with the context and to prevent undermining school leadership. At the same time, teachers' autonomy was maintained by permitting them to choose whether to participate after being fully informed about the study's scope and their rights.

This approach minimised coercion while adopting authentic buy-in, which is widely considered a critical precondition for successful intervention implementation (Aarons et al., 2012). Ethical safeguards like voluntary participation, the right to withdraw, and anonymity were consistently emphasised, with all documentation adhering to university and local authority ethical standards.

6.8 Results Phase One

This section presents the results of phase one, which evaluated the workshop model and collected feedback to inform implementation. This phase examined changes in teachers' self-reported knowledge, understanding, and confidence after each workshop. It addressed Research Question 1 (impact of training) and Research Question 2 (readiness for implementation).

Data were collected using pre- and post-workshop questionnaires with 5-point Likert scales (section 6.8.1, Appendix L). A readiness questionnaire was completed following the final workshop, alongside a post-workshop FG. While the quantitative data captures shifts in teachers' perceptions and confidence, the FG explored the structure, clarity, and perceived usefulness of the training content. It also assessed whether the workshops were considered sufficient, robust, and relevant, while evaluating their manageability in real-world settings. Together, these measures aimed to understand the mechanisms influencing uptake and implementation fidelity.

6.8.1 Quantitative Data Analyses: Likert Questionnaire

The three professional learning workshops focused on: (1) SR, (2) MBC and (3) Breath. Each workshop was evaluated using five consistent Likert-scale items assessing knowledge and understanding, confidence, motivation, perceived relevance, and prior training or CPD (section 6.4.1). Pre- and post-workshop means, standard deviations, and mean changes are summarised in Table 6, with Figures 20-22 illustrating trends across items.

Inferential statistical testing was not conducted due to the small sample size (N = 7). Results are therefore presented descriptively, highlighting patterns in line with the phase one research questions:

- RQ1: To what extent did the workshops enhance teachers' knowledge and understanding of SR and MBC approaches, including breathwork exercises?
- RQ2: What contextual, personal, or systemic factors influenced teachers' perceived readiness to implement breathwork in classroom practice?

8.8.1.1. Knowledge and understanding. Participants reported improvements in understanding across all workshops, with the most significant gains observed for BR (ΔM = +3.00), followed by MBC (ΔM = +2.00) and SR (ΔM = +1.58). Post-training scores showed reduced variability, indicating more consistent knowledge acquisition (Table 6).

6.8.1.2. Confidence. Confidence in applying workshop content increased for all topics, particularly for MBC and BR (ΔM = +2.29 each). Scores were more consistent post-training, suggesting participants felt increasingly equipped to implement the strategies.

6.8.1.3 Motivation. Motivation was initially high and generally maintained. Slight decreases were observed for SR and MBC (ΔM = -0.29 and -0.43), possibly reflecting a shift from initial curiosity to readiness to apply. At the same time, BR motivation increased slightly (ΔM = +0.71), likely due to its immediate classroom relevance.

6.8.1.4 Perceived Relevance. Perceived relevance remained high across all topics, with minor changes reflecting reflection on practical application. This indicates participants consistently valued the workshops' applicability to their teaching roles.

6.8.1.5. Prior Training. Participants reported limited prior training in these areas. Post-workshop gains were substantial (ΔM range: +2.43 to +3.21), suggesting that the workshops effectively addressed gaps in professional development and enhanced readiness to implement new strategies.

Overall, the description indicates that the workshops were effective in enhancing teachers' knowledge, confidence, and perceived applicability of SR, MBC, and breath exercises (RQ1). Slight decreases in motivation or relevance probably reflect cognitive shifts towards practical application rather than disengagement. Gains in confidence and prior exposure to training emphasise an increasing readiness to implement these approaches in classroom practice, addressing RQ2. These findings will be further contextualised through qualitative analyses examining personal and systemic influences on implementation readiness and fidelity.

Table 6

Pre- and post-training means, SDs, and mean differences (ΔM) for SR, MBC, and Breath workshops (N = 7)

Construct	Item	SR Pre (M ± SD)	SR Post (M ± SD	SR Δ Mean	MBC Pre (M ± SD)	MBC Post (M ± SD)	MBC Δ Mean	Pre B (M ± SD)	Post B(M ± SD	B Δ Mean
Knowledge and understanding	Understanding and its relevance to classroom practice	2.71 ± 0.76	4.29 ± 0.49	1.57	2.43 ± 0.79	4.43 ± 0.53	2.00	1.71± 0.49	4.71±(0.49)	3.00
Confidence	Confidence in the ability to apply in the classroom	2.57 ±(0.79	4.00 ±(0.58)	1.43	2.14 ± 0.90	4.43 ± 0.53	2.29	2.00±(0.00)	4.29 (0.49)	2.00
Motivation	Motivated to learn and how it applies to my role as a teacher	4.14 ±(0.90)	3.86 ±(0.90	-0.29	4.29 ± 1.11	3.86 ± 0.38	-0.43	4.00±(0.58)	4.71±(0.49)	0.71
Perceived relevance	is relevant to my work as a teacher	4.14 ±(0.69)	4.29 ±(0.49)	0.14	4.71 ± 0.76	4.43 ± 0.53	-0.29	4.00±(0.58)	4.71±(0.49)	0.71
Prior training / CPD	Previously received training complemented / enhanced previous learning	1.86 ±(1.07)	4.29± (0.76)	2.43	1.86 ± 0.38	4.86 ± 0.38	3.00	1.50±(0.55)	4.71 ±(0.49)	3.21

Figure 20

Mean Levels across 5 Questions: SR

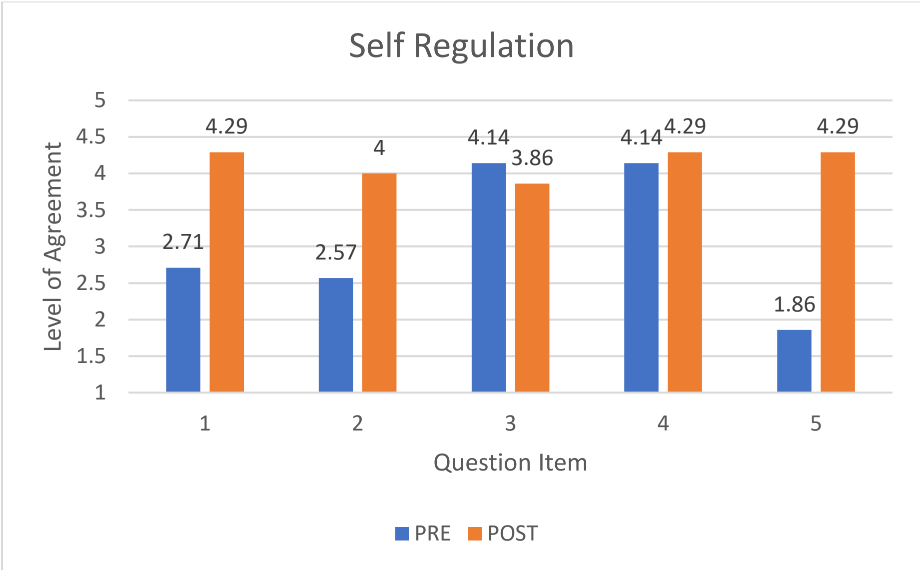


Figure 21

Mean Levels across five questions: MBC

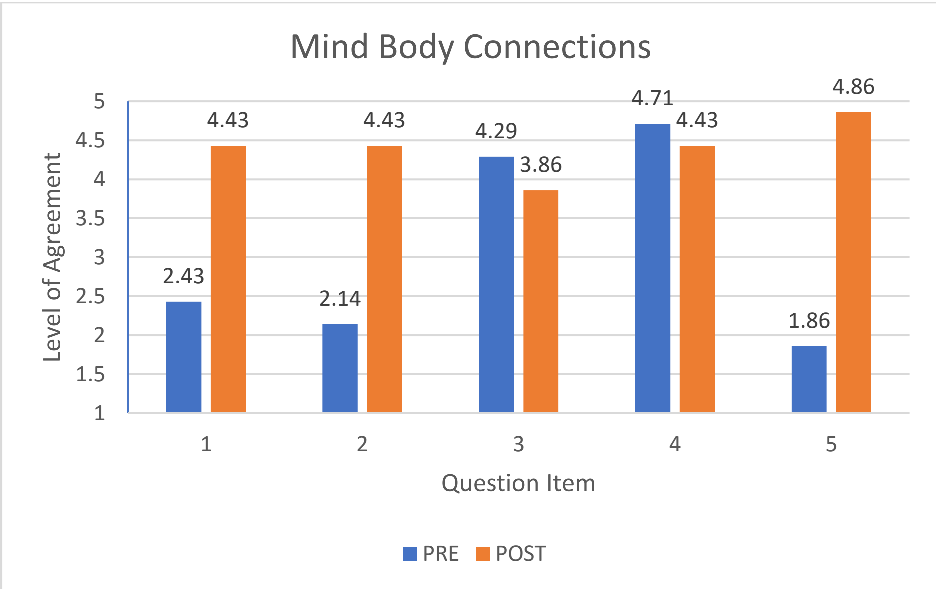
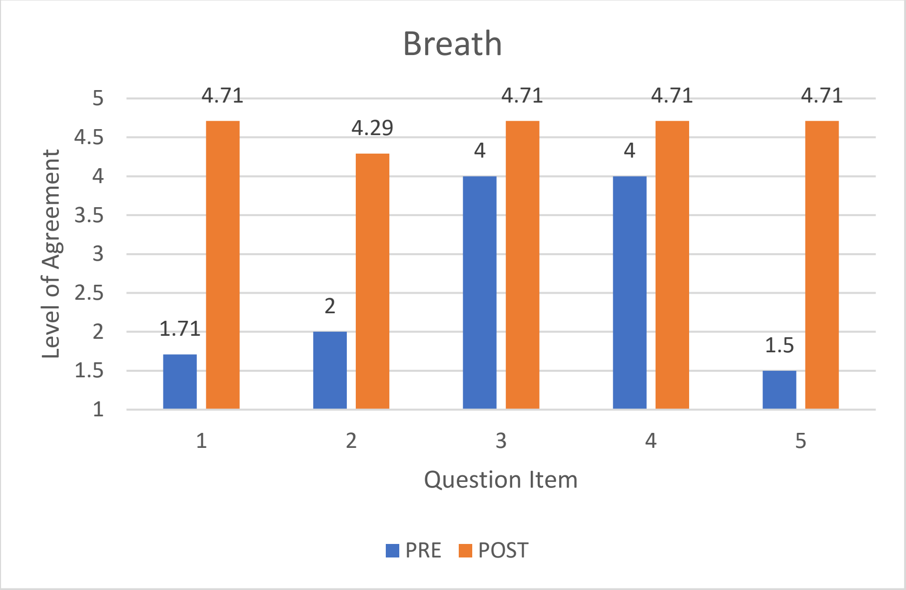


Figure 22

Mean levels across 5 Questions: Breath



6.8.1.5. Readiness for Implementation. This section presents findings from the readiness-for-implementation questionnaire (Appendix N), completed by six of the seven participants at the end of the final workshop in phase one. The data (Figure 23, Table 7) reflect self-reported preparedness before intervention delivery and help address phase one RQ2 and the Overarching RQs 1 and 4.

Only six participants completed the questionnaire and rated their understanding of the intervention at 4, indicating consistently high comprehension of key concepts and practices. Confidence ratings ranged from 3 to 4 (M = 3.67, SD = 0.52), suggesting that most teachers felt reasonably confident, while two reported only moderate readiness, highlighting some variability. Perceived resource availability received a high score (5), implying no concerns regarding materials, time, or logistical support. Likewise, all participants rated anticipated challenges at 5, indicating either strong preparedness or possibly under-recognised implementation complexity.

Perceptions of training and support varied: three participants rated this area 5, two 4, and one 3 (M = 4.33; SD = 0.75). While overall satisfaction was high, this spread indicates differing experiences and suggests a potential need for tailored follow-up support. Insights from the post-workshop FG Section 6.82 shed light on individual differences in confidence and preparedness. These data strands contribute to phase one RQ2 by demonstrating that perceived readiness is influenced not only by content exposure but also by relational and contextual factors.

High ratings for understanding, resources, and challenge-readiness ratings suggest readiness. However, the limited variability in confidence and training satisfaction, paired with uniformly high scores for anticipated challenges, may reflect an early-stage over-optimism or limited awareness of real-world barriers. These quantitative findings align with the qualitative themes, in which enthusiasm was coupled with time-related concerns and recognition of variability in pupil responsiveness. As such, the readiness data serve as an early indicator of implementation feasibility and surface important areas to consider in phase two, particularly around confidence consolidation, support needs, and fidelity across varied classroom contexts.

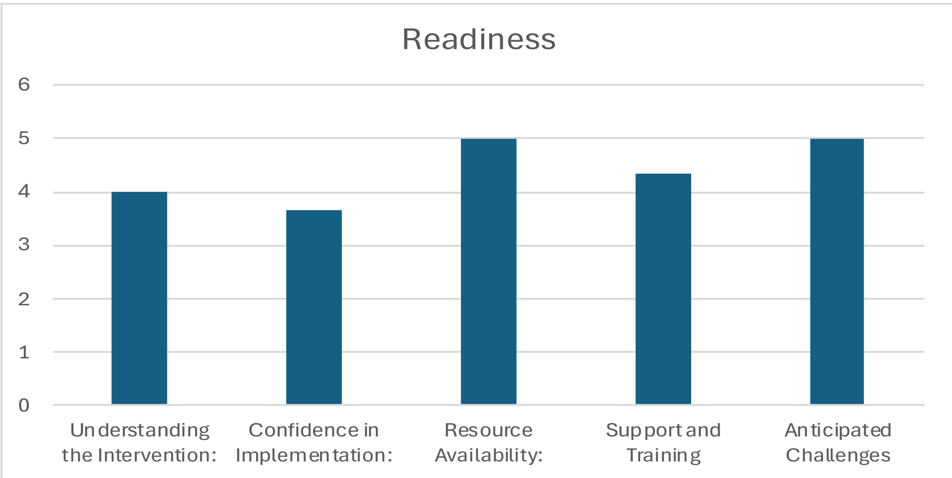
Table 7

Readiness for Implementation: Descriptive Statistics Across Constructs (n = 6)

Construct	M	SD
Understanding of the Intervention	4.00	0.00
Confidence in Implementation	3.67	0.52
Resource Availability	5.00	0.00
Support and Training	4.33	0.75
Anticipated Challenge Preparedness	5.00	0.00

Figure 23

Readiness for Implementation Across Five Readiness Constructs



Note. Items rated on a 5-point Likert scale (1 = not at all ready, 5 = completely ready). Only six participants completed the questionnaire following Phase one training. SD = standard deviation.

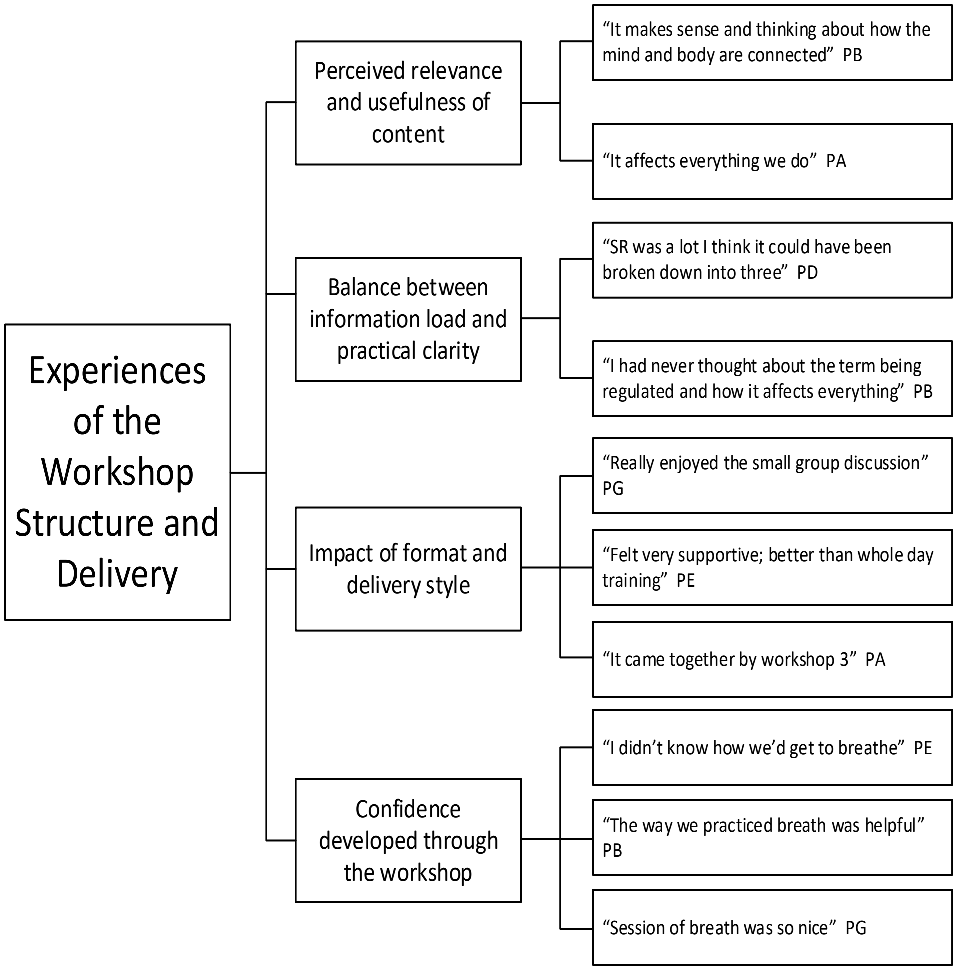
6.8.2 Qualitative Analysis of Phase One: Teacher FG

Following the workshops, an FG was conducted with participating teachers. Thematic analysis identified five overarching themes that supported and extended the questionnaire findings (section 6.8.1). These findings address the phase one research questions and inform broader questions about implementation fidelity and feasibility. Each theme is accompanied by a diagram illustrating its sub-themes and representative quotes (Figures 24–28). To illustrate the breadth of perspectives among the five participants, representative quotations in the figures are labelled with anonymised participant identifiers (P-A, P-B, P-D, P-E, and P-G).

6.8.2.1 Experiences of Workshop Structure and Delivery (Figure 24) Teachers described the workshops as relevant, well-structured, and valuable, aligning with questionnaire findings on perceived usefulness. While participants appreciated the clarity and organisation, several noted that the SR component felt dense and information-heavy: *"*It is so relevant, it could be over three sessions, it is just so much, and I did not know how it was going to translate into my class" (P-G). This reflected the tension between conceptual understanding and practical application. Although Likert scale scores indicated increased confidence and knowledge, the discussion revealed more nuanced reflections, highlighting that the depth of understanding varied across participants.

Figure 24

Theme: Experiences of the Workshop Structure and Delivery

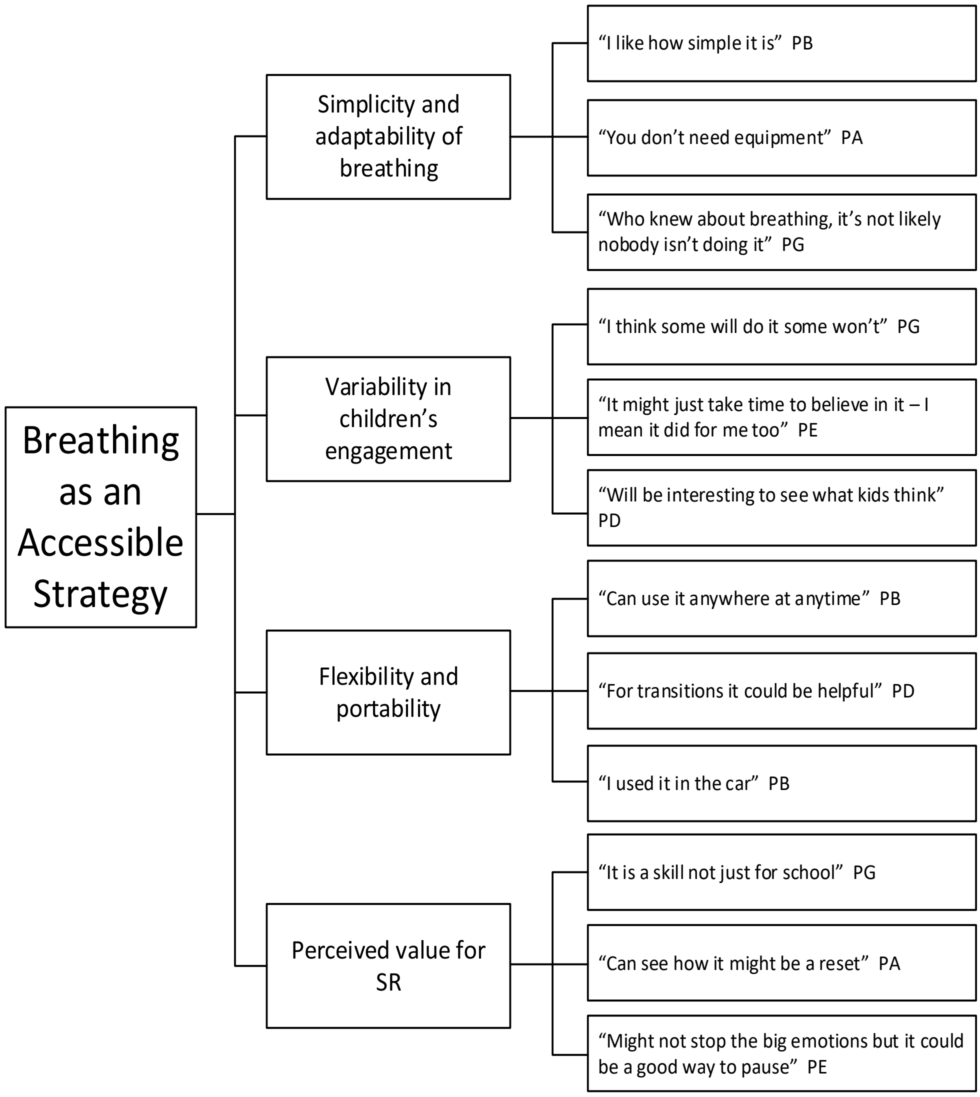


Note. P = Participant

6.8.2.2 Breathing as an Accessible Strategy. (Figure 25) Teachers found breath exercises to be accessible, flexible, and suitable for a variety of classroom settings. "It can be done anywhere" (P-B). This supported their confidence in using these exercises. Some noted that not all children would participate, suggesting possible variability in engagement, which addresses phase one RQ2 and contributes to the overall feasibility question. Alternatives like drawing or colouring were suggested. Teachers linked breathing exercises to SR and reflected on how the workshop structure strengthened this connection. They described feeling more confident in the exercises after practice in workshop 3, recognising that personal use would improve classroom delivery. One participant (P-B) noted, "Pre-emptive, not reactive regulation," illustrating perceived benefits. A contrasting view expressed concerns about engagement: "I am not sure all pupils will stay engaged, especially the challenging ones" (P-G). These perceptions directly address phase one RQ2 and the broader feasibility question. These are expected, not observed, outcomes; phase two will determine whether expectations align with classroom data.

Figure 25

Theme: Breathing as an Accessible Strategy

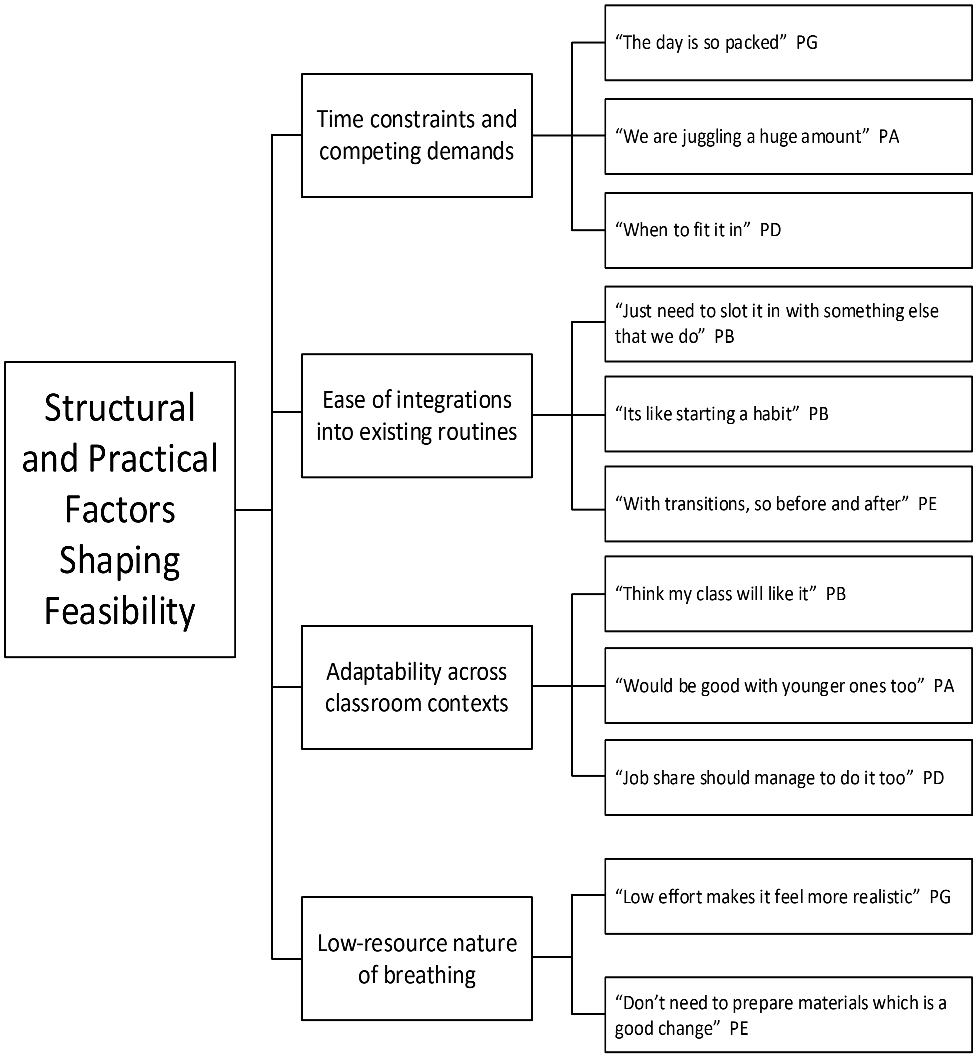


Note. P = Participant

6.8.2.3 Structural and practical Factors Shaping Feasibility. (Figure 26) The ease of integration and minimal resource demands were recognised as facilitators, supporting questionnaire findings of high perceived usability. Lower confidence was associated with structural constraints such as timetabling and curriculum pressures. Rather than a lack of belief in the exercises, these reflections highlighted practical tensions between intention and implementation. This theme addresses phase one RQ2, showing how feasibility depends not only on the intervention's design but also on the broader operational realities of schools. In doing so, it contributes to overarching RQ4, emphasising contextual barriers that may affect implementation fidelity in phase two.

Figure 26

Theme: Structural and Practical Factors Shaping Feasibility



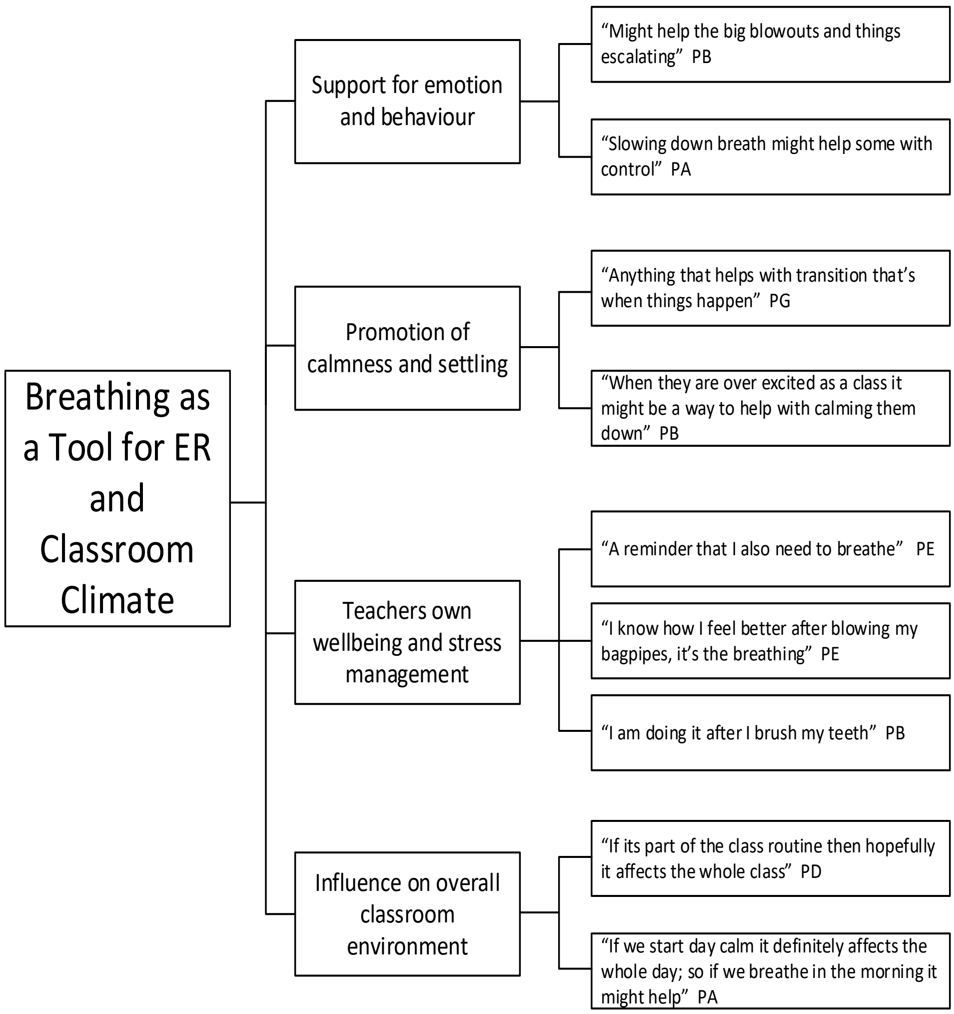
Note. P = Participant

6.8.2.4 A tool for ER and Classroom Climate. (Figure 27) Teachers anticipated key benefits, including improved pupil SR, a calmer classroom, and increased personal control, addressing phase one RQ2 and contributing to overarching questions regarding implementation (overarching RQs 1 and 2). One predicted a calmer classroom: "I hope it helps the class stay calmer" (P-A). Another anticipated greater personal control: "I already feel more in control of my reactions" (P-E). Teachers also described breath exercises as a mechanism for pre-emptive regulation rather than reactive behaviour management: "It should help pupils and me regulate before things escalate" (P-B).

While most anticipated positive outcomes, a few expressed concerns about sustaining pupil engagement over time: "I am not sure all pupils will stay engaged, especially the ones who struggle most" (P-G). This variability highlights how contextual factors may shape confidence in the effectiveness of interventions. These anticipated outcomes reflect perceived value and align with implementation science principles: expectations can support initial fidelity but may also lead to disappointment if outcomes are not realised. These are predicted outcomes; phase two will examine whether they are realised in practice.

Figure 27

Theme: Breathing as a Tool for ER and Classroom Climate

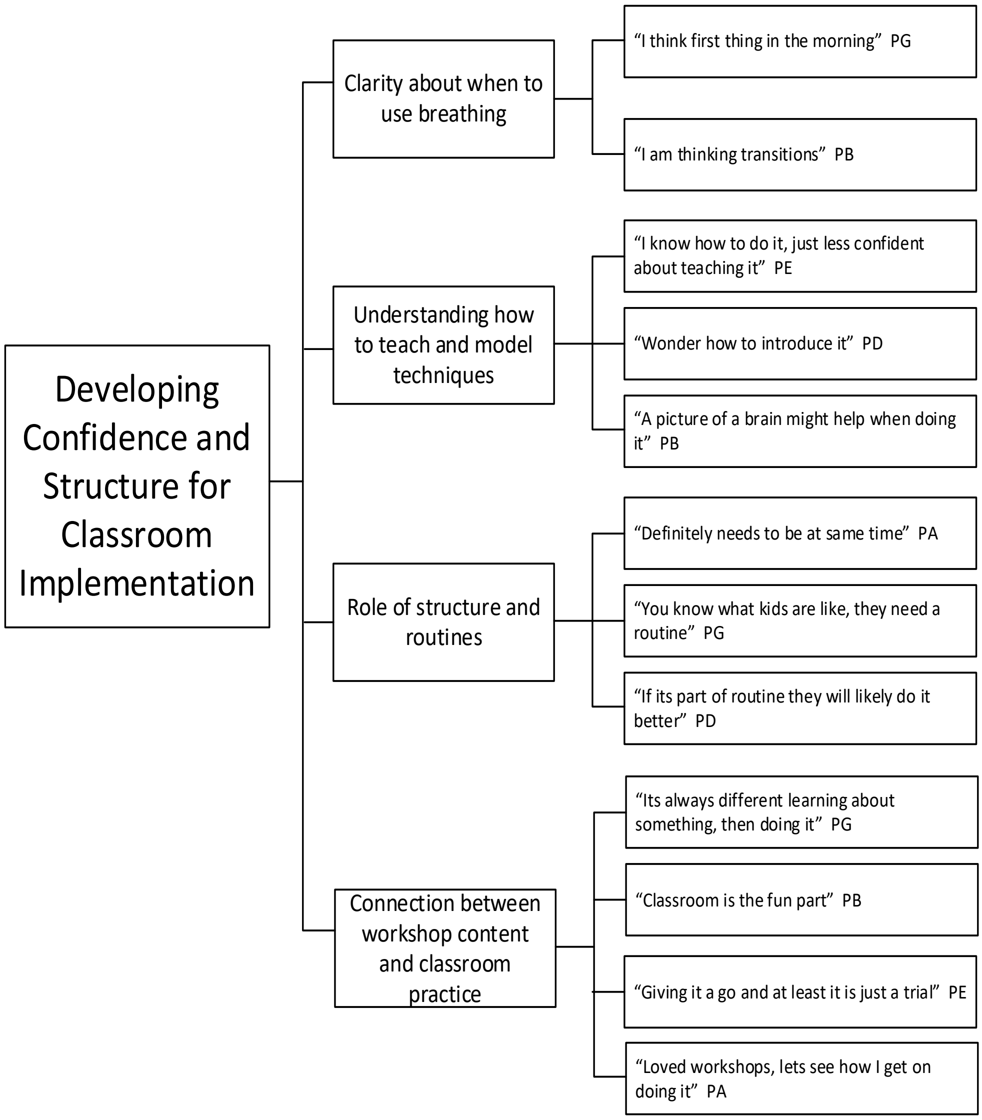


Note. P = Participant

6.8.2.5 Developing Confidence and Structure for Classroom Implementation. (Figure 28) A shared implementation plan emerged from the FG, proposing three daily breathwork sessions (morning, post-break, and post-lunch). This consensus reflected a practical interpretation of the training and perceived feasibility, aligning with the quantitative increases in confidence and perceived feasibility. Co-constructing the plan indicated shared belief in the value of consistency while recognising the need for contextual flexibility. However, limited discussion of anticipated barriers, despite acknowledgement of time constraints, suggests a potential mismatch between perceived readiness and practical realities. Enthusiasm was high, though assumptions persisted about integration into established routines.

Figure 28

Theme: Developing Confidence and Structure for Classroom Implementation



Note. P = Participant

These findings address phase one RQ2 by demonstrating a strong initial commitment to implementation and contribute to overarching RQ1 and RQ4 by highlighting areas where fidelity and sustainability might be challenged in phase two. Overall, the FG extended questionnaire findings, showing knowledge and confidence (phase two RQ1), translated into shared intentions for classroom delivery, while revealing contextual and relational factors such as time constraints, pupil variability, and personal resonance that affect feasibility (phase one RQ2; overarching RQs 1 & 4).

Phase one offered insights into both conceptual readiness and practical preparedness, establishing a shared foundation while emphasising structural and contextual factors likely to influence delivery. Thematic patterns with individual confidence improvements and system constraints provide a baseline for monitoring phase two fidelity and feasibility. Implications for phase two: early fidelity support, lightweight implementation tracking, and strategies to engage reluctant pupils will be needed to maintain adherence and sustainability.

6.9 Chapter Summary

Chapter 6 presented findings from phase one, examining the feasibility, acceptability, and teachers' readiness to implement breath-based practices. Quantitative results showed increases in teachers' knowledge, understanding, and confidence in SR, MBCs, and breathwork. Teachers reported motivation and recognised the practical relevance of the workshops for supporting children's SR in classrooms. FG data provided deeper insight into teachers' perceptions, emphasising the value of the experiential approach, the accessibility of breathwork, and potential barriers including time pressures, workload, and integration of new practices into existing routines. The chapter also addressed the co-design of the implementation plan, ensuring alignment with the context and adherence to core components. Overall, phase one findings indicated sufficient readiness to progress to classroom implementation with appropriate support.

Chapter 7: Phase Two Methodology & Results

7.1 Introduction

Phase two focuses on implementing and assessing the effectiveness of the breathing exercise intervention within the classroom. This stage supports the overall research objectives by exploring how well the intervention becomes integrated into daily school routines and how effective it is in improving children's SR and engagement. In this study, SR is defined as the ability to manage one's physiological, emotional, behavioural, and cognitive responses to environmental demands; the intervention mainly emphasises calmness as a proxy for ER.

As a pilot study, phase two aims to explore how breath exercises can be effectively implemented and identify the contextual factors that support or hinder their integration. This understanding is crucial for guiding the sustainable design, delivery, and scaling of similar school interventions.

Only teachers who found the intervention accessible, acceptable, and manageable in phase one chose to incorporate it into their classrooms. Teacher self-selection was employed to support implementation fidelity, based on the belief that voluntary participation would encourage greater commitment and consistency.

The study emphasised the practical use of the intervention in real classroom settings, examining how breath exercises were integrated into routines, how often they were delivered, and their perceived value in supporting children's SR and engagement. Pre- and post-exercise measures captured both immediate and lasting effects, complemented by observational data and qualitative insights from teacher and child FGs. Collectively, these data offered a comprehensive understanding of the intervention's reception, challenges, and contextual effectiveness.

Overall, phase two provided evidence on the feasibility, consistency, and broader relevance of classroom-based breath exercises in promoting children's SR and engagement.

7.2 Rationale

Phase two investigated the effectiveness and implementation of breathing exercises in the classroom, following the preparation and training in phase one. Building on the insights gained, phase two evaluated the immediate and sustained impact, practical application, and the fidelity of delivery to assess both the mechanisms of change and the contextual factors influencing success in classroom settings.

7.2.1 Implementation of Fidelity

Phase two assessed the fidelity of intervention delivery, examining how consistently teachers implemented the breath exercises as planned in phase one. This ensured the intervention's integrity and that observed outcomes could be attributed to its intended application. Fidelity data examined alignment between classroom practice and the intervention framework, ensuring consistency across participants, which is key to understanding the relationship between adherence and outcomes (Carroll et al., 2007). High fidelity enhances internal validity and assists in determining which intervention elements are essential versus adaptable, guiding future scalability.

7.2.2 Immediate Effect on Children

The study explored the immediate effects of breath exercises on SR, particularly ER, and on children's subjective well-being before and after the practice. This assessment was crucial for understanding the short-term impact of the exercises and whether they helped children achieve a calmer classroom environment. Examining these quick results aimed to identify early success indicators that could guide future teacher involvement and policy choices (Weare & Nind, 2011). In school-based interventions, like in this study, early impact motivates teachers and children and shapes perceptions of usefulness, which can influence ongoing implementation (Domitrovich et al., 2008).

7.2.3 Teacher and Children's Experiences

The intervention explored the lived experiences of teachers and children, focusing on their motivation to continue breathing exercises after the intervention and whether children enjoyed them. Understanding user experience is crucial, since pupil engagement and teacher support are vital factors influencing the sustainability and long-term success of interventions (Domitrovich et al., 2008). Teachers' perspectives also reveal implementation barriers and enablers that are often invisible in quantitative outcome data alone.

7.2.4 Feasibility in the Real World

Phase two evaluated the practical aspects of integrating breathing exercises into classroom routines, including their timing, frequency, and adaptability to classroom demands. The insights informed the refinement of the intervention to maximise its feasibility and relevance to classroom settings. Assessing feasibility is a crucial step in intervention development, ensuring that what is effective in principle can also be implemented in practice (Moore et al., 2015). Interventions in schools must consider practical constraints, such as curriculum time and classroom management, to ensure they are accepted and sustainable.

7.3 Mixed Methods Methodology

Phase two used a mixed-methods approach aligned with the overall research framework outlined in chapter 5, reflecting the dual aims of assessing effectiveness and feasibility. This design explored intervention outcomes and participant experiences in classroom settings.

Quantitative data were gathered through pre- and post-exercise self-ratings completed by children, teacher fidelity monitoring, and classroom observations. The self-ratings measured immediate changes in SR, specifically ER and calmness, while fidelity monitoring assessed adherence and consistency in performing the breathing exercises. Observations offered contextual insights into how the exercises were incorporated into classroom routines and how children responded in real time. Qualitative data were collected through post-intervention FG with teachers and children to explore perceptions of usefulness, enjoyment, and barriers and enablers to implementation.

A convergent parallel design was used, with quantitative and qualitative data collected separately but analysed together to find similarities and differences in outcomes and experiences. This combination enabled a detailed understanding of the intervention's effectiveness, feasibility, and how context influences outcomes, supporting targeted improvements and guiding potential expansion.

7.3.1 Research Questions: Phase Two

Does the proportion of children reporting a calm state increase immediately after each breathing session compared to before? The proportion was assessed immediately before and after each breathing session. Calmness was dichotomised from emoji diary ratings: the calm emoji (😐) was coded as 1, and all others as 0. McNemar's test was applied to these paired nominal data, with discordant pairs (pre-post) contributing to the test statistic and ties (pre = post) excluded from the calculation.

Does the proportion of children reporting calmness increase during the intervention? Self-reported calmness ratings from diary entries at the start, midpoint, and end of the intervention were analysed using Cochran's Q test to evaluate changes in dichotomous responses across the three time points. This non-parametric test is suitable for repeated binary outcomes within the same group.

Does implementation fidelity affect the effectiveness of the breathwork intervention? Fidelity was monitored using teacher checklists, recording frequency, duration, and the techniques used. FGs with teachers and children provided insights into execution, factors influencing fidelity, and perceived impact on calmness.

What are children's and teachers' experiences with breath exercises, and what factors affect their acceptability? FGs provided insight into beliefs, attitudes, and contextual influences shaping these perceptions.

7.5 Measures and Analyses

7.5.1 Quantitative Data Collection and Analysis

7.5.1.1. Children's Diaries Data Collection. Children used diaries to record their feelings immediately before and after engaging in the breath exercises in the classroom, providing real-time, self-reported insights into the intervention's impact on ER. This method aligned with Lundy (2007) conceptualisation of meaningful child participation, placing children's experiences at the heart of the evaluation process, while supporting developmentally appropriate, ethically grounded data collection (Kirk, 2007; Punch, 2002).

A log-type diary (Appendix O) format was employed, using predefined emotional states represented by emojis: Happy (😊), Calm (😐), Anxious (😕), Angry (😠), Sad (😢), Stressed (😬), Tired (😴), or Other (🤔), with space for specification. The calm emoji (😐) was coded as 1 and all others as 0 for quantitative analysis. These options were designed to capture a broad spectrum of emotional responses and provide a nuanced understanding of the breathing exercises' immediate impact on ER. This design maximised accessibility, minimised cognitive burden, and enabled children to actively report their emotional states in a child-friendly, engaging manner, supporting meaningful child participation (Arndt & Rose, 2023; Lundy, 2007).

Children completed diaries to rate their emotions in a child-friendly and accessible format, providing longitudinal data on the immediate and cumulative effects of the breathing exercises over the 8-week intervention (Iida et al., 2012; Nezlek, 2012). The 8-week duration of the intervention aimed to provide information in two key areas:

Immediate effect: Children recorded their feelings twice during each data collection session, immediately before and immediately after the breathing exercise, allowing assessment of immediate changes in ER.

Changes over time: Diaries also tracked shifts in emotional state across the intervention. To minimise disruption to classroom routines, entries were scheduled at three key points: start, midpoint, and end. These intervals were considered feasible by teachers based on phase one feedback and align with common practice in school-based interventions (Felver, 2016). Cumulative data were collected during week 1, weeks 3-4, and the final week, enabling analysis of longer-term changes in ER. Diary administration procedures were explained to teachers in Workshop 3.

Diary data were triangulated with teacher fidelity logs and qualitative FG data, combining objective indicators of implementation with children's subjective experiences. This mixed-methods approach offered a comprehensive understanding of how breath exercises influenced ER in classroom settings, enhancing both validity and depth of the findings.

7.5.1.2 Children's Open-Ended Diary Questions. To capture children's personal experiences with the breathing exercises, three open-ended questions were included in the diaries (Appendix O):

1. What did you like about the breathing exercises?
2. What could have made the breathing exercises better
3. Any other comments or drawings about the exercises?

These questions aimed to gather insights into children's preferences, engagement, and suggestions for improvement. Their responses complement the quantitative diary ratings, helping to contextualise emotional changes through children's narratives. This approach seeks to improve understanding of how children experienced and interpreted the intervention, supporting a child-centred evaluation framework.

These items were created to enhance quantitative diary ratings by adding context and interpretation. They sought to gather children's views on enjoyment, engagement, and relevance, providing qualitative insights alongside self-rated data. Open-ended prompts reinforced the study's child-centred approach and supported the mixed-methods framework by ensuring children's voices contributed to understanding their emotional reactions.

7.5.1.3 Teacher Diary. Fidelity, defined as the consistent and intended delivery of the breath exercises (e.g., three times a day), was monitored through a daily checkbox diary completed by teachers. As teachers served as both implementers and data collectors, the risk of observer bias or selective reporting was recognised. To address this, diary data were triangulated with teacher and child FG, which offered an independent qualitative source to verify implementation patterns and provide contextual insights.

The diary format (Appendix P) included simple daily checkboxes to record deliveries, along with brief free-text fields for observations. Teachers were encouraged to comment on engagement, time constraints, and classroom atmosphere, for instance, "The class was noticeably calmer after the exercise," or "It was difficult to settle the group due to a noisy transition." This concise design supported feasibility within the busy classroom routine while still enabling the collection of naturalistic data on implementation and response.

Teachers documented observations in real time, providing insights into how the intervention was carried out across different classroom settings. Although the simplified diary format was designed to fit within time limits, it reduced the detail and consistency of qualitative entries. Since teachers acted as both implementers and data collectors, the risk of positive bias or under-reporting was recognised. To address this, diary data were triangulated with teacher and child FGs, which offered more detailed contextual information to verify implementation patterns and interpret perceived effects.

Fidelity monitoring can be particularly challenging for "outsider" educational researchers (Arndt & Rose, 2023). Accordingly, the design prioritised practicality and minimal disruption to teaching routines (Nezlek, 2012). Observational notes were descriptively summarised to identify recurring themes relating to dosage, adherence, engagement, and classroom atmosphere.

7.5.1.4 Usage Rating Profile for Intervention Implementation (URP-I) As part of the implementation science focus, data collection examined the extent and quality of intervention delivery (Appendix Q) and, importantly, identified potential barriers and facilitators to long-term use. To capture these factors, the Usage Rating Profile for Intervention (URP-I) was administered at the end of phase two, immediately following the 8-week intervention. This timing allowed teachers to reflect on their experiences of implementing and maintaining the breath exercises, highlighting potential barriers and facilitators to long-term use.

Originally developed to identify factors that promote or inhibit the adoption and continued use of school-based interventions (Chafouleas et al., 2009). The URP-I was selected to evaluate whether the breathing practices could be embedded as routine classroom strategies rather than short-term activities. While assessing effectiveness was important, sustained integration into daily classroom practice was central. The instrument also provided teachers with a structured opportunity to reflect on their implementation processes.

Framing the translation of evidence into classroom practice as a process-oriented challenge (Fixsen et al., 2009). The study used the URP-I to assess overall factors influencing implementation, rather than those related to a single programme.

Teachers completed the URP-I to assess their perceptions of the intervention's practicality and feasibility. The collected data offered measurable insights that complemented the FG's qualitative findings, providing a more complete picture of both real-world application and personal experience.

Measures that are intervention-general are preferable to those that are intervention-specific (Briesch et al., 2013). Since this study was a small-scale pilot, subscale interpretation was regarded as exploratory rather than confirmatory, reflecting caution when applying psychometric findings from larger-scale validations to a limited sample. The researcher aimed to provide insights into the intervention's successful and unsuccessful aspects and to offer recommendations for adapting the pilot study to facilitate its incorporation into routine practice.

Treatment acceptability alone does not entirely predict intervention success; the original tool was revised to measure better factors influencing adoption and maintenance (Briesch et al., 2013). The revised instrument includes six sub-scales: acceptability, understanding, feasibility, family-school collaboration, system climate, and system support. Each subscale assesses a different aspect of implementation. Prior factor-analytic studies have validated the tool's psychometric reliability. Additionally, all subscale correlations stayed below 0.85, demonstrating adequate discriminant validity (Briesch et al., 2013). For example, the weakest correlation was observed between acceptability and system support ($r = -0.03$), suggesting that valuing the intervention does not necessarily imply strong support from the school system. Conversely, the strongest correlation was found between acceptability and system climate ($r=0.82$), suggesting that how well the intervention fits the school environment likely affects its perceived acceptability. The family-school collaboration subscale showed the weakest correlations with other measures (range = -0.02 to 0.15), likely because the importance of family involvement varies across interventions.

The URP-I form was used to evaluate teacher perceptions of the breathing intervention using 29 questions Likert-scale items (1 = strongly disagree to 6 = strongly agree), divided across the six subscales as follows:

- Factor I: Acceptability (9 items)
- Factor II: Understanding (3 items)
- Factor III: Home-School Collaboration (3 items)
- Factor IV: Feasibility (6 items)
- Factor V: System Climate (5 items)
- Factor VI: System Support (3 items)

The URP-I was viewed as a helpful tool for identifying potential barriers and facilitators to implementing and maintaining interventions. Minor adjustments to language and terminology were made to ensure clarity and contextual appropriateness for Scottish teachers.

To supplement the questionnaire data and gain deeper qualitative insights, a follow-up FG was conducted. Emerging themes from the URP-I responses were used to inform and refine FG prompts. During analysis, data from both sources were compared side by side to explore convergence and divergence in teachers' perceptions, strengthening the mixed-methods framework and supporting a robust understanding of implementation processes.

7.5.1.4 Coaching Support with Teachers. Coaching support was included in the implementation strategy to improve fidelity and troubleshoot challenges. It is a key driver that supports the fidelity and sustainability of evidence-based practices through structured, context-specific guidance (Fixsen, 2005). This study's coaching sessions offered a collaborative environment for reflection, addressing challenges, and adaptive implementation, aligning with implementation science principles (section 3.8.2).

Two voluntary online sessions were held via Microsoft Teams after school in Weeks 2 and 5 of the intervention. These sessions encouraged open discussion and peer exchange, guided by structured prompts addressing:

- Implementation successes and challenges
- The suitability of workshop materials or procedures
- Barriers affecting the delivery of exercises
- Progress with diary completion

Notes from these sessions were used solely to support formative adjustments and were not included in formal data analysis. Discussions remained flexible to foster reflective, supportive professional dialogue.

7.5.2 Qualitative Data Collection

Given the informal and supportive nature of the coaching discussions, no formal or thematic analysis was conducted. Sessions were not recorded; instead, the researcher took notes, which were summarised descriptively to identify recurring issues and reflections in response to discussion prompts. The main aim of these sessions was to offer implementation support and promote reflective dialogue, not to produce research data. Insights were used formatively to make minor procedural refinements, ensuring ongoing fidelity and feasibility in the classroom.

FG discussions examined teachers' views and reflections on the intervention, organised around four key domains: fidelity (adherence to the intended structure and any adaptations), feasibility (practicality of fitting activities into existing schedules), acceptability (perceived value, relevance, and sustainability), and effectiveness (visible improvements in children's SR and the classroom environment). The FG was led by the researcher, who took a reflexive stance to reduce potential bias linked to her dual role as facilitator and intervention designer. Detailed notes were taken to improve transparency and minimise interpretive bias. Analysis focused on identifying facilitators and barriers to implementation, along with practitioner-driven recommendations for maintaining and improving the approach in future iterations.

7.5.2.1 Children FG. Children from each of the four classes were asked to discuss the intervention's effectiveness, feasibility, and acceptability. Holding one FG per class enabled participation from all classes and helped identify common themes and contextual differences.

Including one FG from each of the four classes ensured that the qualitative dataset captured a wide range of experiences across different implementation contexts. In line with Braun and Clarke's reflexive thematic analysis, the study did not seek data saturation as a methodological endpoint, as saturation is not regarded as a requirement within this approach (Braun & Clarke, 2021). Instead, the adequacy of the dataset was assessed based on the richness, relevance, and patterned meaning of the accounts generated across the four FGs.

Each FG included six to eight children, consistent with guidance on optimal group size to support interaction and reflection (Krueger, 2014). While the rationale was similar to that of teacher groups, sessions were adapted to be age-appropriate, accessible, and ethically robust, aligning with the Lundy model of child participation, which emphasises giving children an active voice.

Participants were selected from a group of children who had given assent and for whom parental consent had been obtained (Appendix E-G). During a classroom visit, those interested in participating raised their hands, and their names were placed in a hat; participants were then randomly chosen to ensure fairness and to minimise potential selection bias. To ensure developmental appropriateness, FG questions (Appendix R) were informally reviewed by the class teachers, resulting in minor wording adjustments to improve clarity and accessibility.

FGs were held in a quiet space within the school and conducted in line with ethical best practice for research with children, including clear explanation of assent, confidentiality, and participation rights in age-appropriate language. The researcher fostered a relaxed, non-hierarchical atmosphere to minimise power imbalances (Sun et al., 2023). Neutral, open-ended questions and prompts such as: "Can you tell me more about that?" "Does anyone want to add anything else?" Emphasis was placed on the value of all perspectives and the absence of 'right' or 'wrong' answers.

Discussions examined children's experiences, perceptions of effectiveness, and engagement with the breathing exercises intervention: Effectiveness and Impact: helpfulness, emotional, focus, behavioural changes, and practical contexts. Engagement and Feasibility: enjoyment, preferred/disliked exercises, ease in class, and session frequency. Connection to SR and future use: exercises outside school, benefits for calming/concentration, willingness to continue in class.

7.6 Analysis Phase Two

7.6.1 Quantitative: Children's Diaries

This section examines whether breathwork exercises enhanced children's calmness both immediately (from pre- to post-breathing) and over time (across the start, middle, and end of the intervention). Calmness is a key SR skill that supports emotional control, attention, and adaptive behaviour in classroom environments (Blair & Raver, 2015). During phase one of the FG, teachers identified calmness as a primary desired outcome of the intervention. Emphasising both momentary and sustained regulation throughout the school day.

To examine whether breathwork induced calmness, the analysis focused on changes in the proportion of children reporting calmness across multiple time points rather than on mean emotional scores. This choice reflects the study's interest in identifying an increased prevalence of calmness across the group, rather than detecting small shifts in average affective states, which would require parametric assumptions incompatible with the data structure.

Calmness was coded as 1, and all other responses as 0, generating binary data suitable for nonparametric analysis. Cochran's Q test, a dichotomous equivalent of the Friedman Test, was used to account for within-subject dependency arising from repeated measures on the same participants across three time points (start, middle, and end of the intervention). This method isolates changes attributable to the intervention while controlling for individual variability (Landerman et al., 2011).

Collapsing multiple emotional states into a binary variable was theoretically and analytically justified. The intervention's explicit focus was on eliciting calmness, making this outcome the most meaningful indicator of SR change and directly addressing the study's central research questions. While this simplification inevitably reduces emotional nuance, it enables a more precise, group-level evaluation of whether children transitioned into a calm state following breathwork. A reflexive discussion of this limitation and its implications for interpretation is provided in Section 6.4.4.

7.6.2 Rationale for Statistical Analysis

Given the categorical nature of the data (nominal, not interval or ratio) and the small sample size (N = 22 children), non-parametric tests were selected. The data did not meet the assumptions required for parametric tests, such as normality or homogeneity of variance. Normality assumes data follow a bell-shaped distribution, and homogeneity assumes similar variance across groups. Non-parametric methods do not depend on these assumptions and are more robust when working with small samples and dichotomous outcome variables.

To examine change over time (from the start to the middle and end of the intervention), Cochran's Q test was used. This test is the non-parametric equivalent of a repeated-measures ANOVA for binary data and is suitable for assessing categorical changes across three or more related time points (Stephen & Ahmad Zaidi Adruce, 2018). Although the sample size was small, the recommended minimum of 16 cases for Cochran's Q validity was met.

To examine the immediate impact of the breathwork (pre- vs post-exercise), McNemar's test was applied. This test is designed to compare paired nominal data and capture within-subject changes in binary outcomes. Cochran's Q is effectively a generalisation of McNemar's test across multiple time points (Mason et al., 2022). Both tests assume independence of observations within each time point, which was accounted for through the data collection design.

A within-subjects design was used, involving the same group of children assessed at all time points. This method enhances internal validity by accounting for individual differences, enabling reliable conclusions even with a small sample size. The binary outcome, whether a child reported feeling "calm" (coded 1) or "not calm" (coded 0), was consistently used.

Figure 29 summarises the analytical process, from converting diary entries into binary data to choosing suitable non-parametric tests and visually depicts children's emotional states before and after each breathing session.

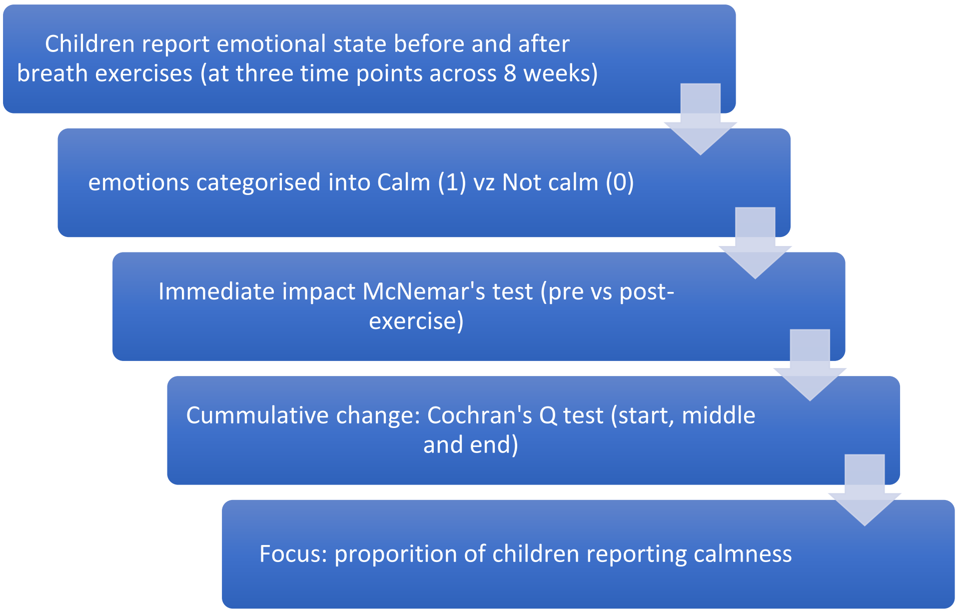
This analysis directly addresses the research questions outlined in Section 7.3.1:

- Did the proportion of children reporting calmness increase as the intervention progressed?
- Was there a cumulative effect over time?
- Did each breathing session produce immediate calmness in children?

Although the primary focus was calmness, all emotional states were recorded. While this section captures short-term impacts of breathwork on ER, it also lays the groundwork for future longitudinal analyses on SR development over time.

Figure 29

Overview of Data Transformation, Non-Parametric Analyses and Pre- to Post-Session Emotional States



7.6.3 Cochran Q

Cochran (1950) developed the test Q to compare proportions in matched samples involving more than two dichotomous dependent variables. It tests whether related binary distributions are statistically similar (null hypothesis) or differ across time points or conditions (Mason et al., 2022).

The Cochran Q test was used to determine whether the proportion of children reporting calmness changed significantly across three time points: start, middle, and end of the intervention. This approach addressed the research question about the sustainability of breathwork effects within the classroom setting and whether a cumulative calming effect developed as the programme progressed.

As a non-parametric test for related samples, Cochran's Q is suitable when comparing proportions across more than two repeated binary measurements. It is the categorical equivalent of a repeated-measures ANOVA. However, it does not assume normality, interval scaling, or homogeneity of variance, conditions that are not met due to the small sample size and the categorical nature of the data.

The null hypothesis for Cochran's Q test assumes no difference in the proportion of children reporting calmness across the three time points. The alternative hypothesis suggests a significant shift at least one time point, indicating a change in the frequency of calmness over the course of the intervention.

The null hypothesis stated that there was no difference in calmness across the three time points. Meanwhile, the alternative hypothesis proposed a significant change in at least one period, suggesting a temporal shift in calmness throughout the intervention. The within-subjects design improved internal validity by controlling for inter-individual variability, thereby supporting robust inference despite the limited sample size.

To meet analytical requirements, children's emotional states were categorised as "calm" or "not calm". This simplification enabled alignment with the study's aim but may not fully capture the complexity of children's emotional experiences. Future research should examine more detailed emotional categories to better represent the range of ER and its connection to self-regulatory development over time.

7.6.4 McNemar Test

McNemar's test, designed for paired nominal data, was used to evaluate the immediate impact of each breathing exercise by comparing each child's pre- and post-session calmness. This measured within-subject changes in binary outcomes ("calm" vs. "not calm") and addressed the research question: did the breathing exercises produce an immediate calming effect?

The test also compared pre-exercise states across different time points (e.g., pre-start vs pre-middle, pre-start vs pre-end) to identify shifts in baseline calmness, suggesting possible sustained benefits of the intervention. Used alongside Cochran's Q, McNemar's test offered complementary insights: Cochran's Q captured cumulative changes across the intervention, while McNemar's test isolated effects specific to each session. Together, these tests enabled the analysis of both short-term impacts and longer-term patterns in children's emotional SR.

7.6.5 Quantitative: Teacher Diary

The researcher examined quantitative data on intervention fidelity and classroom observations to offer a picture of the intervention's implementation and impact.

Quantitative fidelity data were collected through daily teacher diaries, in which teachers recorded implementation using a simple tick-sheet format (tick/no tick) to indicate whether breathwork exercises were completed as planned (Appendix P). This straightforward method provided precise compliance data. Descriptive statistics were analysed for overall implementation rates and patterns during the eight-week intervention.

This approach helped track changes in engagement, providing insights into consistency and identifying potential barriers to sustained use.

7.6.6 Usage Rating Profile for Intervention Implementation (URP-I)

Responses to the URP-I were summarised using descriptive statistics, with means and standard deviations calculated for both individual items and subscales to identify perceived strengths and challenges.

Due to the exploratory nature of the study and the small sample size, inferential statistics were not used. Instead, differences across subscales were examined to inform possible improvements to the intervention and to guide future implementation.

7.6.7 Qualitative Analysis

Qualitative content analysis (Schreier, 2012), was selected to analyse the children's brief, concrete, and focused open-ended diary responses. This flexible inductive approach enabled the researcher to organise the content around the children's own words, remaining close to their language and meaning. The aim was to capture children's direct perspectives on the breathwork intervention.

The analysis focused on identifying descriptive response patterns rather than interpretative themes. Responses were grouped into meaning categories based on shared ideas and expressions, reflecting the most common experiences reported. The inductive categorisation included:

- Data familiarisation and initial coding.
- Categorisation of responses: similar responses were grouped into descriptive categories.
- Quantification of categories: the frequency of each response category was recorded to identify patterns.
- Visualisation- findings summarised.

Analytical accuracy was maintained through iterative coding and peer cross-checking. A colleague reviewed categories for consistency, to support reliability and to ensure children's voices were meaningfully represented.

7.6.8 Thematic Analysis of Focus Groups: Children and Teachers

The thematic analysis drew on data from all four children's FGs and the teacher FG, capturing both shared and differing experiences across the participating classrooms. A reflexive, inductive thematic analysis was conducted using Braun and Clarke (2006) Six-Phase framework, consistent with phase one (See section 6.4.4). This approach was chosen to identify key themes related to the experiences of both teachers and children participating in the intervention.

Themes were developed through iterative coding and reflection, rather than applying pre-defined categories. The researcher's dual role as both an EP and yoga instructor required careful reflexivity. While this position offered insights into the data, it also posed a risk of bias, which was managed through self-awareness and critical reflection during the analysis.

To strengthen credibility, a colleague independently examined the coding and initial themes. Collaborative discussions promoted shared interpretations, ensuring the themes genuinely reflected participants' views. Teacher and child themes were then compared for similarities and differences and linked to quantitative data, enabling an integrated understanding of intervention outcomes.

7.6.9 Teacher Diary: Classroom Observations

Classroom observations were analysed qualitatively, using inductive coding to capture naturalistic, real-time dynamics such as mood, engagement, and children's behaviour. Codes were then grouped into broader thematic categories and examined for patterns throughout the intervention period.

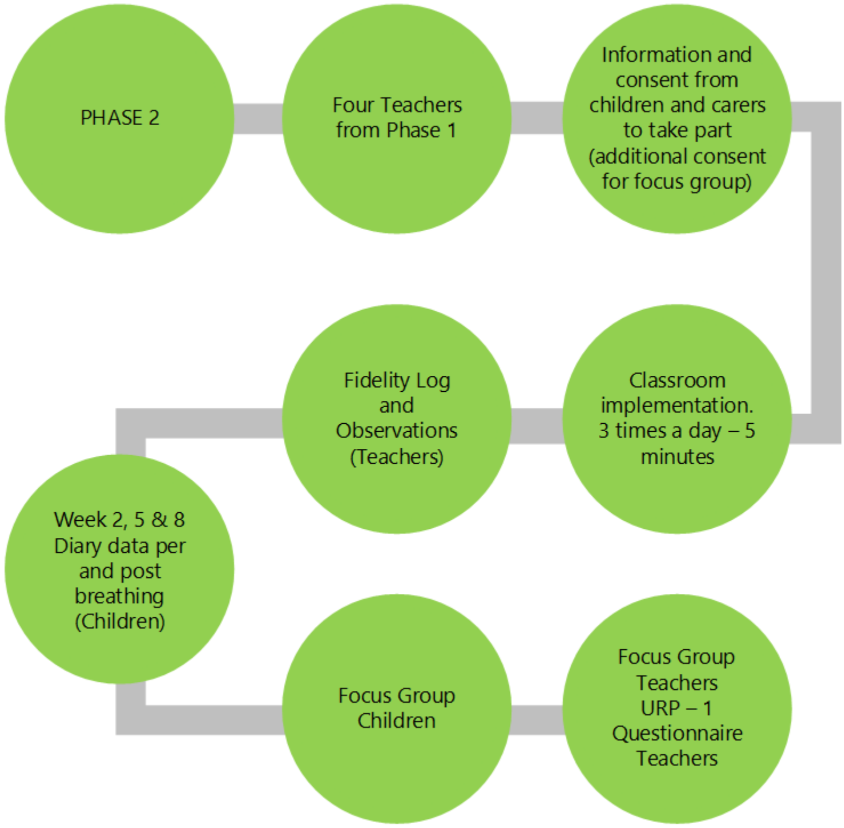
Descriptive frequencies quantified the frequency with which specific classroom dynamics occurred, enabling qualitative insights to be integrated with the intervention's quantitative fidelity data and outcomes. This approach supported methodological triangulation, thereby improving depth, credibility, and validity by offering additional perspectives on how the intervention was experienced and implemented across various classroom settings.

7.7 Intervention Procedure

Figure 30 illustrates the intervention procedure implemented during phase two of the study. Phase one involved pre-intervention preparation and teacher training. Teachers received guidance and optional visual aids (Appendix K) to support classroom delivery, keep pupils engaged, and ensure consistency. Visual materials included whiteboard-based resources designed for use during the intervention, allowing teachers to deliver exercises effectively while reinforcing key ideas for the children.

Figure 30

Phase Two Intervention Procedure



7.7.1 Breathwork Intervention Delivery

The intervention involved brief 3-5 minute classroom-based sessions of regulated breathing, grounded in coherent breath practices (Brown & Gerbarg, 2012). Coherent breathing involves approximately five breaths per minute in adults, a rhythm shown to promote autonomic balance and nervous system equilibrium when practised regularly for 10–20 minutes. For children, the practice was adjusted to 8–12 breaths per minute, reflecting age-related differences in resting respiratory rates and aligning with children's physiological capacities.

Each session focused on a slow, balanced inhale-exhale rhythm to activate parasympathetic responses, without stressing breath frequency. Sessions occurred three times daily: upon arrival, after the morning break, and post-lunch, to integrate breathwork into the school routine, promote the habitual use of SR strategies, and support ER internalisation.

7.7.2 Implementation Flexibility

Recognising the variability of classroom settings, the intervention allowed flexible timing and delivery. Teachers adapted sessions to suit class needs, accommodating timetable constraints or unexpected disruptions. This flexibility supports implementation science principles (Fixsen, 2005), promoting feasibility and sustainability.

As a pilot study, this phase examined the feasibility of the intervention and key implementation elements, including delivery fidelity (as measured by teachers' logs and observations), teacher adaptability, and how well it fit within everyday classroom settings.

7.7.3 Alignment with Study Aims

This approach aligned with the study's dual aims: to examine the feasibility of integrating breathwork into everyday classroom practice and to evaluate its immediate and cumulative effects on children's ER. Ethical approval and informed consent were obtained prior to implementation (Section 5.8).

7.8 Participation and Recruitment

Four teachers wanted to continue into phase two. Subsequently, consent was obtained for children in these teachers' classrooms to participate in the intervention.

7.8.1 Children

The consent process ensured transparency, voluntary participation, and a clear understanding of the study's purpose and potential implications for pupils, parents, and carers (Appendix E-G).

An opt-in consent approach was used to respect for pupil autonomy and enable meaningful assent, aligning with child participation frameworks that emphasise informed, voluntary engagement (Alderson & Morrow, 2011). Age-appropriate information and consent forms were distributed and collected by class teachers, with researcher support allowing the process to be integrated into the classroom.

Teachers explained the requirement for parental consent with sensitivity. If a child wished to participate but lacked parental approval, teachers discussed why participation was not possible while maintaining a supportive approach. These strategies were developed collaboratively with the researcher to ensure consistent communication and reduce distress.

Inclusion was integrated into the study design. Pupils with Additional Support Needs (ASN) were not specifically targeted for recruitment; instead, the intervention was made accessible and inclusive of a diverse range of physical, learning, developmental, and communication needs. Adapted materials were available if required. All children were informed of their right to withdraw from the study at any time without any consequences. The researcher offered to visit classrooms to facilitate consent and answer questions, though this was unnecessary in the pilot as teachers managed the process effectively.

Fewer than 100 children from four classes, aged 8–11, participated, representing a variety of backgrounds and abilities. After the intervention, pupils were invited to take part in FGs. Each class had up to 8 volunteers; since only 6–8 were needed per group, participants were randomly selected to minimise selection bias and promote diverse viewpoints, thereby enhancing qualitative credibility.

FGs were conducted 2–3 weeks post-intervention to capture reflective insights on the breath exercises and their ongoing relevance. In total, 25 children participated across four FGs in two school contexts (Table 8)

Table 8

Number of Children in Each FG

Context X	FG1	6 children
Context Y	FG2	7 children
Context Y	FG3	6 Children
Context Y	FG4	8 Children

Following the intervention, children received a summary of the questionnaire and FG themes, along with an age-appropriate infographic on SR and breathing exercises. Participants, parents, and carers were invited to contact the researcher to discuss further.

All questionnaires and FG data were anonymised and assigned unique participant codes. Discussion notes captured content without including names. Data were securely stored on the researcher's University OneDrive, with access restricted to the researcher. Data handling procedures complied with university ethical standards and the Data Protection Act (Scottish Executive, 1998), ensuring participant confidentiality and safeguarding.

The comprehensive recruitment, consent, and data management protocols ensured robust ethical compliance and participant engagement, establishing a robust foundation for the intervention's data collection and analysis.

7.9 Results Phase Two: Effectiveness of Intervention and Implementation

This section reports the findings related to RQ2–RQ4, which investigated the immediate and longer-term impacts of classroom-based breathwork on children's ER, as well as the fidelity and practicality of its implementation. Four teachers (three from Context Y, one from Context X) fully delivered the intervention across four classes, involving fewer than 100 pupils aged 8–11. The results integrate quantitative and qualitative analyses to assess the consistency of the intervention's delivery, whether children's self-reported calmness increased both immediately and over time, and how teachers and pupils experienced the process in practice.

7.9.1. Teachers' Diaries: Fidelity of Implementation

Although all four teachers completed the intervention, implementation fidelity varied considerably across contexts and individuals. This variability is an important factor when interpreting the outcome data.

Table 9 summarises intervention dosage, detailing the number of sessions each teacher delivered and recorded across the 8-week intervention. To support the explanation, the following codes are used:

- F = exercises were completed but not recorded,
- CO = exercises were completed occasionally but recorded inconsistently,
- ND = no data was submitted.

One teacher in Context X consistently demonstrated high fidelity, delivering 12–15 sessions each week (out of a possible 15). In contrast, the three teachers in Context Y showed more variable implementation. During the initial weeks, delivery ranged from 6 to 11 sessions, with further decline observed over time. Some sessions were completed but not logged (F), while others were only partially recorded (CO). In the final three weeks, only one teacher continued to submit fidelity data, while the remaining three reported none (ND).

Table 9

Teacher Diary: Recording Fidelity

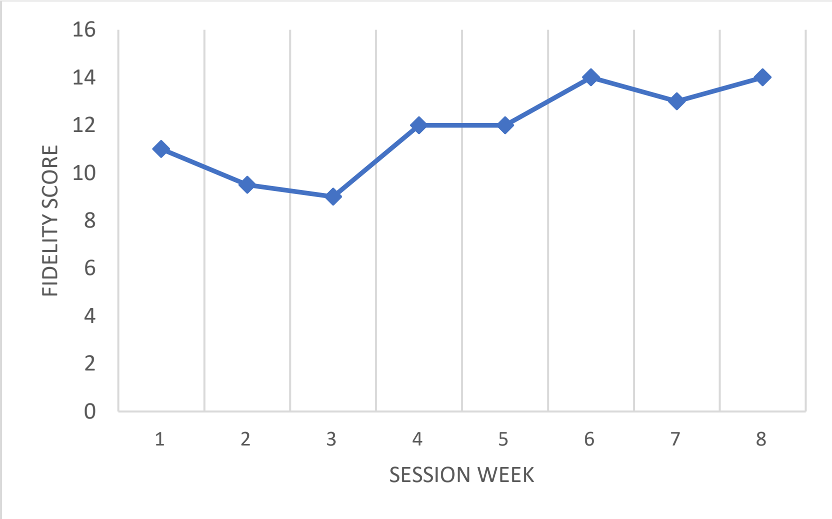
Session Week	Dosage out of 15 Context X	Dosage out of 15 Context Y Class 1	Dosage out of 15 Context Y Class 2	Dosage out of 15 Context Y Class 3
1	14	11	11	9
2	15	8	9	10
3	12	ND	6	7 & F
4	15	9	F	F
5	12	F	CO	F
6	14	F	ND	ND
7	13	ND	ND	ND
8	14	ND	ND	ND

Figure 31 shows median fidelity trends, indicating moderate overall adherence but hiding significant individual differences. One teacher remained highly consistent, while others experienced fluctuations or declines in engagement. This variation highlights the practical challenges of maintaining daily interventions in busy classroom environments and may reflect individual differences in confidence, perceived relevance, and competing professional commitments.

A notable temporary increase in fidelity occurred in Week 4, coinciding with an unplanned in-person check-in between the researcher and teachers during a Context Y visit. Although informal, this contact seemed to reinforce motivation and engagement, indicating that ongoing relational support can positively affect adherence. However, the subsequent decline indicates that without continued reinforcement, initial enthusiasm might diminish amid routine classroom pressures.

Figure 31

Teacher Diaries: Median Fidelity Trends



7.9.2 Teacher Observations

Teacher observation notes were analysed inductively, resulting in three main categories: classroom management, children's feedback, and classroom atmosphere (Figure 32), e.g., "class calmer" noted 5 times; "easy to settle after breath" noted 3 times. These categories reflect recurring descriptive patterns in the data, where similar observations were grouped and quantified to illustrate the lived classroom experience.

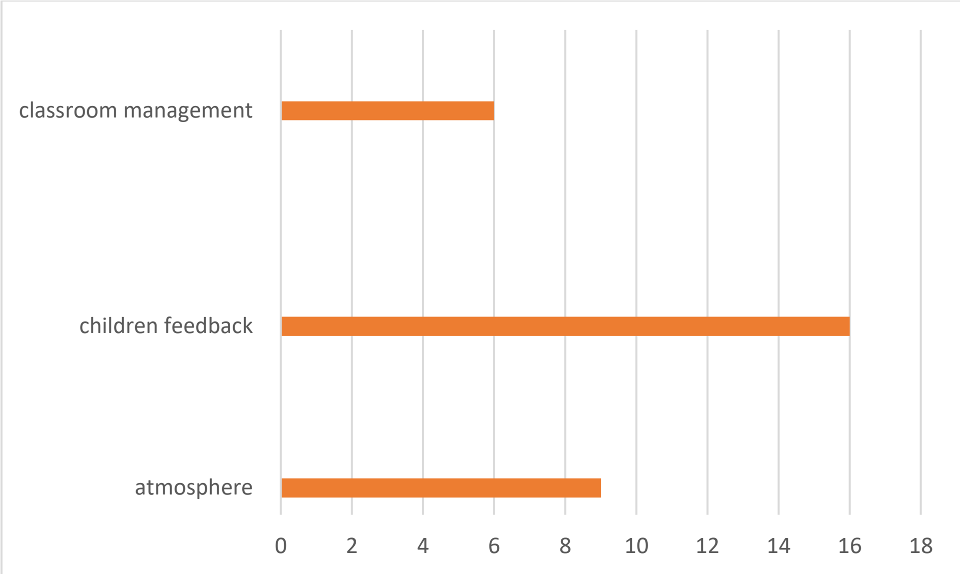
Only one teacher (Context X) consistently recorded observational data, which limits its representativeness and generalisability. This teacher's ongoing engagement might also have introduced recording bias, possibly overstating positive experiences. Despite these limitations, the observations provide valuable insights into how breath exercises were perceived and enacted in everyday classroom contexts. Illustrative examples include:

- "The class settled more quickly after the breathing today." (Classroom management)
- "There was a noticeably calmer feel in the room afterwards." (Atmosphere)
- "One child said she feels like her head is less busy after the breathing." (Children's feedback)

Although limited, these qualitative insights complement the quantitative calmness data and directly inform RQ3 (implementation context) and RQ4 (participant experiences). They highlight changes in classroom atmosphere, student engagement, and perceived emotional benefits. While based on a single teacher's experience, they offer valuable context about how breathwork was perceived in real classroom settings. More extensive and consistent observations would have improved triangulation with the quantitative data and strengthened the analysis.

Figure 32

Teacher Diaries: Recordings by Class Teachers



7.9.3 Children's Diaries: Changes in Calmness

Due to data inconsistencies from Context Y, all reported analyses rely solely on Context X to ensure accuracy and reliability. Incomplete data collection across the three Context Y groups resulted in an insufficient sample for valid comparisons.

Statistical analyses were performed using IBM SPSS Statistics (version 28) predictive analytics software. In Context X, sample sizes varied over time, reflecting natural fluctuations in attendance and voluntary diary entry. Notably, participation increased as the intervention progressed, indicating growing engagement. Matched sample sizes for pre–post comparisons were Pre-start & Post-start (N = 17), Pre-Mid & Post-Mid (N = 18), Pre-End & Post-End (N = 20). These variations were considered during analysis to maintain internal validity and accurately reflect proportional changes over time.

7.9.4 Progressive Changes in Calmness Across the Intervention

Descriptive statistics were used to examine changes in self-reported calmness across three stages of the intervention. Calmness was coded dichotomously as:

1 = calmness reported

0 = other emotional state reported

This binary coding facilitated consistent tracking of trends in emotional states across pre- and post-intervention time points. Table 10 displays the raw counts and corresponding percentages for children (N = 17) who completed all diary entries.

Table 10

Descriptive Statistics of self-reported calmness across intervention phases (Context X, N = 17).

	Start		Mid-Point		End	
Primary Outcome	Pre	Post	Pre	Post	Pre	Post
Calm	0(0%)	16(91.4%)	5(29.4%)	11(64.7%)	7(41.2%)	13(76.5%)
Not Calm	17(100%)	1(5.9%)	12(70.6%)	6(35.3%)	10(58.8%)	4(23.3%)

To assess overall changes in calmness across the six measurement points (pre-start, post-start, pre-midpoint, post-midpoint, pre-end, and post-end), Cochran's Q test was used. McNemar's tests were then performed to assess immediate pre–post changes at each phase.

Results from Cochran's Q test (Table 11) indicated a statistically significant difference in reported calmness across the six time points, $Q(5) = 44.56$, $p < .001$. This finding demonstrates a consistent pattern of increased self-reported calmness following each breathing exercise throughout the intervention.

Table 11

Summary of Statistical Output Context X

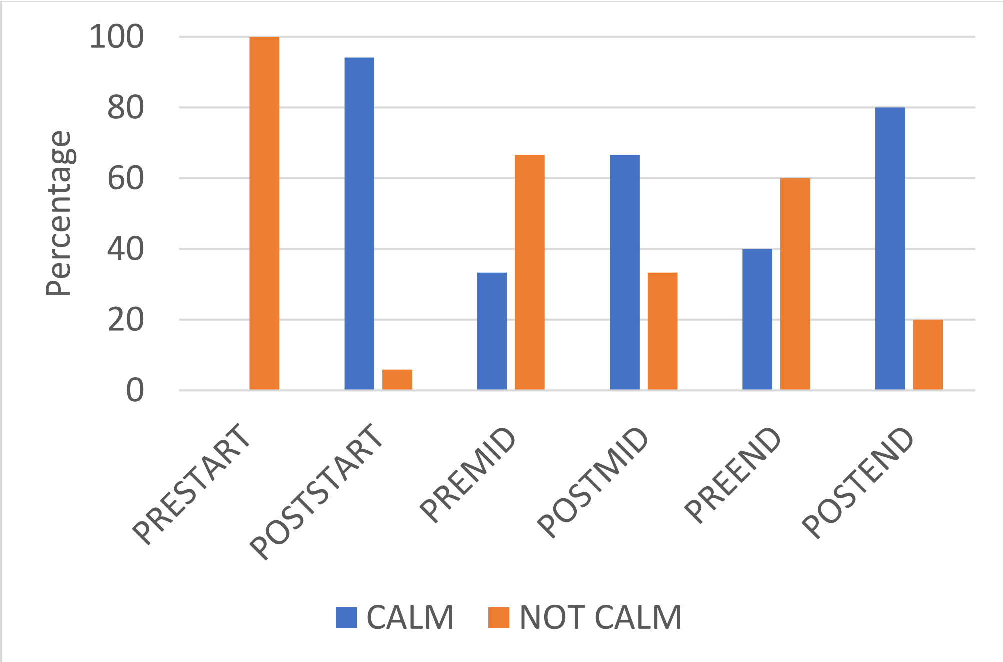
Summary Statistic	Statistic
N	17
Cochran's Q	44.561
df	5
Asymp. Sig.	<.001
Exact Sig.	<.001
Point Probability	.000

7.9.5 Immediate Effect in Calmness Across the Three-Time Points: McNemar

To assess the immediate effect of the breathing intervention on children's self-reported calmness, changes were analysed from pre- to post-exercise at three key stages: start, midpoint, and end of the intervention (Figure 33). Across all time points, a marked and consistent increase in the proportion of children reporting calmness immediately after each breathing exercise was observed. This pattern provides direct empirical support for the hypothesis that the intervention produced an immediate and replicable calming effect.

Figure 33

Distribution of Calmness Across the Three Stages (pre- and post-exercise at the start, midpoint, and end of the intervention)



Building on the significant overall change identified by Cochran's Q test, McNemar's tests were performed to evaluate paired pre–post differences at each stage. Table 12 shows these results, confirming statistically significant increases in calmness immediately after each breathing exercise. One-tailed exact tests ($p < .05$ for all comparisons) confirmed that changes occurred in the expected direction, with low p-values indicating effects unlikely due to chance. The consistency of this pattern across all three stages supports the conclusion that the intervention reliably promoted a calm state immediately following use.

Table 12

McNemar Test Results for Pre–Post Changes in Calmness Across Intervention Stages

McNemar Test Statistics	PRESTART & POSTSTART	PREMID & POSTMID	PREEND & POSTEND
N	17	18	20
Exact Sig. (2-tailed)	<.001	0.031	0.008
Exact Sig. (1-tailed)	<.001	0.016	0.004
Point Probability	0	0.016	0.004

7.9.6 Cumulative Effects in Calmness

To assess whether calmness levels increased cumulatively throughout the intervention, beyond the immediate post-exercise effects, children's pre-exercise calmness states were analysed at three time points: pre-start, pre-mid, and pre-end. This analysis examined whether calmness improved over time, suggesting potential longer-term benefits for ER.

Descriptive statistics (Table 13, Figure 34) indicate a progressive increase in pre-session calmness throughout the intervention. The consistent sample size (N = 17) across all three time points supports comparability. Mean calmness scores increased from 0.00 (pre-start) to 0.29 (pre-mid) to 0.41 (Pre-end), indicating that more children reported calmness as the intervention progressed. The increasing standard deviation indicates greater variability in responses, reflecting individual differences in how children responded to the intervention and highlighting the potential value of future personalisation.

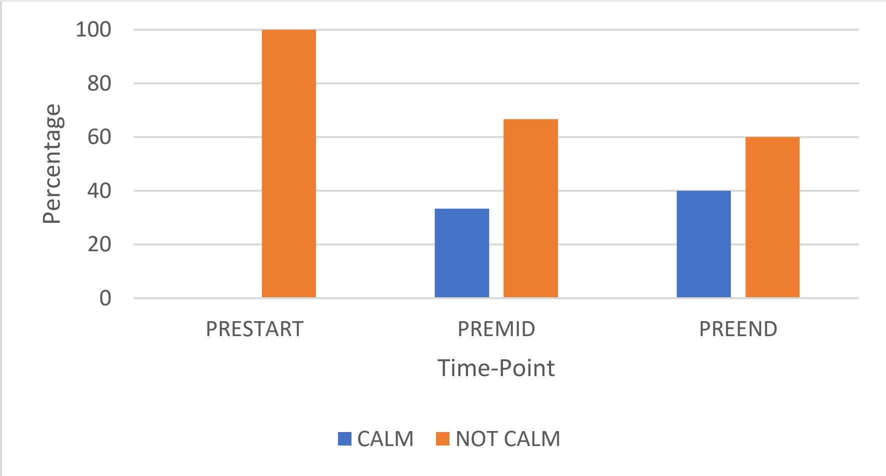
Table 13

Descriptive Statistics for Pre-Exercise Calmness Across Intervention Time Points

Timepoint	N	Mean	Standard Deviation	Minimum	Maximum
Pre-Start	17	0.00	0.000	0	0
Pre-Mid	17	0.29	0.470	0	1
Pre-End	17	0.41	0.507	0	1

Figure 34

Number of Children Calm Pre-Intervention Across Time Points



7.9.7 Overall Changes Across Time Points

Cochran's Q test was used to determine whether the proportion of children reporting calmness pre-exercise changed significantly across the three time points. Results (see Table 14) indicate a statistically significant increase in calmness (Q = 11.143, df = 2, p = .004 (Asymptotic), p = .003 (Exact)), demonstrating a cumulative regulatory effect from repeated exposure to breath exercises. The low *p*-values suggest that these results are unlikely to be due to chance, indicating a sustained improvement in calmness prior to each exercise.

Table 14

Cochran's Q Test for Changes in Pre-Exercise Calmness Across Time Points

Summary Statistic	Statistic
N	17
Cochran's Q	11.143[a]
df	2
Asymp. Sig.	.004
Exact Sig.	.003
Point Probability	.003

7.9.7 Pairwise Comparison Between Time Points

To explore where these changes occurred, McNemar's tests were performed for pairwise comparisons (Table 15). The comparison between pre-start and pre-mid showed a positive but non-significant trend (*p* = .063), suggesting early improvement. The pre-start-to-pre-end comparison demonstrated a statistically significant increase (p = .016), confirming cumulative gains in calmness across the intervention. The pre-mid to pre-end comparison was non-significant (p = .500), indicating that calmness levels stabilised in the later phase. Together, these results provide clear statistical evidence of a cumulative benefit, with calmness improving significantly throughout the intervention.

Table 15

McNemar Pairwise Comparisons of Pre-Exercise Calmness

Summary Statistic	PreStart-PreMid	PreStart-PreEnd	PreMid-PreEnd
N	17	17	17
Exact Sig. (2-tailed)	0.063	0.016	0.500

7.9.8 Transition Pattern in Calmness

Descriptive transition analyses (Tables 16-18) further illustrate how calmness states developed across phases. Of the 12 children who were not calm at pre-start, five reported being calm by mid-intervention. By the end, seven of the original ten who remained not calm had shifted to a calm state. Notably, no children reverted from calm to not calm, indicating sustained progress. Between pre-mid and pre-end, ten children remained not calm while two became calm; all six children who were calm at pre-mid remained calm at pre-end. These patterns reinforce the cumulative and stable regulatory benefits of the breathing exercises over time.

Table 16

Transition in Calmness: Pre-Start vs. Pre-Mid

	Pre-Mid (0)	Pre-Mid (1)
Pre-Start (0)	12	5
Pre-Start (1)	0	0

Table 17

Transition in Calmness: Pre-Start vs. Pre-End

	Pre-End (0)	Pre-End (1)
Pre-Start (0)	10	7
Pre-Start (1)	0	0

Table 18

Transition in Calmness: Pre-Mid vs Pre-End

	Pre-End (0)	Pre-End (1)
Pre-Mid (0)	10	2
Pre-Mid (1)	0	6

7.9.10 Qualitative Content Analysis of Children's Diaries

Usable diary data were obtained solely from Context X, as Context Y exhibited inconsistencies in implementation and adherence to data collection. Of the 22 diaries collected, 12 contained responses to at least one of the open-ended items.

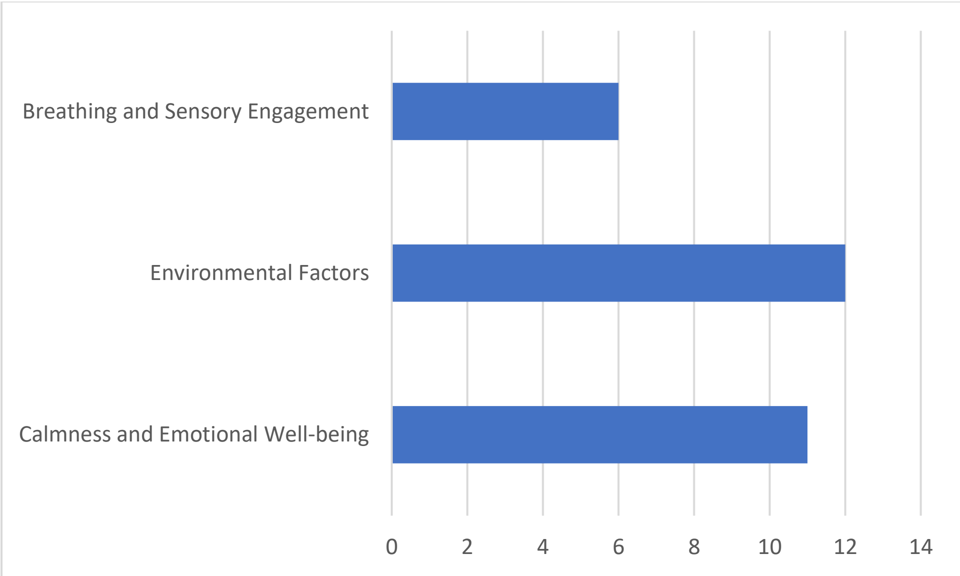
An Inductive content analysis was employed to analyse children's descriptions of their experiences during the intervention. The process consisted of three steps: first, open coding to identify common expressions, such as "I felt calm after breathing"; second, grouping similar codes into subcategories, such as calm feelings or sensory focus; and third, consolidating these into broader categories, such as calmness, breathing, and sensory engagement. The researcher performed coding and subsequently had a colleague review it to ensure consistent interpretation.

Three categories emerged: (1) Calmness, (2) Environmental Factors, and (3) Breathing and Sensory Engagement. These categories represent the experiential dimensions children associated with the intervention, indicating which mechanisms they found meaningful or impactful (Figure 35).

Children's focus on calmness and sensory engagement shows that the intervention is closely connected to their embodied and emotional experiences. Overall, these themes support the intervention's role in ER and embodied awareness, aligning with its intended goals.

Figure 35

Children's Diaries: Common Expressions



7.9.11 User Rating Profile-Intervention

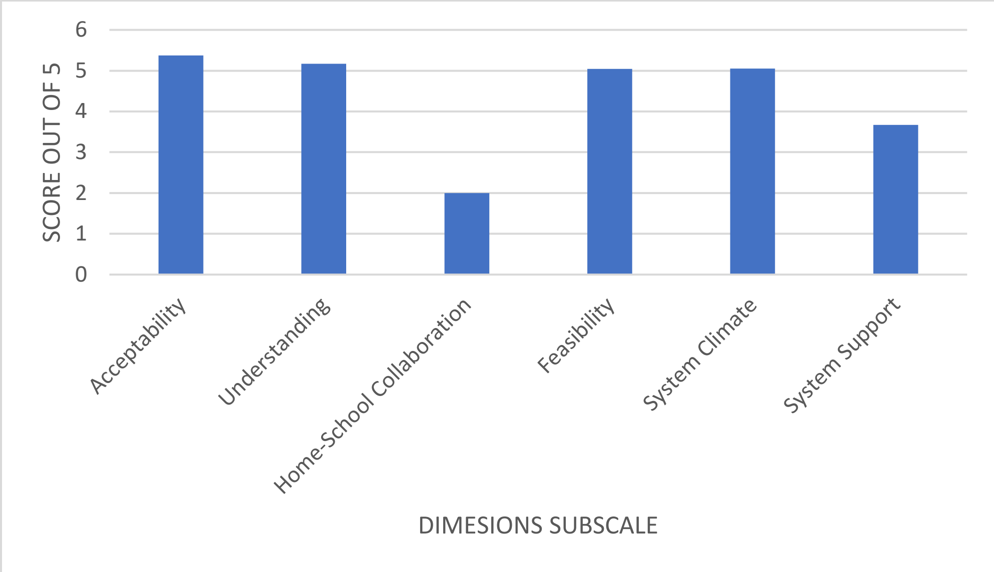
Figure 36 presents the URP–I results. Ratings were obtained from four teachers (three from Context Y, one from Context X). Overall, teachers rated the intervention highly for acceptability, understanding, feasibility, and system climate, indicating a positive perception of its relevance and potential integration into classroom practice.

Lower scores for home-school collaboration likely reflect its limited inclusion in the intervention design rather than a perceived shortcoming. Similarly, moderate ratings for System Support may indicate reliance on researcher facilitation, highlighting the need for school support to sustain implementation.

Notably, these positive perceptions contrast with the implementation inconsistencies reported in teacher diaries from Context Y (Section 7.9.1), suggesting a discrepancy between perceived feasibility and actual fidelity. This tension highlights the importance of ongoing coaching and system-level support for successful integration.

Figure 36

Ratings on the URP–I Dimensions



7.9.12 Coaching Support

Table 19 shows attendance at the two coaching sessions. Of the four eligible teachers, three attended in Week 2 and two in Week 5. Reported barriers included childcare responsibilities, illness, scheduling conflicts, and one teacher needing to leave early. These constraints highlight the practical challenges of adding extra support activities to teachers' existing workloads and school timetables.

Despite low attendance, the sessions offered opportunities for reflection on the intervention's implementation. Participating teachers discussed their experiences, perceived effectiveness, and barriers to fidelity. Table 20 summarises the key themes and selected illustrative responses drawn from the coaching discussions.

Table 19

Attendance at Coaching Session

Week	Attendance	Attendance Barriers
Week 2	3	Childcare
Week 5	2	One forgot, one was off sick, one who attended had to leave early

Table 20

Themes and Illustrative Teacher Comments from Coaching Sessions

Questions asked (See Section 7.5.1.4)	Theme	Example Response
Q1 implementation	Effectiveness	"Calmer after doing exercises" "I feel calmer"
Q2 Suitability materials/ workshops	Workshop Support & Resources	"Used the brain visual" "Looked over breath again
Q3 Barriers	Implementation Challenges	"Probably need to practice it myself"
Q4 Diary	Fidelity	"Forgetting to do them", "Forgot about the diaries", "Have been doing them but forgetting to record them"

7.9.6 FGs

Teacher and pupil FGs examined participants' perceptions of the breathing exercises, with particular attention to their effectiveness**,** practical application**,** and accessibility. Discussions also explored the teacher's role in supporting delivery and highlighted both shared and divergent perspectives (Gray, 2021).

For teachers, the FG data complemented and triangulated findings from the diaries and URP-I ratings, providing deeper insight into perceived feasibility and implementation challenges. Collectively, these data highlight both practical enablers and organisational barriers that influence intervention fidelity and uptake.

7.9.7 Children's FGs

Children generally rated the exercises as enjoyable, easy, and valuable, reinforcing the intervention's accessibility and relevance in the classroom. A total of 25 children participated in 4 FGs (3 from context Y, 1 from context X). Ratings across three dimensions (on a 0–10 scale) are shown in Figures 37-39.

7.9.7.1 Enjoyment. Figure 37: 15 out of 25 children rated eight or above.

7.9.7.2 Ease of Use. Figure 38: 21 out of 25 children rated nine or above, highlighting that ease of engagement may support sustained classroom adoption.

7.9.7.3 Usefulness. Figure 39: 18 out of 25 rated seven or higher, suggesting that children not only enjoyed the practice but also recognised its value in supporting classroom experience and emotional well-being.

Figure 37

Children's Ratings of Enjoyment (0–10 scale)

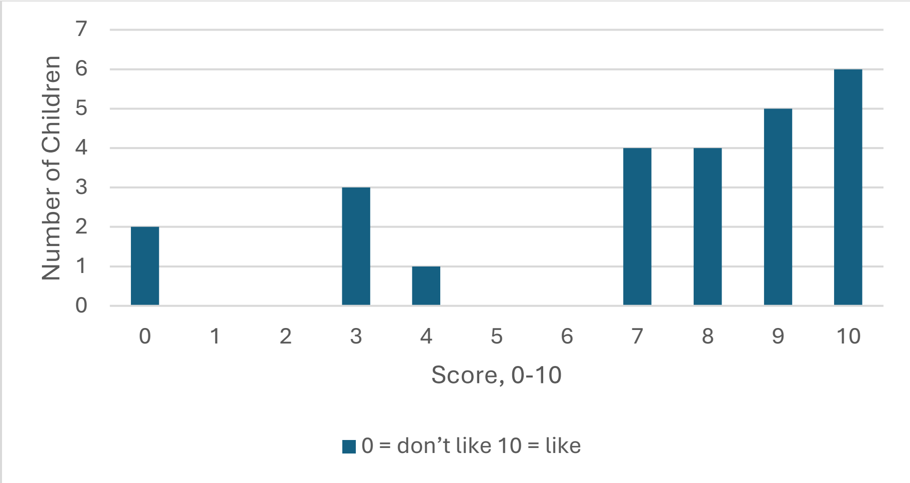


Figure 38

Children's Ratings Ease of Use (0–10 scale).

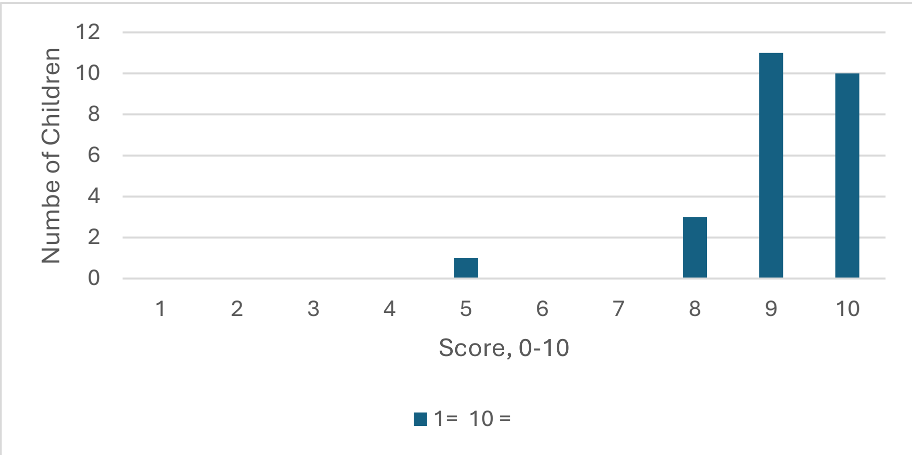
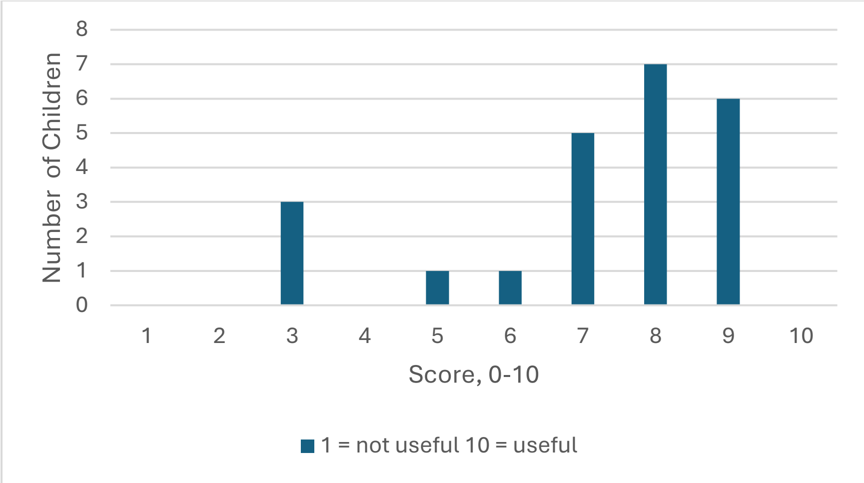


Figure 39

Children's Ratings of Usefulness (0–10 scale).



An inductive thematic analysis of children's spontaneous, unprompted comments during the FGs identified five key themes (Figure 40-44). These comments emerged outside of the structured prompts and represent child-led reflections on the breathing activities. The themes capture children's emotional, physiological, cognitive, and practical experiences of the intervention, highlighting both perceived benefits and contextual features that supported their engagement. Together, the themes present an account of how children understood and used the breathing practices. Given the larger number of children across the four FGs, quotations are not attributed to individual participants to preserve anonymity; instead, they are presented as illustrative of the broader themes identified across groups.

Figure 40

Theme: Breathing as a Pathway to Calm

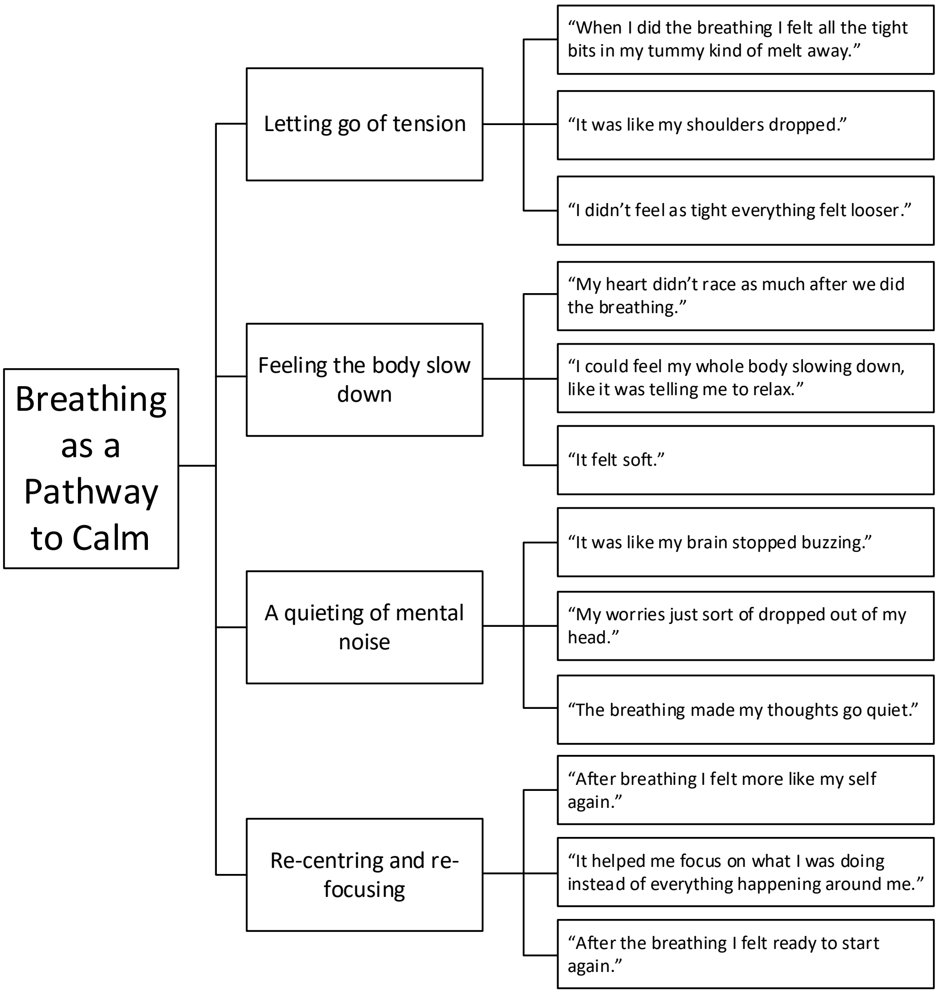


Figure 41

Theme: Developing a Physiological Connection

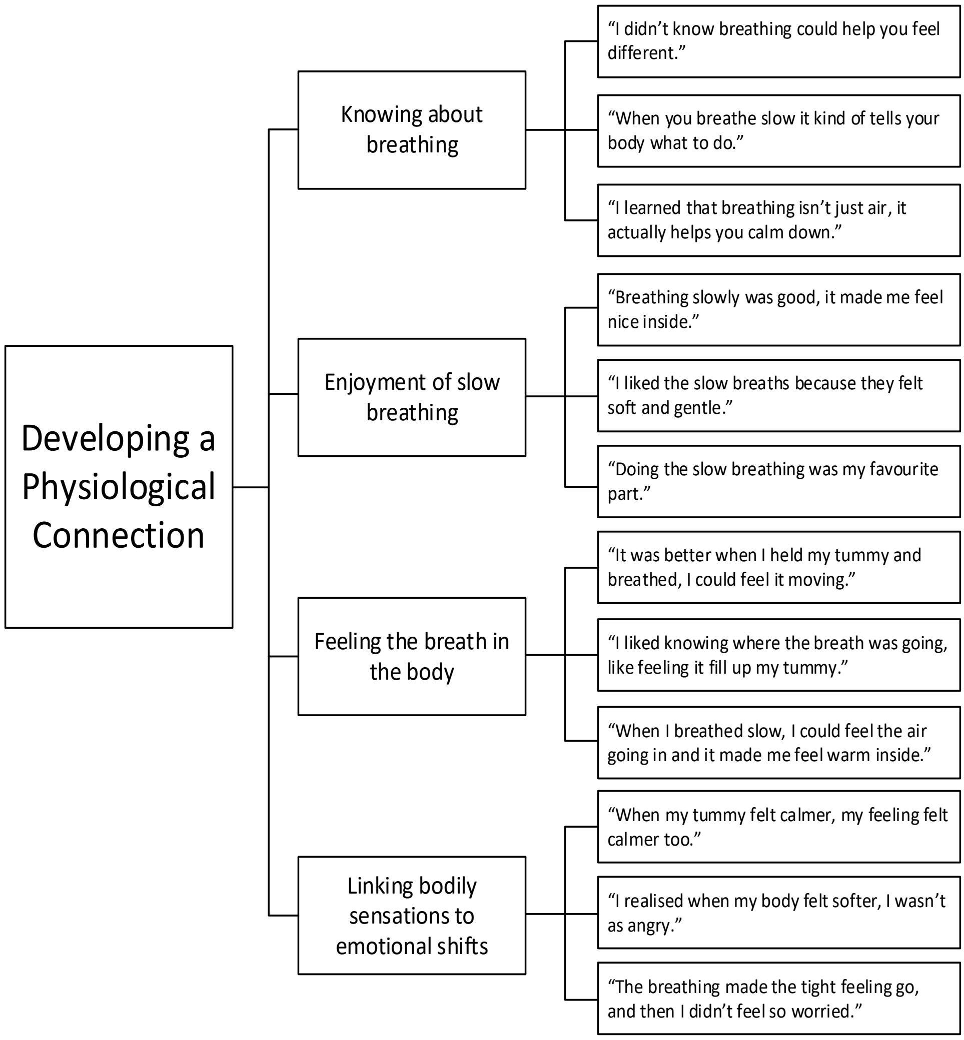


Figure 42

Theme: Conditions that Enhance Effectiveness

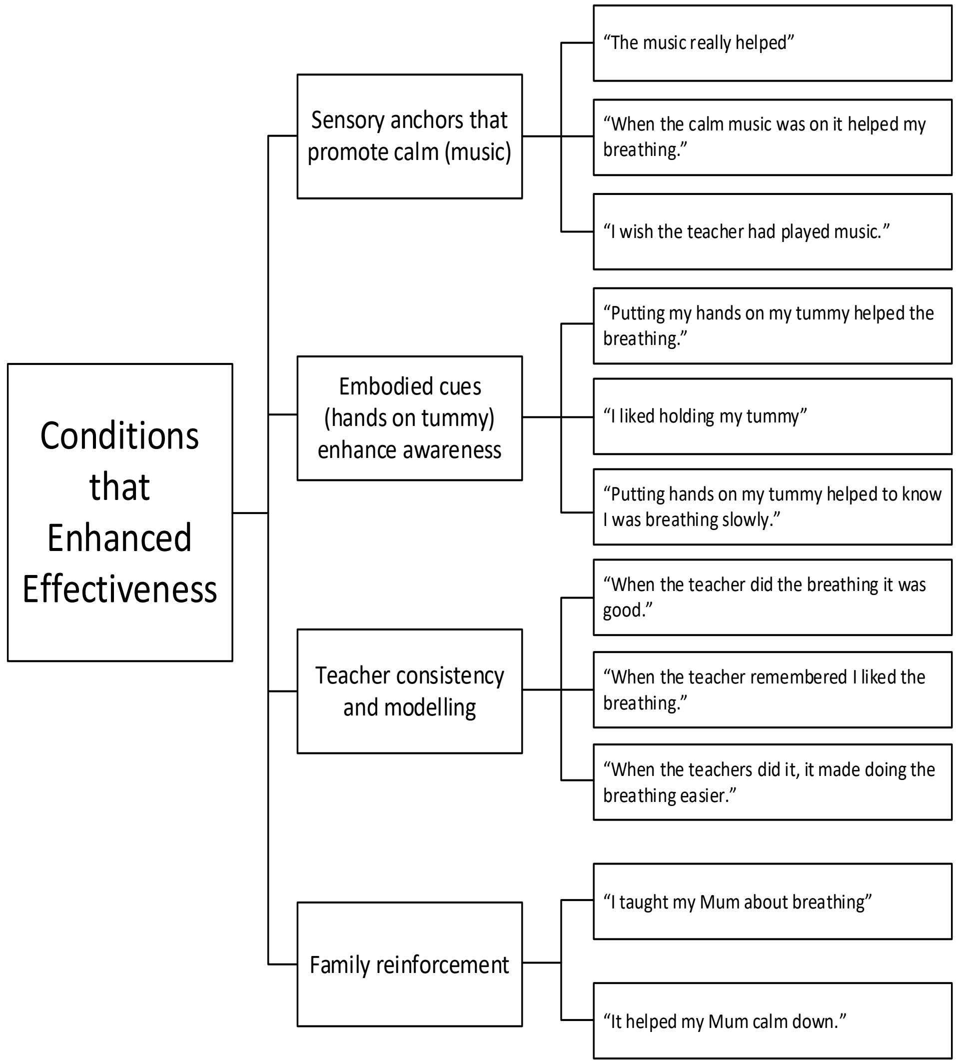


Figure 43

Theme: Cognitive Regulation Through Breathing

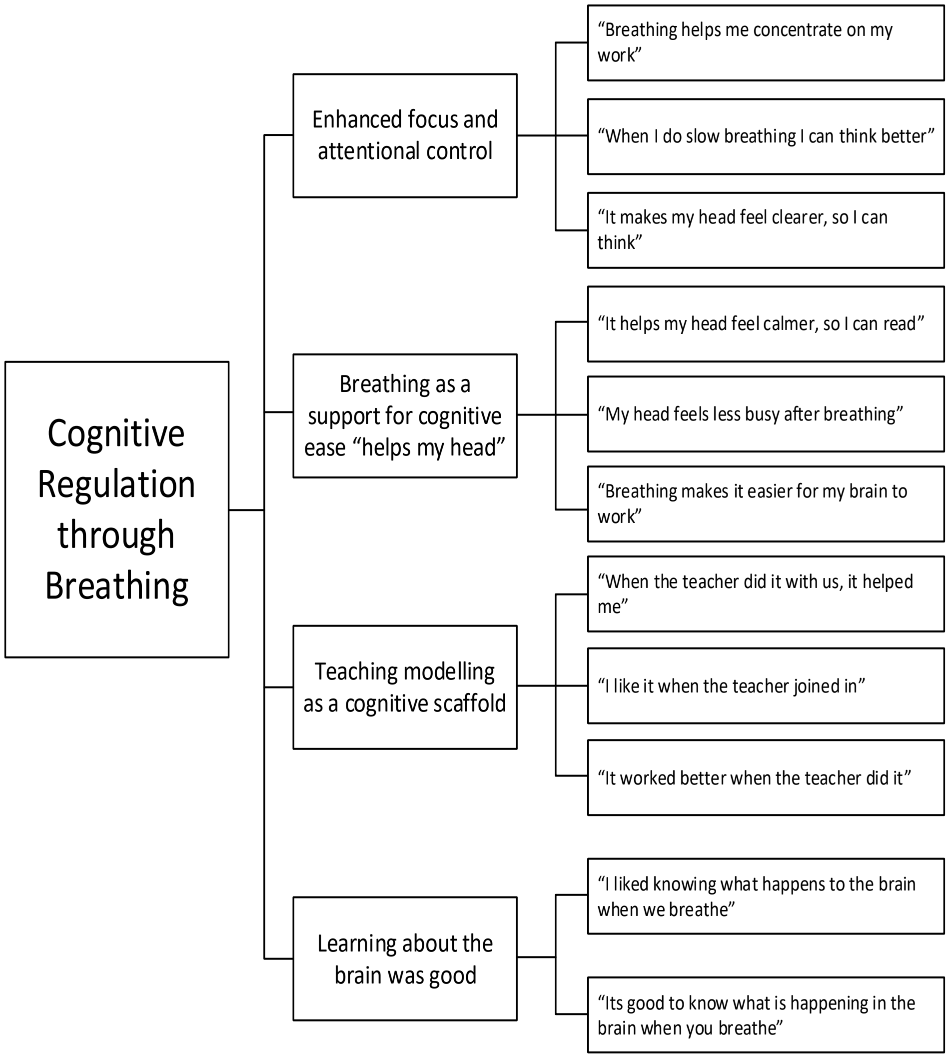
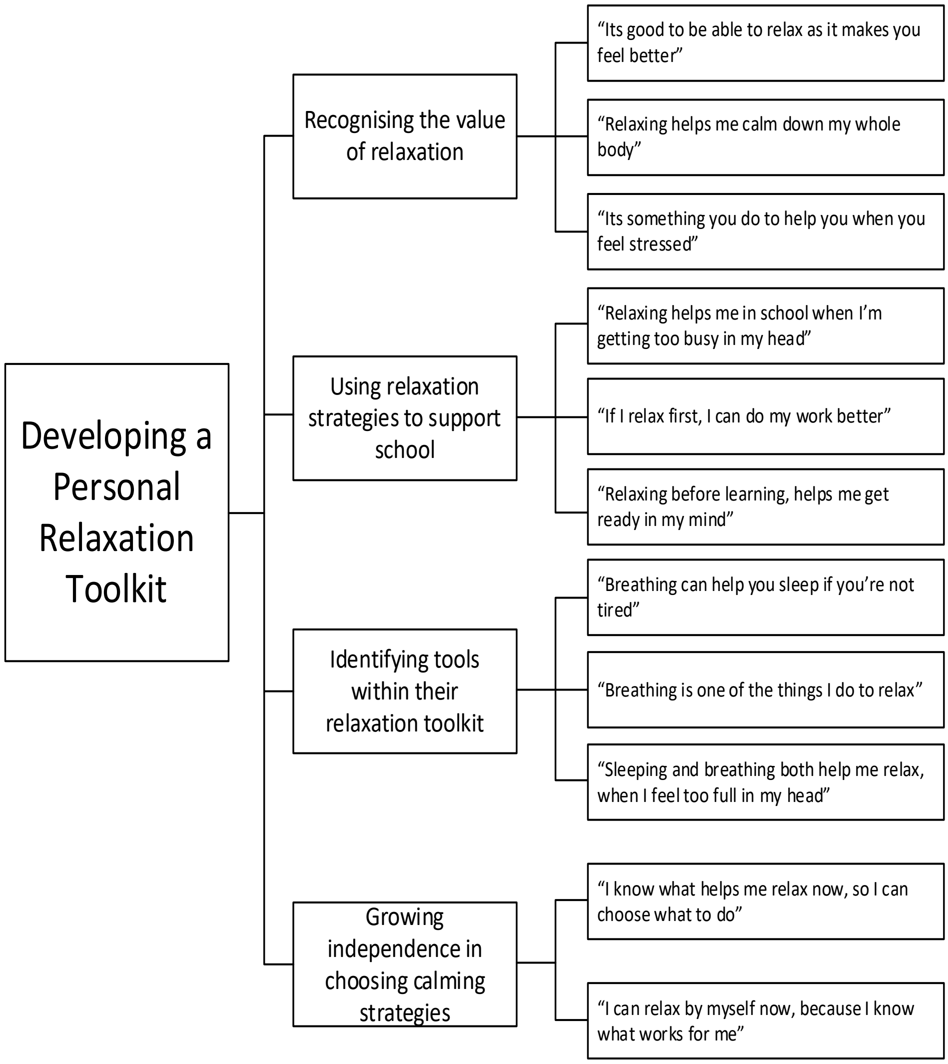


Figure 44

Theme: Developing a Personal Relaxation Toolkit

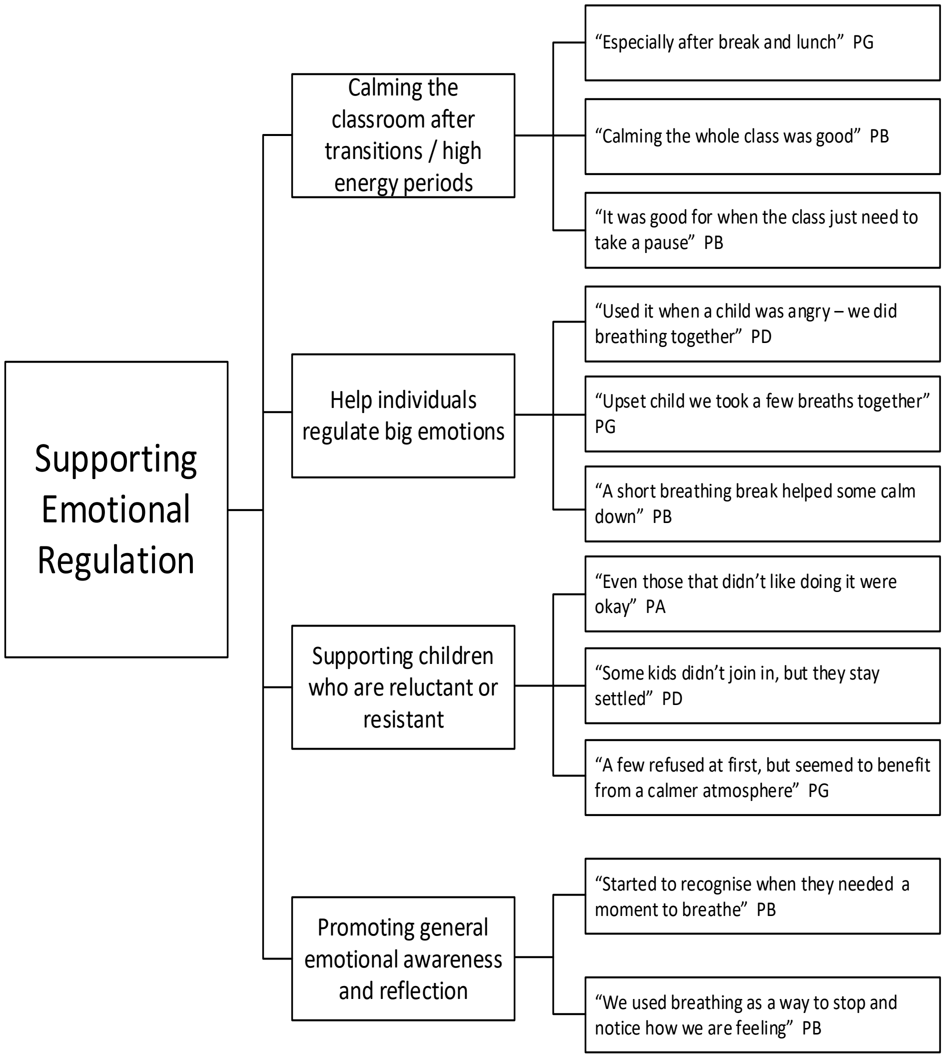


7.9.8 Teacher FG

A thematic analysis of teacher FG discussions identified five key themes reflecting their experiences with the breathwork intervention (Figures 45-49). These themes were inductively developed from teachers' spontaneous reflections and offer insights into both their perceptions of effects on children and the practical aspects of implementing the exercises. Each theme includes sub-themes, illustrated with representative quotes, that highlight patterns in classroom use, engagement, and emotional and cognitive outcomes. To illustrate the range of perspectives across the four participants, quotations are labelled using anonymised participant identifiers (P-A, P-B, P-D, and P-G). Reflexive notes summarising how teachers' confidence, modelling, and personal engagement influenced uptake are included at the end. Overall, the themes demonstrate how breath practices were integrated into classroom routines, affected by both external factors (e.g., time) and internal factors (e.g., motivation, confidence), with teacher insights aligning with children's reports, particularly regarding emotion regulation and focus.

Figure 45

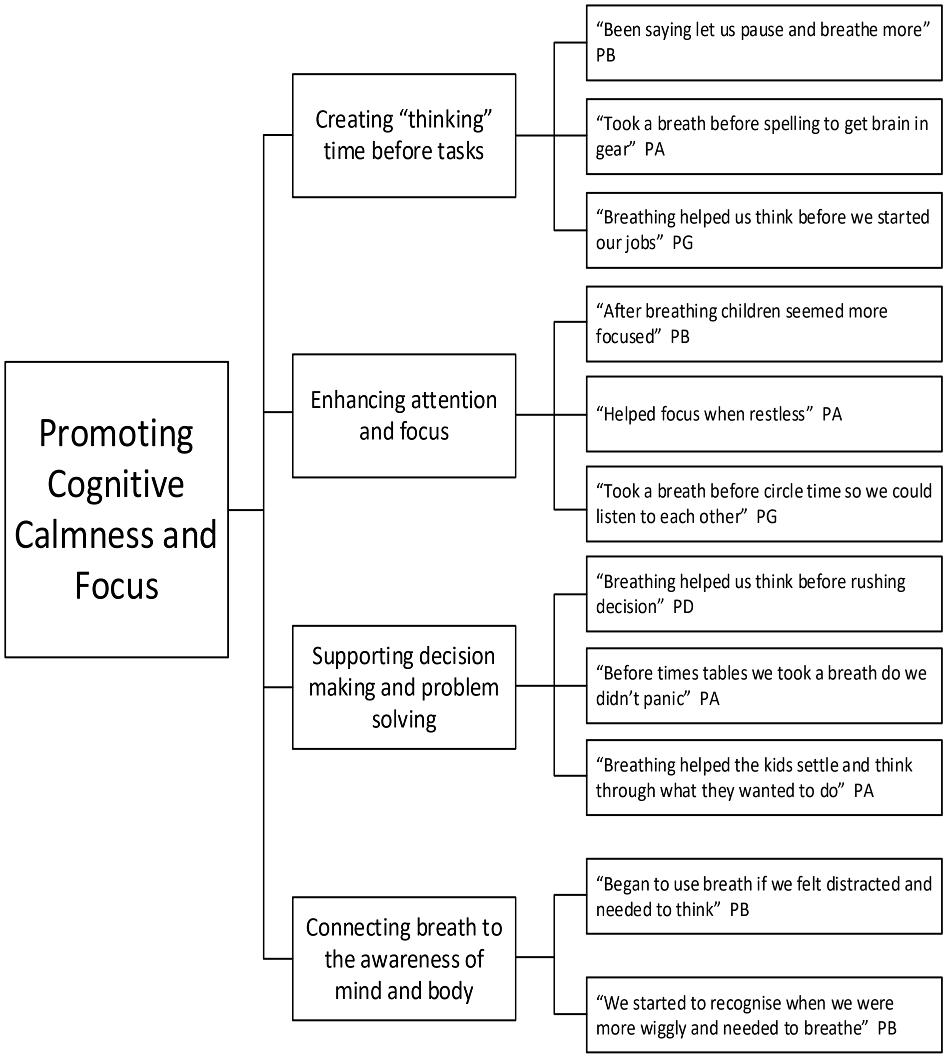
Themes Supporting Emotional Regulation



Note. P = Participant

Figure 46

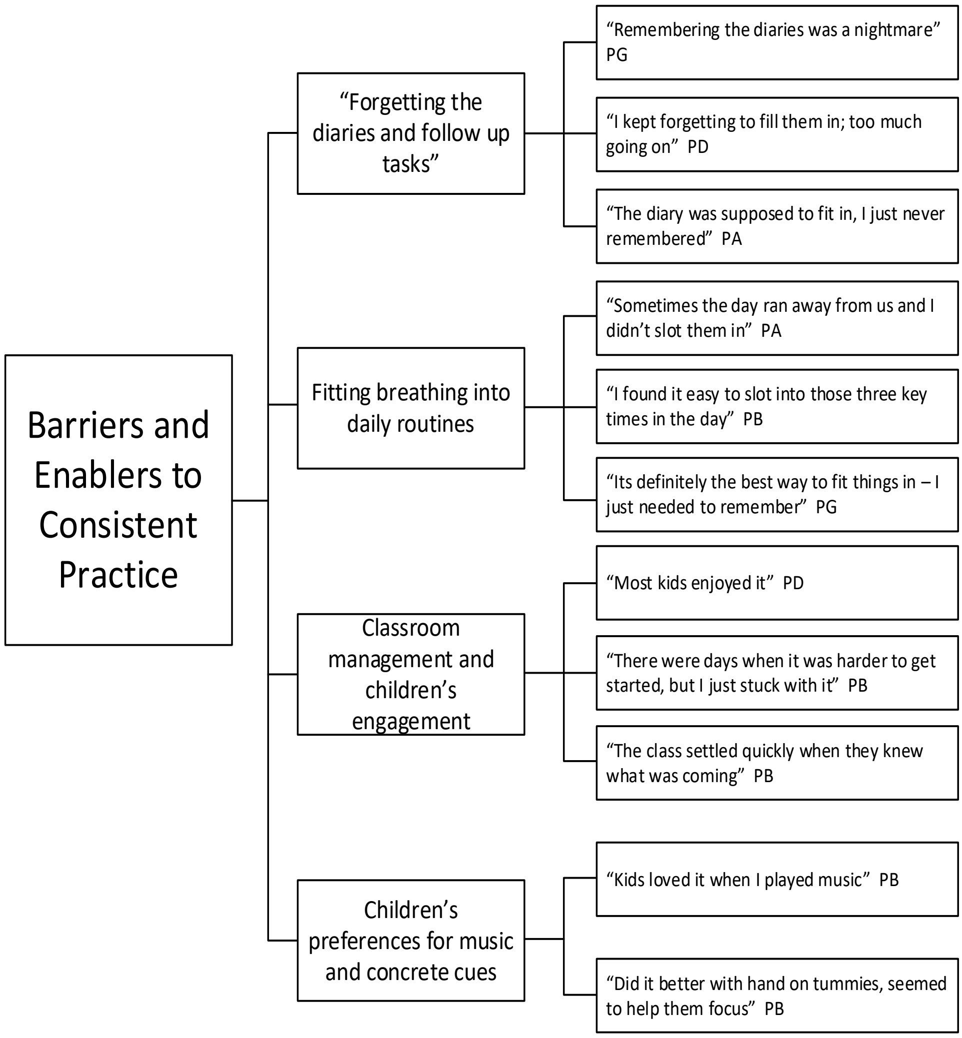
Theme: Promoting Cognitive Calmness and Focus



Note. P = Participant

Figure 47

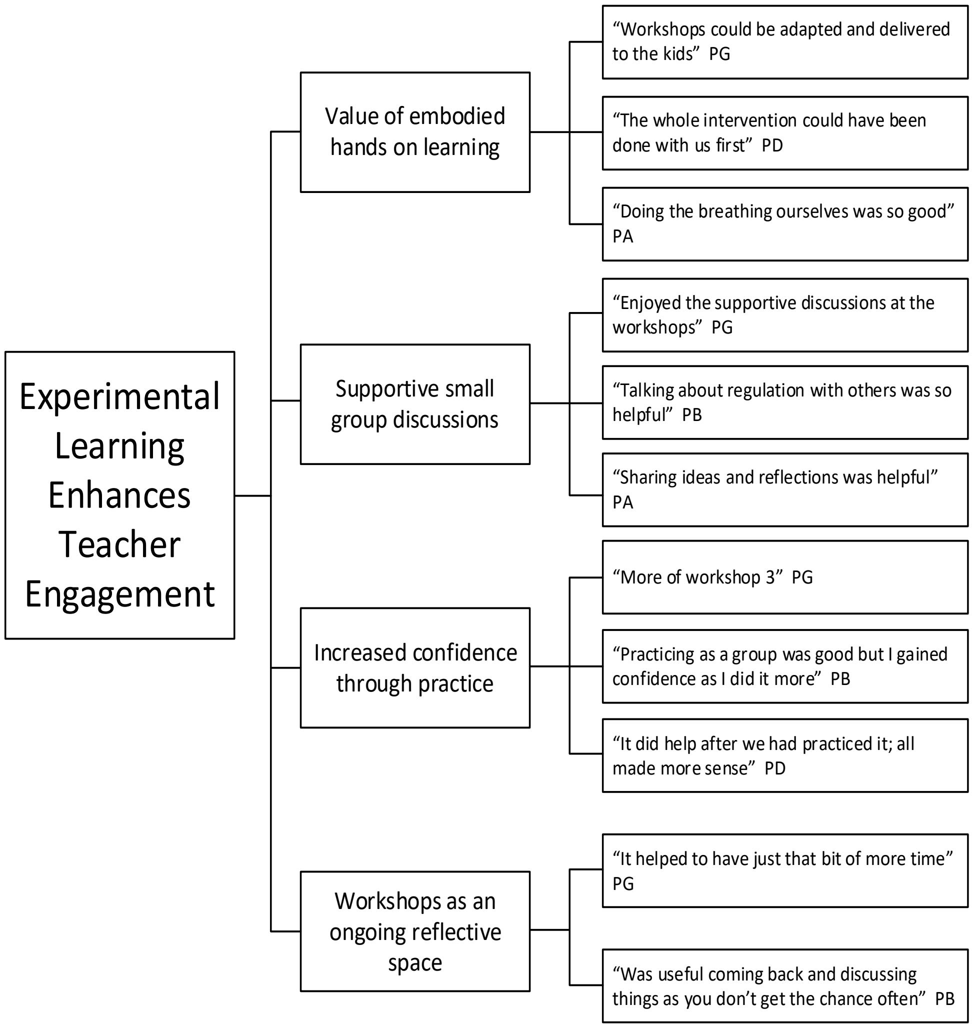
Theme: Barriers and Enablers to Consistent Practice



Note. P = Participant

Figure 48

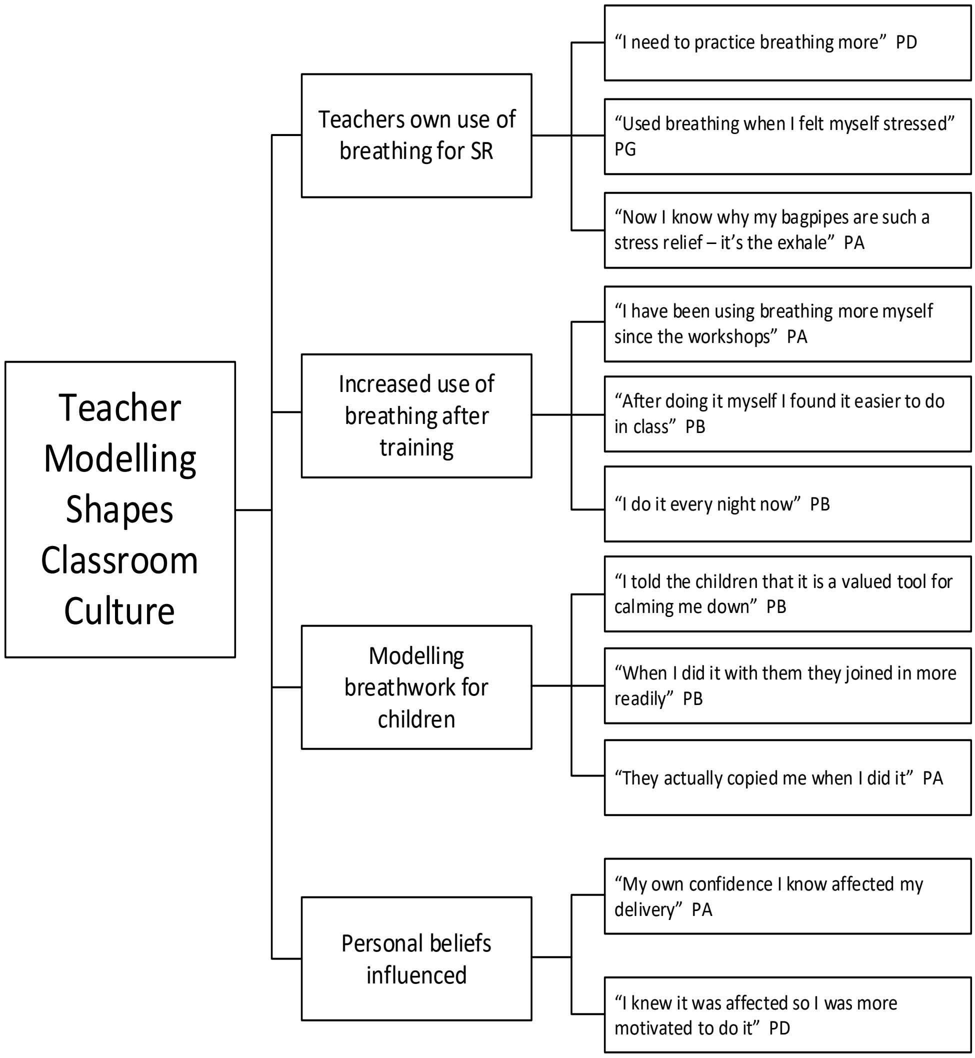
Theme: Experiential Learning Enhances Teacher Engagement



Note. P = Participant

Figure 49

Theme: Teacher Modelling Shapes Classroom Culture



Note. P = Participant

Teachers reported both emotional and cognitive benefits from the breathwork activities, including calmer classroom atmospheres after high-energy transitions and support for individual children managing intense emotions. Brief breathing pauses were linked to improved focus and "thinking time." Implementation varied across the small sample, with only one teacher consistently delivering the exercises as intended. Fidelity and success appeared to be influenced by teacher factors, including confidence, motivation, and personal engagement, as well as practical constraints such as time and routine pressures. Teachers valued the workshops for embodied practice and discussion, which supported understanding and application, but consistent modelling and active use were central to achieving the intended classroom outcomes. Across both groups, the findings converge to show how breathing practices were experienced, supported, and shaped within the classroom context.

7.10 Chapter Summary

Chapter 7 described the phase two classroom implementation, evaluating both the effectiveness of the breath-based intervention and the challenges encountered in real school settings. Although five teachers completed phase one training, only four proceeded to classroom delivery, and ultimately, only one teacher implemented the full intervention with high fidelity and submitted complete data. As a result, the quantitative analysis of children's calmness ratings relied solely on data from this one classroom, the only dataset sufficiently consistent for statistical testing. This limitation stemmed from time constraints, competing classroom demands, and varying teacher confidence and belief in the intervention, all of which affected fidelity and data collection. Despite this, the analysis showed significant immediate and cumulative improvements in children's self-reported calmness after breathwork sessions. Qualitative findings across classrooms indicated that children found the exercises calming, enjoyable, and easy to incorporate into their day, and that they demonstrated emerging interoceptive awareness. Teachers reported improvements in classroom climate, transitions, and ER, but also highlighted barriers, including limited time, prioritisation pressures, and the challenge of establishing new routines during a busy term. The chapter highlights that, while the intervention showed potential, implementation was heavily influenced by contextual factors. Variations in teacher buy-in, along with competing demands and differing levels of confidence, led to inconsistent fidelity across classrooms. The chapter concluded that, although preliminary, these findings are promising and emphasise the need for ongoing support, school-level alignment, and protected time to enable broader and more consistent implementation in future research.

Chapter 8: Discussion

8.1 Overview

This chapter synthesises the study's key findings, emphasising the role of breath exercises in supporting children's SR through fostering calm, while also addressing the complexities of implementation in school settings. Although the immediate regulatory effects of breathwork were apparent, consistent integration indicates potential for lasting benefits. By focusing on physiological regulation and targeting the body's autonomic responses rather than only on cognitive or behavioural strategies, this study presents SR as an embodied process. This aligns with theories of embodied cognition and somatic education, positioning SR not just as a skill to be taught but as a state accessible through bodily awareness and practice.

Implementation, however, is shaped by contextual factors such as teacher confidence, workload, and child receptivity, which shape how practices become part of daily routines. This chapter places the findings within theoretical frameworks and explores these key factors, with implications for embedding breathwork in education and guiding future interventions.

8.1.2 Framing the Discussion: Balancing Effectiveness and Implementation

The study was designed in two interconnected phases to both enhance teacher understanding and support their readiness for implementation. This dual focus reflects a broader challenge in educational research: validated interventions often struggle to translate into practice due to contextual constraints, including time pressures, policy demands, and teacher confidence (Durlak, 2015; Durlak, 2008; Langley et al., 2010).

The first phase comprised three interactive workshops, designed to build knowledge and understanding sequentially, from foundational concepts to the practical application of SR, MBC, and breathing exercises. Each session incorporated reflection, modelling, and peer discussion, with the final workshop focusing on breath practice and readiness for implementation. Although researcher-designed, the workshops were adapted collaboratively to classroom settings, with teacher input guiding relevance and feasibility (Collier-Meek et al., 2016).

Pre/post data and post-intervention reflections addressed the two key research questions, informing how teachers' understanding and readiness evolved across the phase.

- How effectively were the workshops improving teachers' understanding of SR, MBC, and breath practices?
- How prepared do teachers feel to implement breathwork in the classroom, and what factors influence their readiness?

Phase one examined the intervention's effectiveness and fidelity, integrating data from both teachers and children. Fidelity, defined as the extent to which the intervention was implemented as intended, is recognised as a key moderating factor in intervention success (Durlak, 2008). By combining quantitative and qualitative insights, the study explored how variations in implementation, whether logistical (e.g., limited time), relational, content-related, or personal, influenced children's SR outcomes. Understanding these patterns is crucial for interpreting the findings and informing future applications.

8.2 Phase One: Workshop Analysis, Implementation Readiness

Phase one demonstrated an increase in teachers' self-reported knowledge and confidence across the three workshops, as indicated by pre- and post-questionnaires. However, as implementation science highlights, training alone does not guarantee fidelity in real-world application (Durlak, 2008). While the workshops provided a theoretical and practical knowledge foundation, the FG discussions highlighted the complexities of translating this understanding into classroom implementation.

Teachers questioned SR's scope, noting overlap with emotional literacy, sensory regulation, and MBP, making pinpointing targets in daily teaching difficult. Breath was regarded as an accessible, valued entry point, owing to its physiological basis, simplicity, and immediacy. Key challenges included maintaining pupil engagement, finding calm moments in the day, and integrating practice alongside curriculum demands. Leadership support, peer discussion, and protected time emerged as essential enablers of consistent implementation. Co-regulation techniques from training were especially valued for their ability to connect theory to practice.

The analysis centred on themes that most effectively supported teachers' developing understanding and readiness to implement, rather than presenting a complete thematic account. These themes were selected for their relevance, recurrence, and practical applicability. Consistent with research indicating that targeted knowledge enhances confidence and fidelity (Desimone, 2009). Drawing on implementation science and experiential learning theory, engagement with these themes fostered the reflective practice required for sustainable change (Fixsen, 2005; Kolb, 1984).

8.3.1 Concepts that Supported Implementation

8.3.1.1 Understanding SR. Teachers consistently recognised the importance of SR for functioning effectively, influencing physical and mental health, well-being, and academic outcomes (Buckner et al., 2009; Inzlicht et al., 2021; Moffitt et al., 2013). Discussions enabled teachers to extend their understanding beyond the classroom, linking SR to life domains such as health-related decisions and interpersonal relationships.

Teachers engaged actively, offering concrete examples of how learning strategies could support everyday choices that influence well-being (Rodríguez et al., 2022), prompting a reframing of SR as a broader, life-wide capability. This shift from abstract comprehension to applied understanding indicated effective CPD, making SR more tangible, relevant, and transferable across contexts.

8.3.1.2 MBC. Teachers acknowledged SR as a multi-component concept encompassing behavioural, cognitive, and physiological elements. The workshop structure intentionally moved from broad SR to MBC and finally to breathwork as an accessible application point.

This insight aligns with stress contagion literature, which highlights how teacher stress can affect pupil stress and classroom climate (Oberle & Schonert-Reichl, 2016) and situates teacher well-being as central to effective classroom practice. Discussion reinforced that autonomic regulation underpins higher-order cognitive and emotional functioning (Muehsam et al., 2017), and that effective SR begins with the teacher's physiological awareness.

Framed as both a personal insight and a professional responsibility, teachers recognised the importance of modelling SR to support pupil regulation (Taylor et al., 2010), consolidating personal resilience with pedagogical strategy.

8.3.1.3 Starting with the Physiology Blair & Ku Model. Given the overwhelming complexity of SR, participants valued the Blair & Ku (2022) model for its integrative, MB framing and interconnected visual scaffolding (figure 3, chapter 2). Referring to the model during the FG promoted a more concrete and applicable understanding of SR's components.

The "bottom-up" language highlighted physiology as the foundation of SR, facilitating recognition of the body's role. Teachers described the model as a useful pedagogical scaffold, offering metaphorical and visual cues that supported conceptual shifts. Opportunities to pause, reflect, and explore links between breathing and brain function reinforced embodied awareness. One participant noted, "When I took a moment to breathe with my children, I could feel the difference not just in them, but in me too; it is like the brain settles."

This reframing positioned SR as more than a cognitive skill, emphasising physiological awareness as central to mental states. Teachers increasingly saw SR as a holistic, embodied process aligned with relational pedagogies.

8.3.1.4 Balancing Stress and Being Calm. Teachers engaged with the concept of allostasis, recognising that maintaining physiological balance underpins well-being (Chin & Kales, 2019). They acknowledged that without internal regulation, fostering SR in the classroom is challenging. Time pressures caused visible stress during discussions, highlighting the need for structural support, protected reflection time, ongoing well-being initiatives, and interventions aligned with teachers' realities. The protective role of SR against burnout was emphasised. One teacher reflected, "If I am not calm, the whole class feels it, it starts with me," reinforcing research linking teacher ER to lower burnout and better occupational health (Greenberg et al., 2017).

Teachers discussed using MBPs to reduce allostatic overload. One participant noted, "It is not just calming, it is helping my system reset". MBPs were no longer seen just as relaxation techniques but as tools to regulate physiology, improve emotional stability, and support learning (Tang et al., 2015). Neurocognitive research highlights that such practices activate the prefrontal cortex, supporting EF, like attention regulation and emotional control, which are central to learning (Tang et al., 2015).

Recognising the role of the ANS in SR marked a key conceptual shift, from viewing breathing as a generic calming strategy to understanding its mechanistic physiological basis. Reflection on adult calmness highlighted its impact on classroom climate, enhancing collective regulation (Jennings & Greenberg, 2009). The concept of a balanced state (Porges, 2022) was discussed in relation to both the teacher's and the child's experiences, with visual tools supporting understanding and practical application. One teacher suggested that the visual aid would likely sustain engagement during the intervention.

8.3.1.5 Dynamic Interplay Between Physiology, Emotion and Behaviour. A central theme was recognition that SR extends beyond behaviour management, encompassing a dynamic interplay of cognitive, emotional, behavioural, and physiological processes (Blair & Raver, 2015). Teachers' acknowledgement of physiology's role aligns with research on interoceptive training, including attention to breath, heartbeat, or muscle tension, which influences both emotional and physiological regulation (Farb et al., 2015; Khalsa et al., 2018).

Teachers demonstrated increased understanding of SR as a multi-component construct, as evidenced by language shifts, confident articulation, and reflections that link physiological, emotional, and behavioural elements. One teacher observed, “Breathing affects both emotions and behaviour.”

While SR initially felt overwhelming, the (Blair & Ku, 2022) model provided a tangible scaffold, illustrating the interconnections and supporting understanding. Teachers also recognised that some children struggle to recognise internal bodily sensations. Thinking shifted toward the foundational role of interoceptive awareness in enabling emotional, cognitive, and behavioural regulation (Farb et al., 2015; Zelazo & Lyons, 2012). One teacher described how hunger acted as a trigger for an unrecognised physiological cue, consistent with polyvagal theory, which emphasises unconscious physiological states’ influence on perception, emotion, and reactivity (Porges, 2011; Sullivan et al., 2018).

Breathing exercises were valued not only as reactive tools but also as preventative, universal strategies for all pupils. Teachers discussed how they could use them in regulating physiological states before dysregulation escalates and in supporting interoceptive awareness (Critchley & Garfinkel, 2017). Breathwork was increasingly seen as serving multiple purposes: supporting early regulation, preventing escalation, and providing a shared classroom strategy that promotes connection and co-regulation. Teachers discussed how it might strengthen children’s awareness of their physiological and emotional states, facilitating SR and relational support (Craig, 2002; Khalsa et al., 2018). As one teacher reflected, “I can see how this could help them notice what is happening in their bodies and give us a shared way to settle together”.

8.3.1.6 Understanding the Breath. Teachers had not previously connected breathing to its underlying physiological mechanisms. Workshops and FG discussions prompted a shift from abstract knowledge to applied insight. Teachers recognised that breath activates the PNS, supporting physiological regulation (Brown & Gerbarg, 2005; Streeter et al., 2012)), with controlled exhalation as critical for reducing sympathetic activation.

Breathwork was recognised as universally accessible, low-cost, aligning with evidence that such interventions are more likely to be adopted and sustained (Fixsen, 2005). Initially, teachers considered the exercises almost too simple, but experiencing the calming effects changed their views. One teacher mentioned that incorporating breathwork into routines (for example, before brushing teeth) improved both practicality and motivation, highlighting the importance of belief, ease of use, and intrinsic motivation in shaping sustainable practice.

Physiological regulation is often overlooked in favour of cognitively driven interventions (Porges, 2011). Breathwork provided an embodied regulation strategy that complements social-emotional learning programmes, supporting both physical and mental well-being. Alternative strategies for reluctant children, such as quiet colouring or resting with eyes closed, were discussed.

Experiential workshop components allowed teachers to feel stress release and HR shifts, moving understanding from theory to embodied insight (Porges, 2011; Zaccaro et al., 2018). Teachers reported growing confidence in applying this knowledge, although translation into classroom practice remained emergent. One teacher described experiencing a profound emotional release during the workshop, which alleviated accumulated tension, reinforcing the link between embodied experience and ER.

Repeated breath-regulating activities and observation of physiological responses gave teachers a tangible sense of calm and growing confidence. The workshop highlighted controlled exhalation as the key mechanism promoting parasympathetic activation and autonomic balance (Porges, 2011), transforming SR from an abstract concept into a teachable, felt experience. As one teacher reflected, “Everything became more relevant once I felt it, then I knew it was something we could actually do in class” (Emerson, 2020).

8.3.2 Barriers to Implementation

8.3.2.1 Knowledge: SR. The three workshops followed a structured progression, moving from broad SR concepts to a more focused exploration of interoceptive accuracy in enhancing regulation (Garfinkel et al., 2015). Teachers initially reported feeling overwhelmed by SR’s multifaceted nature during workshops and FG. All five expressed a desire for extended exploration, noting that recognising physical sensations within the body was particularly essential (Bellato et al., 2024).

These reflections emphasise the cognitive challenges of engaging with SR concepts. Future professional development might adopt a phased approach, dedicating sessions to specific SR components: cognitive, emotional, behavioural, and physiological, spread over a term to foster a deeper understanding without overwhelming participants.

8.3.2.2 Time Pressure. Teachers recognised the importance of developing SR skills but anticipated difficulty in integrating them into their existing curriculum. Consistent with the literature, SR interventions not integrated into familiar frameworks can be seen as an additional responsibility rather than a supportive tool (Durlak, 2008). Teachers expressed pressure from expanding role demands and competing curricular tasks, limiting perceived capacity to adopt new strategies (Jennings & Greenberg, 2009).

Embedding SR strategies into familiar classroom routines, such as transitions or morning meetings, was suggested as a way to make the approach feasible, reducing perceived burden and aligning with the staged professional development model discussed (Fixsen, 2005; Forman et al., 2013).

8.3.2.3 Workshop Delivery. Teachers valued the sequential workshop design, which moved from broad SR concepts, MBC and finally to breath exercises as a practical tool. The holistic, embodied approach and Blair and Ku (2022) visual model which facilitated understanding (figure 3, chapter 2). Small-group discussion and extended reflection during FGs were especially beneficial for engagement and collaborative learning.

While after-school sessions posed logistical challenges, teachers preferred this format to full-day sessions, highlighting the importance of sustained, interactive and contextually relevant professional development for lasting change (Durlak, 2008; Fixsen, 2005).

Teachers suggested that future iterations could enhance transfer to practice by including co-planning, embedded classroom examples, or opportunities for modelling and feedback. One teacher commented, “I get it now, but I think I would need to see how this would look in my timetable to feel confident using it”. These insights informed planning for the classroom implementation phase.

8.3.3 Readiness, Feasibility and Accessibility

8.3.3.1 Focus on Breath only. The third workshop and the post-workshop FG allowed the teachers to consider their readiness, accessibility, and feasibility of implementing breath exercises. Beyond reframing SR, teachers acknowledged the universal accessibility of breath: it requires no resources, can be used anywhere, and is constantly available.

Teachers emphasised adapting language and delivery for different age groups, using visual prompts, playful metaphors, or brief routine exercises for younger children.

These adaptations ensured breath-based strategies were both theoretically and practically accessible across diverse classroom settings.

Breath was seen as an immediate strategy for physiological regulation and a starting point for SR development. Teachers discussed reframing SR from a skill that some children “have” to one that can be explicitly taught and strengthened over time (Bailey & Jones, 2019). Despite time constraints, teachers judged breathwork feasible, recognising regulation as a tangible, teachable skill with direct classroom implications. Breathwork was considered as one component within SR’s broader cognitive, emotional, and behavioural framework (Blair & Raver, 2015; Diamond, 2013), supported by the (Blair & Ku, 2022) visual model.

Although the gap between the third workshop and FG arose from unforeseen circumstances, it unintentionally allowed teachers to practise breathwork; one teacher had already integrated it into her routine, reinforcing embodied experience and confidence (Durlak, 2008)

8.3.3.2 Readiness. Readiness for implementation extends beyond questionnaire responses. Quantitative phase one data reflected generally positive perceptions; however, FG discussions revealed underlying uncertainties, suggesting the need for sustained support and clearer implementation structures. Teachers proposed short refresher sessions, peer support, and opportunities for direct practice to reinforce confidence and accountability. These structures, alongside leadership engagement, were seen as critical for embedding strategies into daily routines rather than allowing them to fade as isolated tools (Durlak, 2008).

Despite high ratings (4/5) for understanding and confidence, teachers expressed uncertainty about translating breath exercises into classroom routines. This was not resistance but a lack of clarity regarding integration. The discussion became collaborative, with teachers exploring practical ways to embed the intervention into routines. This iterative dialogue demonstrated the value of sustained professional development, peer collaboration, and guided support in moving from conceptual understanding to implementation (Fixsen, 2005).

Teachers proposed implementing the breath exercises three times a day: upon arrival, after break, and after lunch, which aligned with classroom routines. The researcher introduced a diary for monitoring implementation fidelity, ensuring the intervention was delivered as intended (Durlak, 2008; Fixsen, 2005). Teachers considered the diary feasible, but variations in completion indicated that ease of use alone does not guarantee consistent, high-quality fidelity**,** which will be examined further in phase two.

8.4 Summary of Workshop Delivery and Readiness

The workshops successfully improved teachers' understanding of SR, MBC, and breathwork, supporting research on the role of structured professional development in increasing knowledge (Desimone, 2009). Teachers valued shared reflection, recognising that SR is integral to classroom life and a supportive environment, rather than an isolated skill. This aligns with the literature, which emphasises that SR must be integrated into classroom practice, with CPD providing ongoing opportunities for reflection and adaptation (Fixsen et al., 2009; Moir, 2018).

The pre-implementation FG emphasised that professional learning in SR should go beyond simply acquiring knowledge and incorporate experiential learning and dialogue in line with implementation science (Fixsen, 2005; Moir, 2018). A CPD model with progressive content, interactive small groups, and structured reflection could be scaled across different contexts, with consideration of timing, staff capacity, and peer collaboration.

A key insight from the FG was that embodied practice strengthens teacher confidence and fidelity (Durlak, 2008). Teachers' efforts to focus on a single SR component were influenced by beliefs about its importance, confidence in implementing it, and practical classroom realities. Time pressures and competing priorities made it challenging to imagine prioritising breath exercises, even when recognising their potential value. Teachers suggested anchoring breathwork to routine moments, such as after transitions, as a low-effort integration strategy. These discussions point to contextual adaptations and practical embedding strategies to explore in phase two implementation.

To support consistent engagement across participants, the intervention design could more explicitly promote embodied learning by embedding additional guided practice, modelling, or co-reflection activities. This would ensure that experiential learning is not only recognised as valuable but consistently integrated into practice, supporting the translation of knowledge into everyday classroom routines.

8.5 Phase Two: Evaluating the Effectiveness of the Intervention

In phase 2, data from children's diaries, teachers' diaries, and FGs (children and teachers) were analysed. Findings from chapter 7 are organised around interconnected themes that address research questions on perceived effectiveness, implementation fidelity, and contextual delivery strategies.

Primary outcomes focused on emotional and physiological SR: children consistently reported immediate feelings of calmness and cognitive quieting (e.g., feeling their minds were "less busy") following the exercises. Notably, this sense of calmness increased over time, with more children reporting both the immediate and sustained benefits of the practice. These patterns were most clearly evidenced in one context where quantitative diary data were available, although qualitative insights were reported across all contexts.

Diaries provided meaningful reflections from children; however, statistical data on adherence and frequency were only available from a single context, limiting cross-site quantitative comparisons. Observational data from teachers regarding classroom engagement and responsiveness were also incomplete, restricting comparative analysis.

FG discussions added contextual depth. Notably, one teacher implemented the intervention with high fidelity, embedding exercises within a sensory-rich environment and linking activities to their theoretical basis. Children reported that observing their teacher model calm breathing improved understanding and comfort with participation, highlighting the importance of teacher-led modelling in co-regulating emotions. Such implementation appeared to strengthen the perceived effectiveness of the intervention.

8.5.1 Perceived Effectiveness

8.5.1.1 ER. Teachers described children as "emotionally more regulated" in FG, referring to them as calmer and more settled, and noting improved concentration. Observable behaviours (reduced restlessness, enhanced attention) were more prominent than internal emotional descriptions. These align with evidence that breath exercises support SR by reducing stress responses (Gross, 2015; Porges, 2011). Teachers indicated that the emotions most influenced by the breathing exercises were frustration, anger, and anxiety-related responses.

8.5.1.2 Calmness. In context X, a statistically significant rise in reported calmness across six measurement points, $Q=44.561$, $P< 0.001$, supported the use of breathwork as an effective SR tool (Brown & Gerbarg, 2005; Porges, 2011). Even within a structured, time-limited implementation, calmness was both subjectively felt and externally observed. While most diary entries referred to immediate post-exercise effects, some teacher and child accounts suggested that the sense of calm extended into later classroom activities, indicating short-term carryover beyond the exercise itself.

8.5.1.3 Immediate Effects. McNemar analyses showed significant immediate improvements in calmness after each exercise at all three time points, with 'immediate' defined as the period between completing the breathing exercise and children recording their self-reported calmness within minutes. A notable shift was seen from pre- to post-start ($p < .001$), indicating an immediate effect after initial exposure. Although significance slightly decreased at mid-intervention ($p = .031$, one-tailed $p = .016$), improvements from pre-mid to post-mid suggest the intervention maintained its influence over time. By the final phase, the pre-end-to-post comparison ($p = .008$, one-tailed $p = .004$) showed continued effectiveness, emphasising a sustained immediate increase in calmness. The results demonstrate the quick impact of breathwork on SR.

8.5.1.4 Cumulative Effects. Data suggest a potential sustained effect on children's ER, particularly calmness (section 7.9.3). While increases were modest, repeated engagement appeared to support more consistent calm states, in line with research on the cumulative benefits of structured regulation practices (Jennings et al., 2017; Tang et al., 2015; Zenner et al., 2014).

Calmness was captured through self-report rather than physiological measures. While physiological data (e.g., HR and breathing rate) could have provided further insight, obtaining such measures was not feasible within the constraints of this school-based intervention.

The observed incremental increase in calmness, coupled with the absence of regression, suggests that embedding breathing exercises into daily classroom routines may support more sustained ER (Durlak, 2011). Regular implementation of ER strategies appears to reinforce these effects, consistent with prior evidence that structured, repeated practice fosters longer-term benefits (Jennings et al., 2017).

In the quantitative analysis, calmness was operationalised as a binary variable, categorising children as either calm or non-calm after the intervention. While this approach enabled consistent comparisons across time points, it inevitably oversimplified the range of emotional experiences. Notably, a 'non-calm' rating did not necessarily indicate dysregulation; children may have experienced other, positive emotional states (e.g., happiness or excitement) not captured by this measure. This underscores a limitation in classifying emotional responses and suggests that while calmness was the most commonly reported outcome, the intervention may have had broader, more subtle effects on children's emotional states (Durlak, 2011). Factors such as baseline ER skills, classroom environment or additional stressors may moderate individual responses (Compas et al., 2017). The qualitative insights discussed offer further insight into differential responses and elaborate on the effectiveness.

8.5.2 Qualitative Insights

The increase in children's self-reported calmness was confirmed through qualitative insights from the FG discussions. Methodological triangulation across data sources included children's diaries, teacher diaries, and FGs, offering complementary perspectives on perceived effectiveness, accessibility, and engagement. While the quantitative diary data were limited to a single context, FG participants were drawn from all intervention sites, providing a broader, cross-contextual view of impact.

Capturing children's perspectives was essential for evaluating not only effectiveness but also perceived accessibility, ease of use, and enjoyment. Most children described the exercises as enjoyable, straightforward, and calming. Several articulated apparent emotional shifts, consistent with research highlighting the centrality of perceived ease and accessibility for engagement and intervention efficacy (Durlak, 2011).

All four classes participated in the FGs. Although the quantitative data for three classes could not be statistically validated, the descriptive scores suggested similar patterns. Implementation fidelity varied, yet FG discussions indicated that when the breath exercises were delivered, children reported positive outcomes, with most feeling calmer. This aligns with research emphasising the role of even brief mindfulness interventions in promoting SR (Felver, 2016; Semple et al., 2017). While the fidelity remains a critical (Durlak, 2008). Qualitative insights suggest that breathwork retained perceived benefits despite inconsistent delivery, supporting the notion that SR strategies can be effective even when irregularly implemented (Diamond & Lee, 2011). Nevertheless, these findings underscore the importance of structured implementation support to ensure long-term sustainability in school settings (Fixsen, 2005).

Children's descriptions of feeling calm, referring to the immediate effect, suggest an instant real-time shift. Their sense of calmness was accompanied by a less "busy head", "able to do my work better", and "felt more relaxed". This aligns with Schuman-Olivier et al. (2020) who emphasise that a healthy ER promotes behaviour change and learning readiness. Such reports highlight the link between interoception and emotional awareness, suggesting that the exercises support both immediate physiological regulation and conscious recognition of emotional states (Craig, 2009).

Physiological markers such as HRV and cortisol were not collected due to practical constraints in this school-based, practitioner-led research. Including these measures would have required a more targeted, resource-intensive design, beyond this study's scope.

While objective physiological data could have strengthened reliability, children's self-reported experiences and verbal articulation offered meaningful insight into the integration of autonomic and psychological regulation. The capacity to both feel and verbalise calmness indicates that regulation through breathing exercises was not solely autonomic but also consciously processed. This supports research that self-reported emotional states can validly reflect autonomic shifts (Khalsa et al., 2018; Quigley et al., 2021). Experiencing and articulating emphasise the role of bodily awareness in SR (Craig, 2009; Porges, 2011), and indicate that perceived regulation is a core element of SR (Khalsa et al., 2018).

Importantly, children who gave lower ratings described sitting through the exercises as "okay," implying that even without enthusiasm, exposure to regulation practices may have benefits. This reflects findings that, despite varying engagement levels, opportunities to practice regulation, whether through stillness or mindfulness, can still foster awareness and emotional control (Diamond & Lee, 2011; Zeidan et al., 2010). The variations highlight the importance of tailoring interventions to meet diverse needs while maintaining a focus on ease, accessibility and enjoyment (Durlak, 2011).

Children also reported increased engagement and calm when teachers modelled the breathing exercises, describing the practice as more effective. This reciprocal dynamic underscores the role of the emotional climate in supporting learning (Jennings & Greenberg, 2009). As Aldrup et al. (2023) note, both external and internal ER strategies are linked to teaching effectiveness. Children recognised that teachers' ER, particularly their ability to model calm and the exercises themselves, contributed to a more positive experience. The emotional climate established by teachers was mirrored by students, reinforcing a shared process in which teacher beliefs and children's perceptions jointly shape a regulated learning environment (Beauchaine, 2015). Teachers reflected that their own ER affects their well-being and directly influences classroom climate, highlighting the critical role of teacher-led modelling in cultivating sustained SR among pupils.

8.5.1.1 Cognitive Insights. Improved cognitive regulation, including focus and attention, was a repeated topic across all FG discussions. A calmer classroom appeared to create conditions that allowed children to concentrate more effectively (Beauchemin et al., 2008). Although these outcomes were not quantified, children reported feeling calmer after the breathing exercises and articulated that this sense of calm enabled them to focus more effectively.

The exclusion of standardised cognitive assessments was intentional, based on considerations of scope, feasibility, and ethical suitability. In busy composite classrooms covering multiple developmental stages, such measures would have created logistical and cognitive challenges that conflicted with the study's participatory, practitioner-led approach. Instead, qualitative methods were employed to gather experiential data directly aligned with the intervention's goals and ecological environment.

Teachers noted that breath exercises positively influenced overall classroom behaviour and engagement. Such qualitative feedback is crucial for capturing these subtle, often overlooked impacts, supporting more effective implementation and adaptation of SR interventions in schools (Schonert-Reichl, 2017).

Children across all FGs described their minds as "less busy" following the exercises, indicating increased focus, mental clarity, and emerging interoceptive awareness. This aligns with findings in section 7.9.5, where children reported feeling calmer post-exercise. Such interoceptive awareness reflects an evolving ability to recognise and monitor internal cognitive and physiological states, a process foundational to metacognition and attentional control (Farb et al., 2015; Garfinkel et al., 2015). It may be that the simple act of focusing on the breath momentarily unclutters the mind, allowing space for calm and attentional steadiness to arise. In this sense, physiological regulation through mindful breathing could be viewed as a gateway through which higher-order cognitive functions, such as sustained focus and task engagement, are enabled (Blair & Ku, 2022; Nigg, 2017).

Children's reflections suggest that embodied awareness serves as a developmental mechanism that supports cognitive regulation and readiness to learn. Teachers confirmed this, noting that breathing exercises, especially after transitions, helped pupils settle more easily and re-engage with tasks. This supports evidence that a calm physiological state reduces distraction and improves focus (Gunzenhauser & Saalbach, 2020; Howard et al., 2022). Two teachers also described using the exercises with dysregulated children, observing immediate improvements in their emotional state, consistent with evidence that brief regulation strategies can yield rapid cognitive benefits (Zeidan et al., 2010). However, teachers varied in their perceptions of whether these effects were sustained or generalisable, suggesting that outcomes may depend on the degree of teacher engagement, modelling, and belief in the approach. This underscores the importance of implementation fidelity and teacher buy-in for maintaining benefits over time (Diamond & Ling, 2016).

8.5.2.2 Effects for Classroom Environment. Teachers' reflections indicated that individual calmness experienced by children extended to the wider classroom environment, generating a collective sense of stillness that supported concentration (Felver, 2016). One teacher described using the exercises as a classroom management strategy to help settle the group and foster a more regulated learning climate. However, this raised an unanticipated question regarding overuse. Employing the exercises more frequently or outside the planned schedule may have altered their regulatory purpose, with potential implications for fidelity, consistency, and interpretation of outcomes (Durlak, 2008).

The utility of breathwork for managing classroom dynamics was discussed during the initial coaching session and resurfaced during the FG. One teacher noted that the exercises provided immediate behavioural benefits, describing breathwork as an effective behaviour management tool that promoted a calmer, more productive atmosphere. This mirrors findings from Aldabbagh et al. (2024) who highlight the value of equipping teachers with self- and co-regulatory strategies to address externalising behaviours more effectively.

Using the exercises during moments of heightened energy helped sustain calm and enhance focus. Participants consistently agreed that physiological regulation benefits both individual SR and the broader emotional climate of the classroom (Bailey & Jones, 2019; Blair & Raver, 2015; Porges, 2011). Bailey and Jones (2019) conceptualise SR as both an individual skill and a socially embedded process, an interpretation supported by these findings, which underscore teachers' central role in establishing a regulated classroom environment. Teachers who practised regulation themselves appeared better able to manage their emotional responses, fostering stability, responsiveness, and reduced stress or burnout (Jennings et al., 2019; Jennings & Greenberg, 2009).

Beyond individual gains, consistent teacher engagement in daily SR practices appeared to cultivate a classroom climate that reinforced these skills. In the class where the teacher most consistently modelled and practised breathing exercises, children demonstrated a more comprehensive understanding and internalisation of MBC principles. Conversely, inconsistent teacher engagement was associated with less clear articulation and application of SR concepts. This supports evidence that variability in dosage, quality, and teacher commitment critically influences intervention outcomes (Domitrovich et al., 2008; Durlak, 2008).

Teacher engagement also had direct implications for teacher well-being. One participant described using breathwork as a personal tool for stress regulation, highlighting reciprocal benefits for both teacher and classroom. These observations, combining self-reports and the researcher's inference, demonstrate how breathwork can simultaneously improve emotional stability and the classroom atmosphere. These findings support models proposed by Blair and Ku (2022) and Nigg (2017) emphasising the integration of physiological and cognitive dimensions of SR to support adaptive in-the-moment responses and a favourable learning climate.

8.5.2.3 MBC in SR. A teacher reported that children were developing awareness of the link between physical sensations and emotional states throughout the intervention. Another noted that the exercises supported group regulation after transitions by helping children tune into bodily sensations. At the same time, another observed that individual practice helped children recognise internal cues, such as feelings of calm.

In the FG, children’s references to breath sensations and their use of the “up and down stairs of the brain” metaphor demonstrated emerging interoceptive awareness. These examples indicated that children were learning to pause, recognise bodily signals, regulate emotions, and adjust their behaviour accordingly (Blair & Raver, 2012). This interpretation draws on both teacher observations and children’s experiences, suggesting the intervention supported the development of interoceptive awareness, a key component of ER and SR.

Both teachers and children expressed the value of learning about the MBC in supporting SR. Understanding the interaction between physiological and emotional processes reinforces evidence that psychoeducation can enhance children’s SR and engagement (Jennings & Greenberg, 2009; Semple et al., 2017). One teacher highlighted that when the physiological basis of breathwork was made explicit, children participated with greater purpose and curiosity, suggesting that understanding why the practice works may deepen engagement.

Although HRV (a non-invasive marker of ANS function) was not measured (Ghati et al., 2021), findings align with research showing that slower, deeper breathing reduces reported stress and anxiety by shifting the body’s physiological state. Zaccaro et al. (2018) reviewing 15 studies, reported reduced anxiety and depression and increased HRV during slow-breathing interventions. Similar outcomes were observed by Malviya et al. (2022) further supporting breathwork as a strategy for alleviating stress-related symptoms.

However, effectiveness may vary across contexts. While this study demonstrated immediate positive effects of breathwork on emotional states such as calmness, other studies report more mixed findings. For example, Kramer et al. (2022) conducted a micro-randomised control trial. They found that slow-paced diaphragmatic breathing did not consistently improve negative affect or relaxation in children, except for those with higher baseline worry. Thus, while breathwork can be broadly effective, generalising the findings requires caution.

In Kramer et al. (2022) children were guided through breathing via video, supporting consistency in delivery but potentially reducing engagement. The importance of contextual factors such as classroom setting, teacher involvement and relational trust was highlighted by Tuero et al. (2022). Implementation, therefore, benefits from a supportive environment in which a trusted figure delivers the exercises. Bentley et al. (2022) similarly recommend embedding breathwork into routine classroom activities.

Although most children in this study responded positively to breath exercises, some appreciated the moments of stillness and calm that the time offered. This emphasises the need to create a structured, emotionally regulated classroom environment instead of relying on a single technique. It aligns with research indicating that brief, purposeful pauses can support SR by reducing cognitive overload and improving attentional control (Vago & Zeidan, 2016). Children's appreciation of calm moments, despite their enthusiasm for breath exercises, indicates that cultivating a culture of controlled stillness in the classroom may be as important as teaching specific techniques (Jennings et al., 2019).

These findings support a multi-component approach to SR that integrates breathwork with complementary strategies, including co-regulation, teacher modelling, emotional labelling, cognitive reframing, and behavioural prompts, as well as environmental supports. Sustained SR development is likely to depend on this integrated approach. As Jennings et al. (2019) emphasise, teachers' engagement with SR is crucial for both modelling and for their own well-being.

This study supports Blair and Ku (2022) hierarchical model of SR, which highlights the importance of physiological regulation as the foundation for emotional and cognitive control. Children described feeling calmer and more focused after practising breathwork, suggesting that the exercises supported both physiological responses and emotional states.

According to the model, as EF develops, children increasingly manage emotional and physiological responses to stress through top-down control processes. The children's growing interoceptive awareness and ability to self-regulate through breath can be seen as part of a developmental progression. Consistent with Blair and Ku (2022) this study frames SR as a skill acquired through repeated, supported practice.

Teachers also noted improvements in ER, observing that children appeared calmer and more settled throughout the intervention. FG discussions confirmed this, with children describing increased calmness and focus after breathing exercises. Calling the practice a skill emphasises that SR develops gradually through awareness and repetition. In both FGs, participants reflected that calming the mind is reciprocal: negative thoughts can also provoke stress responses, highlighting the iterative and bidirectional nature of SR.

The findings highlight interoceptive awareness as central to SR and suggest that breathwork may strengthen this connection. This aligns with research demonstrating that interoceptive training enhances emotional and physiological regulation (Farb et al., 2015; Khalsa et al., 2018). The iterative nature of SR, influenced by the structured intervention and teacher modelling, reflects implementation science literature emphasising the importance of sustained, embedded practices over isolated techniques (Durlak, 2008; Powell et al., 2017).

As Jennings et al. (2019) note teachers' engagement with SR is key, not only to support practices effectively but also for their own well-being. If breathwork improves self-reported ER, it may enhance both teachers' and children's ability to manage stress and maintain a positive classroom environment. This supports (Blair & Ku, 2022; Nigg, 2017) models, which highlight the need to address both physiological and cognitive dimensions of SR to support real-time regulation and a productive learning environment.

8.6 Summary

While inconsistencies in data collection across context Y limit generalisability, the combined findings and FG discussions suggest a modest cumulative effect. For most children, this was evident in immediate emotional outcomes, such as a feeling of calm during sessions. One teacher, however, reported a broader and sustained improvement in overall classroom calmness, indicating potential for longer-term SR development with continued practice.

Despite variability in delivery, even children who experienced the intervention less consistently described feeling calmer. This suggests that while frequency may strengthen outcomes, intermittent engagement with breathwork can still be beneficial. These findings align with evidence that both consistent and brief exposures to mindfulness practices can influence emotional and autonomic regulation (Tang et al., 2015; Zenner et al., 2014)

Breathing exercises proved to be a valuable tool for supporting physiological and ER, although their effectiveness was affected by environmental and personal factors related to implementation. This included teacher engagement, belief in the approach, classroom routines, time pressures, and confidence in delivery. While school leadership approved the pilot, their engagement was not a part of the intervention. However, its potential impact on teacher motivation and the prioritisation of wellbeing practices remains an important consideration for future efforts implementation.

A key implication is the need to integrate SR strategies that address both teachers' and children's needs. While breathwork may not appeal to all participants equally, the value of structured moments of stillness and regulation appears to offer universal benefits. These findings emphasise that SR in classrooms is less about a single technique and more about creating an environment that normalises pauses, reflection, and calm, allowing SR skills to develop naturally over time.

8.7 Factors Influencing Implementation Success

In primary schools, teachers are the primary implementers of universal, prevention-focused, evidence-based practices (Schonert-Reichl, 2017). Their engagement is central to determining whether interventions are effectively delivered. Following this intervention, the analysis focused on the implementation process, identifying factors that influenced delivery and examining their impact on overall effectiveness. This provided insight into conditions necessary for successful adoption and sustained use.

Key influences included teacher buy-in and belief in the intervention's value, compatibility with existing classroom routines, and time constraints. Motivation and confidence also shaped the consistency and fidelity of implementation. Accurate interpretation of outcomes depends on understanding the quality of implementation; without this, drawing meaningful conclusions is difficult (Durlak, 2008).

8.7.1 Quantitative Data

As a pilot study, it was essential to explore usability, acceptability, and feasibility (Lyon & Bruns, 2019; Proctor et al., 2013). Questionnaire data from the URIP captured key implementation information, with all teachers rating the intervention as both acceptable and feasible, highlighting the importance of perceived relevance and practicality in successful implementation (Durlak, 2008; Fixsen, 2005).

Although three children reported practising exercises at home, limited home-school engagement did not appear to compromise classroom fidelity. However, the lack of extension may have restricted children's ability to generalise and consolidate SR skills in other environments. Future iterations might strengthen home-school links, especially if deeper SR integration across settings is a long-term aim.

FGs with teachers and children contextualised the quantitative data, providing insight into how the intervention was embedded into daily classroom routines and highlighting both facilitators and barriers to implementation (Domitrovich et al., 2008). While fidelity assessment is complex and multi-dimensional (Clayback et al., 2023). It is essential in distinguishing between limited intervention effects and issues with delivery (Bond & Drake, 2020). Monitoring included barriers, influencers, and progress toward the implementation goals (Damschroder, 2009). Fidelity was assessed through adherence to the implementation plan, coaching sessions, classroom observations and FGs with children and teachers. Together, these provided insight into delivery variation, perceived effectiveness of the intervention and sustainability challenges (Carroll et al., 2007; Durlak, 2008).

Three components were central to implementation success: fidelity (delivery as intended), dose (frequency and consistency), and teacher-level factors (belief, motivation, confidence). These personal attributes particularly affected adherence and responsiveness to child engagement.

8.7.2 Fidelity

FG findings showed positive effects in both contexts. However, variations in implementation fidelity, especially adherence to the planned delivery (including exercises and data collection), influenced the depth of children's understanding and overall effectiveness of the intervention.

Fidelity varied: in Context X, one teacher consistently documented sessions and kept detailed records, while in Context Y, teachers were less consistent. All, however, acknowledged conducting exercises more frequently than recorded. This discrepancy highlights a common issue in implementation research: self-reported fidelity data is often incomplete due to practical constraints (Carroll et al., 2007). In this study, underreporting stemmed from time limitations, administrative burden, and a lower perceived value of documentation relative to actual delivery, findings consistent with those of other school-based interventions (Durlak, 2008).

Recognising and tackling these barriers is essential. Simplifying fidelity monitoring with digital prompts, embedded reflection, or easier-to-use tools might boost accuracy while lowering the workload.

8.7.3 Data Gathering

Variations in data collection further influenced adherence to the protocol. In context X, the teacher played a crucial role in supporting data collection by following the procedure: questionnaires were distributed to all children before the breathing exercise and collected immediately afterwards. This approach led to high participation in the quantitative pre- and post-exercise measures. However, participation in the qualitative component was low, indicating potential response bias, as written entries may reflect the views of more engaged children.

In contrast, teachers in Context Y allowed children to fill out questionnaires independently, resulting in lower participation and incomplete diary entries. This demonstrates how even well-meaning lapses in fidelity can affect data quality, despite ethical considerations. Only Context X included observational data, further highlighting the teacher's active role.

These differences reinforce teachers' roles as gatekeepers of data accuracy. Their buy-in, capacity, and perceived value of documentation directly affected both data quantity and quality. Fidelity is thus shaped not only by protocol design but also by contextual and logistical factors, including teacher readiness and external support (Durlak, 2008). Future interventions could improve fidelity and data quality by incorporating streamlined tools, enhanced training and ongoing support.

8.7.4 Coaching Attendance and Implementation Support

Variability was also evident in coaching attendance. In Context X, the teacher attended both sessions; in Context Y, attendance was inconsistent. Research indicates that continued professional engagement sustains fidelity, reinforcing competence and motivation (Powell et al., 2017). Structured implementation support is therefore vital; interventions are more likely to be sustained when teachers receive ongoing guidance and perceive tangible benefits.

Addressing implementation challenges requires more than simplified tracking tools. Integrating fidelity monitoring into existing routines through reflective journals, collaborative planning, or brief digital prompts could reduce burden. Peer support networks, or designated 'implementation champions may also foster shared responsibility and relational reinforcement. These findings reflect the complexities of real-world school environments, where inconsistent reporting is common (Durlak, 2008).

The researcher's reflections during FGs acknowledged these realities, consistent with implementation science principles that emphasise iterative refinement and contextual adaptation.

8.7.5 Fidelity and Effectiveness

A key objective was to examine whether frequency and consistency of practice influenced effectiveness, particularly children's self-reported experiences. Quantitative data showed significant immediate and sustained effects, particularly increased calmness in Context X. Qualitative insights confirmed perceived benefits across both settings, though differences emerged between contexts.

In Context X, children exhibited stronger engagement and a deeper understanding of the MBC, as evidenced by reflective language, behavioural shifts, and spontaneous use of breathwork under stress. For example, one child noted, "When I put my hand on my tummy, I can feel my breathing slow down, and I feel calmer." These examples indicate that frequency supported conceptual integration (Sprung et al., 2015). This aligns with evidence suggesting that when children actively engage with and reflect, they are more likely to internalise and sustain new skills (Diamond & Ling, 2016).

Fidelity appeared to mediate these effects, particularly in fostering children's interoceptive awareness. Children's physical engagement in Context X, such as placing hands on their stomachs, anchored awareness of internal sensations and connected physiological cues to emotions. With regular practice, these embodied experiences deepened understanding of SR, reinforcing the role of embodied learning (Feldman, 2017; Mehling et al., 2011).

This depth of engagement was also evident in the FG behavioural responses. Children in Context X described how they used breathing strategies independently in emotional situations, giving examples of their use during moments of stress. By contrast, references to the exercises in Context Y were sporadic, with fewer children articulating the techniques or their benefits. This suggests a less embedded understanding and highlights the influence of classroom-level factors such as teacher modelling, consistency of delivery, and the perceived relevance of the practice (Carroll et al., 2007; Durlak, 2008).

These contextual differences highlight how implementation quality can shape both uptake and the depth of cognitive and emotional engagement (Domitrovich et al., 2008; Fixsen, 2005). Children's understanding of MBC was closely linked to teachers' beliefs and enthusiasm, supporting research on emotionally supportive environments (Carroll et al., 2007; Jennings & Greenberg, 2009). This also aligns with evidence suggesting that metacognitive awareness of one's emotions, based on understanding the underlying brain processes in children, can enhance SR outcomes (Dignath, 2018). In the FGs, some children recognised the biological basis of being calm. Although not all children were fully engaged, most recognised the importance of calm and identified alternative regulation strategies.

8.7.6 Human and Contextual Factors Influencing the Implementation and Success of Breathing Exercises

Human factors are central to successful implementation (Fixsen, 2005). Interventions are often intentionally and unintentionally adapted when introduced into real-world settings. This study illustrates how teacher autonomy served both as a support and a barrier to implementation fidelity.

Autonomy was valuable, facilitating high engagement and thoughtful adaptation. One teacher enhanced the intervention with music, a context-sensitive adjustment that likely increased pupil engagement without compromising the intervention's core principles. Demonstrating adaptation with integrity (Fixsen, 2005). Conversely, for others, autonomy led to inconsistent delivery, reflecting the tension between flexibility and fidelity (Domitrovich et al., 2015).

Despite structured support and co-designed adherence plans from phase one FG, variability persisted, illustrating the challenges of translating research into dynamic classrooms. Implementation remained influenced by teacher beliefs, contextual realities, and individual practices. These findings reaffirm that human factors cannot be fully controlled, even with careful design (Fixsen et al., 2005; Domitrovich et al., 2015). Ongoing monitoring and responsive support are therefore essential.

All teachers voluntarily participated and viewed the intervention as acceptable. However, observed differences in delivery stemmed primarily from individual factors, particularly confidence and personal engagement, reinforcing the importance of teacher modelling and professional development. Implementation is thus a relational process shaped by individual readiness, not merely a procedural one. Building confidence through experiential training may enhance future fidelity (Fishman et al., 2018).

8.7.6.1 The Role of Teacher Factors in the Implementation. The intervention effectiveness extended beyond the breathing exercises themselves and was shaped by teacher engagement, consistency and modelling. In Context X, teachers' enthusiasm, self-efficacy, and beliefs emerged as critical to successful implementation (Clayback et al., 2023). Self-efficacy refers to teacher confidence in delivering the intervention as intended, while personal beliefs include perceptions of the intervention's value, relevance, and appropriateness for the children. Both factors interact to influence motivation, effort, and consistency in delivery.

This was evident in the teacher's commitment to a breath practice, shown through structured implementation, accurate logging and active participation in the coaching sessions. Such dedication reflects the broader principle that individual-level characteristics of implementers influence both the adoption and sustained use of evidence-based practices (Fishman et al., 2018). In this case, teacher enthusiasm appeared to translate into higher levels of engagement, reinforcing the research that highlights the role of teachers in shaping the uptake and sustainability of interventions (Durlak, 2008; Powell et al., 2017). Although this level of commitment was not typical across all contexts, it raises the importance of educators' buy-in in sustaining and optimising intervention outcomes.

8.7.6.2 Personal Engagement. In Context X, the teacher integrated breathwork into her own routine, modelling it authentically and discussing its benefits. Her engagement reflects identified and integrated regulation within Self-Determination Theory (Deci, 2000) with motivations grounded in personal values and self-concept alignment.

Her belief in the intervention helped communicate its purpose and benefits authentically, increasing pupil engagement and understanding of its effects. During the FG in context X, children showed increased interoceptive awareness by placing their hands on their stomachs to monitor breathing and explaining the physiological impact. Comments like "breathing slowly makes my heart go slower" and "When I get fizzy, I breathe like we do with Miss X, and my tummy goes up and down" demonstrated cognitive understanding and sensory awareness. These observations suggest that teachers' modelling and commitment supported deeper, embodied learning, aligning with Self-Determination Theory's focus on internal motivation driving engagement (Deci, 2000).

Her approach also reflected the idea that SR is not just a skill to be taught but one that develops through environmental and relational support (Bailey & Jones, 2019). She went beyond simple instruction, explaining why breathing is beneficial, experimenting with different delivery methods, modelling the exercises, and using training materials creatively. One notable strategy was the hands-on-belly technique to increase interoceptive awareness (Farb et al., 2015; Mehling et al., 2011), which is linked to improved SR and emotional awareness in children (Zelazo & Lyons, 2012). This physically grounded technique aligns with the research on embodied learning, demonstrating how physical engagement enhances cognitive and emotional processing (Mehling et al., 2011).

The teacher added calming music during practice, which children responded to positively, boosting enjoyment and engagement. This shows how real-world adaptation is needed to keep participation while preserving the intervention's core components. As Bailey and Jones (2019) emphasise that adults play a critical role in scaffolding SR, and teacher commitment can significantly enhance child engagement.

This highlights a key insight from implementation science: fidelity should be reconceptualised beyond mere adherence to prescribed exercises to include the quality and intentionality of delivery (Carroll et al., 2007). In this study, teacher enthusiasm and adaptability became active elements of fidelity. Recognising these relational and contextual factors shifts the understanding of fidelity towards a balance between adherence and flexible, motivated delivery, an approach better suited to the realities of school-based implementation.

8.7.6.3 Reciprocal Influences Between Teacher Engagement and Children's Experience. While music was not incorporated in Context Y, children across all FGs independently mentioned that including music might improve the breathwork session. This is significant because it highlights the teacher-led adjustment in Context X, even though the children in Context Y had no direct experience of music being used during the activity exercises. This alignment highlights the value of participatory feedback and child-informed insight in refining interventions.

Children also noted that placing their hands on their bellies enhanced focus, as consistently modelled in Context X. These sensory cues provided tangible anchors for SR, aligning with embodied cognition theory, which posits that sensory and bodily experiences shape cognitive and emotional processes (Barsalou, 2008). Multisensory engagement thus appears to optimise accessibility, effectiveness and depth of learning. From an implementation science perspective, these context-sensitive adaptations reflect ecologically tailored modifications that enhance an intervention's fit within specific settings while maintaining its core intent (Durlak & DuPre, 2008).

8.7.6.4 The role of Confidence and Belief. The successful implementation of breath exercises depends on the teacher's confidence and comfort in guiding children through them. While all were willing, confidence varied. Phase one training and experiential components helped; some teachers required deeper embodied practice to feel secure. More structured experiential learning, such as guided practice with reflective discussion, might support deeper personal grounding.

Confidence and belief were distinct yet interrelated drivers. The teacher who personally engaged reported higher fidelity and confidence (Fishman et al., 2018; Herlitz et al., 2020). Those in Context Y were less comfortable and implemented less consistently. Importantly, teachers accepted the exercises; the key difference lay in how fully they had internalised the practice and whether they believed in it enough to prioritise it within daily routines. This aligns with Kennedy (2016) argument that implementation requires alignment with professional identity, and with Domitrovich et al. (2015) who emphasise the role of personal engagement in authentic delivery.

Teachers' explanations of why breathing mattered strongly reflected their confidence and perceived relevance, supporting Weiner (2009) model of implementation readiness. Those with lower readiness delivered with reduced fidelity and dose.

In Context X, the teacher's comfort with breathwork allowed her to connect physiological and emotional states meaningfully, helping children understand the science behind calmness, consistent with Greenhalgh et al. (2004). Experiencing the intervention personally may enhance teachers' ability to implement it authentically.

This raises broader implementation questions: can or will all teachers engage with practices in similar ways, and what types of support are needed to foster a sustainable culture of SR in schools? One potential approach is to offer differentiated CPD pathways aligned with various levels of teacher confidence and readiness, such as optional experiential sessions, follow-up support, or advanced workshops, providing greater flexibility while encouraging deeper personal engagement.

The variability in teacher engagement highlights the importance of designing SR strategies that are both practical and meaningful. While the teacher in context X fully embraced and demonstrated a personal connection to the practice, SR practices are inherently individual and may not resonate equally with all teachers. What worked for her was fully embracing and modelling the breathing exercise. Her authentic engagement exemplified reciprocal regulation: the teacher's SR directly influenced children's regulatory capacity (Jennings & Greenberg, 2009).

Even in less consistent contexts, pupils valued the exercises, indicating that partial implementation still holds benefit. These patterns reflect variability across individual, setting, and process domains (Damschroder, 2009). Confidence, belief, and contextual pressures, including teachers' own SR capacities (Jennings et al., 2017), shaped implementation. The limited involvement of teachers in data collection also hindered iterative learning, highlighting the importance of establishing structures that encourage active participation throughout the process (Fixsen et al., 2005).

8.8 Researchers Reflections

8.8.1 Making Implementation Effective

Successful implementation depends on a personalised, context-aware strategy that acknowledges individual teachers' needs and identities while remaining evidence-based, flexible, and sustainable. Tailored training options can address different levels of readiness and confidence, and peer modelling, along with collaborative learning, allow teachers to gain hands-on experience through observation and reflection. Including reflective logs or guided self-assessment tools can foster ongoing self-awareness, critical thinking, and continuous improvement. Due to the complexity of SR, a tiered support system providing multiple entry points is crucial for motivating initial participation and ensuring long-term success across diverse school settings.

Although implementation in Context Y was less consistent, FG data revealed that children nonetheless enjoyed the breathing exercises and recognised their benefits. Teachers in this context also reported positive effects and expressed genuine appreciation for the principles underpinning breathwork, even when delivery was limited. This reinforces implementation research highlighting the importance of embodied and experiential learning, in which direct personal engagement with an intervention cultivates deeper understanding, confidence, and sustained practice (Domitrovich et al., 2008). Notably, teachers in both FGs reflected that the intervention might have been more meaningful and effective had they been supported to engage in regular breath practice themselves.

A more structured approach, incorporating teacher participation in routine breathwork with accountability mechanisms, may have enhanced confidence and consolidated understanding of its benefits, thereby promoting more consistent delivery. Although this expectation was discussed during the pre-implementation FG and encouraged throughout the training phase, it was not fully internalised by all teachers. This suggests that belief in the intervention was not lacking, but that deeper personal integration and familiarity were needed before teachers could authentically model the practice.

It did not seem to be a lack of belief. Instead, it appeared to be a need for personal integration and familiarity. To improve implementation, future versions should focus on helping teachers internalise techniques through accessible, ongoing resources. Practical tools such as researcher-made video demonstrations, micro-coaching with targeted feedback, and straightforward classroom scripts or prompts can link theoretical knowledge to real classroom practice. These methods may help teachers move from mere procedural compliance to genuinely integrating breathwork into their own SR strategies and using it as a valuable tool to support pupils.

This reflection highlights a broader insight emerging throughout the study: sustainable implementation depends not only on the design of an intervention but on how meaningfully it is lived by those who deliver it. Teachers' engagement with the intervention, as both practitioners and participants, is therefore central to its authenticity, fidelity, and long-term impact in the classroom.

8.8.2 The Role of Training and Reflection

Despite initial enthusiasm, implementation was constrained more by teachers' confidence and competing curriculum demands than by a lack of understanding. Teachers regarded the training as valuable, noting a more precise grasp of SR and an interest in broadening this knowledge (section 6.8). However, consistently applying this understanding in daily practice proved challenging, suggesting a need for more practical support to help integrate breathwork into everyday teaching routines.

Recognising that SR includes multiple interrelated constructs, future training models could address these components more explicitly. Although this study centred on breathwork, it raises broader questions about integrating SR into sustained professional development. Such a model might include ongoing coaching for personalised support, in-situ modelling to demonstrate practical application, and peer learning communities for collaborative reflection. This aligns with implementation science, which emphasises the need for continuous, context-specific support beyond initial training (Domitrovich et al., 2008; Fixsen, 2005)

Teachers were receptive to the physiological framing of SR (Blair & Ku, 2022) and expressed interest in further training. Presenting SR as a layered concept, teachers could personalise their practices and use tools to engage with techniques that resonate with them. A structured approach, incorporating ongoing support and reflection, may strengthen teachers' confidence in their regulatory practices while fostering a classroom environment that models SR strategies (Jennings et al., 2019).

FG discussions highlighted the supportive nature of the training and the value of reflective discussions. Two teachers described the experience as "therapeutic," an unexpected outcome not initially intended by the FG. This highlighted for the researcher the significance of a nurturing training environment in promoting self-reflection. Including intentional reflective and experiential components in future training sessions could be advantageous. A supportive environment appears crucial for fostering self-reflection and may help teachers regulate their physiological reactions, thereby enhancing SR both cognitively and physically (Porges, 2011). Professional learning for SR should be both cognitive and embodied. Teachers enhance their ability to foster SR in children through experiential and reflective training in supportive, context-sensitive settings.

8.8.3 Stillness

Kabat-Zinn and Hanh (2009) advocate for moments of "non-doing time," intentional pauses with no agenda. An idea that seems radical in today's world. Allowing the nervous system to access a calmer, more balanced state can reduce stress and aid regulation. Helping children learn how to reach such moments is vital. Whether through music, time in nature, quiet breathing, or simple stillness, supporting them to find what resonates encourages agency and awareness.

Breath offers a tangible pathway to stillness. Although we cannot directly control the nervous system, focusing on the breath gives us time to regulate thoughts and reactions. Since breathing is usually automatic, paying attention to it redirects focus from the sensory and cognitive loops that sustain emotional activation, momentarily breaking the momentum of reactivity. This pause creates space for awareness and adjustment, making calm breathing less of a final strategy and more of a starting point for regulation.

Micro-interventions, such as grounding breaths before transitions, quiet listening at the start of the day, or rhythmic movement like the Daily Mile, can embed these moments naturally within school routines. When aligned with existing transitions, they enhance feasibility and sustainability (Durlak, 2008). From a Polyvagal perspective (Porges, 2011), such structured stillness signals safety, allowing access to the social engagement system and supporting connection and readiness to learn.

In this study, most children reported feeling calmer after the breath-based practices, and the teacher who led them consistently observed a more settled classroom environment. Music, when used alongside these pauses, increased engagement and complemented the sense of calm, demonstrating how stillness, rhythm, and sensory elements can work together to create moments of regulation that are both accessible and meaningful.

8.9 Limitations of the Study

SR is a complex, multifaceted construct; its scope presents significant challenges for research. This study focused specifically on MBCs through breath exercises. While this enhanced feasibility in primary classrooms, it also limits generalisability to the broader range of self-regulatory functions.

This small-scale pilot assessed the feasibility, acceptability, and practicality of a teacher-led, breath-based intervention. Although the results were promising, several limitations must be recognised, especially within implementation science frameworks that emphasise not only whether an intervention is effective but also how, for whom, and under what conditions (Damschroder, 2009; Fixsen, 2005).

A key limitation was the self-selected sample and attrition during implementation. Of the 10 teachers initially interested, 7 began training, and only 4 went on to carry out the intervention. This introduces bias, as participants may already have positive attitudes towards well-being practices, thereby reducing transferability. Attrition also highlights barriers within the Exploration and Preparation phases (Fixsen, 2005), potentially related to workload and competing priorities. Without data on reasons for dropout, conclusions about feasibility remain tentative. Contextual challenges, such as rural Scottish schools, composite classes, weather conditions, long travel, and staffing shortages, affected implementation and limited its applicability to other settings.

Fidelity and consistency of implementation posed additional limitations. Data were gathered from a single classroom, which restricted understanding of how teacher practices or classroom climate influenced outcomes. Although FGs offered rich qualitative insights, they were affected by subjective recall and social dynamics. These challenges reflect real-world complexity rather than methodological flaws. Limited fidelity, partial adoption, and inconsistent data mirror the relational and systemic realities of implementing low-intensity well-being practices in busy schools. In line with implementation frameworks (Fixsen et al., 2005; Durlak & DuPre, 2008; Domitrovich et al., 2008), outcomes should therefore be viewed as emerging from the interaction between intervention design, practitioner engagement, contextual fit, and implementation infrastructure.

The absence of physiological measures, such as HRV, also limited the understanding of embodied regulation. While affective self-reports were collected, biological data could have enhanced triangulation (Davidson & McEwen, 2012). This reflects ethical and practical constraints in school-based research, as well as the trade-off in implementation science between methodological rigour and ecological validity (Durlak & DuPre, 2008; Proctor et al., 2011).

Adopting a critical realist stance, this study recognised schools as complex, open systems where isolating causal mechanisms is inherently challenging (Bhaskar, 2013). Variation in teaching style, classroom atmosphere, and responsiveness influenced implementation. Teachers were not neutral facilitators; their interpretations, enthusiasm, and readiness shaped delivery. While this limits internal validity, it authentically reflects the dynamics of real-world practice. It underscores the tension between fidelity and contextual relevance (Carroll et al., 2007), highlighting the importance of providing enhanced support and improving fidelity monitoring in future studies.

The researcher's active involvement and enthusiasm may have created facilitator bias, influencing the perceptions of both teachers and children. Common in small-scale practitioner-led studies, this challenges internal validity and complicates the distinction between implementation and evaluation (Yoder et al., 2019). The short duration and absence of follow-up also limited conclusions about sustained impact. As Fixsen et al. (2005) note, meaningful implementation often emerges over years, highlighting the need for longer-term follow-up.

Ultimately, the intervention focused solely on classroom practice. Achieving wider change requires involvement at multiple ecological levels, including families and entire school systems, which were beyond the scope of this study. This pilot offers initial insights into the feasibility and acceptability of a teacher-led, breath-based intervention. Most children reported feeling calmer, and the teacher who implemented it consistently observed a positive effect in the classroom. However, challenges with adherence and data collection highlight barriers to broader adoption. Factors such as teacher confidence, readiness, and engagement influenced uptake. Future studies should include ongoing teacher participation, utilise objective outcome measures, and incorporate implementation frameworks to improve fidelity, scalability, and sustainability across settings.

8.9.1 Trauma-Informed Considerations

As a universal, teacher-led intervention, the breath-based approach was designed to be inclusive and accessible across the whole class. However, body-focused practices that highlight internal physiological states merit consideration within a trauma-informed framework.

Research suggests that directing attention towards internal bodily sensations may, for some individuals, heighten awareness of distressing somatic states, particularly where there is a history of trauma or adverse experience. Trauma has been associated with altered interoceptive processing, including both heightened sensitivity to bodily cues and a tendency to experience such cues as threatening or overwhelming (Schmitz et al., 2023).

In the present study, several contextual features reflected trauma-sensitive principles: the intervention was delivered by a trusted adult in a calm, predictable environment, with no pressure to participate and with access to quiet alternative activities. These conditions are consistent with trauma-informed approaches emphasising safety, choice, predictability and supportive relationships, which have been identified as core components of trauma-informed practice in child and educational settings (Steen et al., 2022).

Research on breath-focused and mindfulness-based practices further indicates that, although controlled breathing is generally beneficial, directing sustained attention to the breath can occasionally evoke difficult somatic or emotional experiences, particularly for children with trauma histories or heightened sensitivity to internal cues. Mindfulness-based interventions with children and young people, therefore, require careful attention to individual differences and to the relational context in which they are delivered (Greenberg & Harris, 2012; Zoogman et al., 2015).

While teachers in Scottish educational settings are generally familiar with trauma-informed practice, the workshops did not explicitly explore how such principles relate to body-focused or interoceptive work. Including a dedicated element within the training or coaching sessions could effectively address individual differences, the importance of choice, and signs indicating when additional support might be needed. In future iterations, integrating this understanding into professional development could strengthen both the ethical basis of the intervention and teachers' confidence in delivering it.

8.10 Implications for Research and Future Educational Psychology Practice

SR is a multifaceted construct central to both physical and psychological well-being. EPs are uniquely positioned to translate research into practice by collaborating with schools to design and implement evidence-informed interventions grounded in SR theory.

Future research should investigate the interaction between intervention content, practitioner engagement, and delivery context. Using implementation science frameworks can support not only the design but also the evaluation of scalable, sustainable models in educational settings. Small-scale studies, such as this one, offer valuable insights into the complexities of real-world application, where feasibility, acceptability, and contextual fit determine success. Embedding such frameworks within educational psychology service delivery aligns evaluation and practice, supporting coherent, system-level approaches to implementing SR interventions.

This study emphasises the significance of teacher motivation, confidence, and training quality for sustainable implementation. Drawing on SR models, breath-based strategies may be effective for some pupils but are not universally suitable; differentiation remains essential. EPs play a crucial role in embedding SR practices by promoting evidence-based approaches that explicitly connect theory to practice and are tailored, accessible, and adaptable to school requirements. Incorporating implementation processes within school culture enhances regulatory capacity and supports well-being at systemic levels.

Evaluating real-world impact through feedback loops with teachers and children can improve adaptation and fit. Participatory methodologies such as co-design and action research enhance relevance and ownership (Damschroder et al., 2009). Observational data can complement self-report measures, providing a nuanced understanding of practice. EPs are well placed to facilitate these iterative, data-driven evaluations that enhance ecological validity and real-world effectiveness.

8.11 The Role of the EP in Systemic Change

EPs are uniquely positioned to lead the implementation of evidence-based practices at scale. This involves shifting from isolated interventions to whole-school strategies that integrate SR throughout systems via ongoing training, support, and professional development.

Frameworks provide a bridge between research and practice. EPs operate within policy contexts such as Scotland's GIRFEC, which prioritises preventative, universal, and multi-agency approaches. These align with evidence supporting whole-school strategies that combine preventative, universal, and targeted interventions to foster mental health and early support. However, translating policy into consistent, sustainable practice remains a challenge, exposing a persistent gap between intention and implementation.

EPs must go beyond policy compliance to shape context-specific implementation processes that respond to school readiness, culture, and constraints. System-wide adoption is hindered not only by resistance or complexity but also by the absence of structured implementation processes. Frameworks such as the Active Implementation Framework (Fixsen, 2005) highlight the importance of readiness, ongoing support, and contextual adaptation. EPs can operationalise these principles by developing implementation plans, identifying barriers, and building school capacity for fidelity and adaptation.

Teacher feedback in this study highlighted the value of professional dialogue in small-group settings, with some participants describing sessions as unexpectedly supportive. This reflects the importance of coaching, adaptive feedback loops and reflective spaces (Fixsen, 2005). Incorporating practitioner enquiry and action research into CPD models could enhance both fidelity and relevance, with EPs facilitating these relational processes as part of systemic capacity-building.

Systemic change also requires self-reflection within EP services. Assessing service delivery frameworks and integrating implementation principles into core practices such as consultation, training, and service design ensures models are sustainable, responsive, and grounded in evidence. Promoting implementation must be accompanied by active enactment.

Future research should go beyond isolated interventions to focus on co-produced, scalable approaches integrated within existing school systems. Priorities include understanding how factors such as school culture, leadership, and teacher agency influence implementation, and how EPs can foster the conditions for effective delivery. Professional development alone is not enough; systemic change necessitates ongoing coaching, feedback, and organisational alignment (Durlak, 2008; Forman et al., 2013).

Even simple interventions can be challenging to embed in complex school environments. Simplicity in design does not ensure ease of implementation; universal approaches must be integrated within structured whole-school frameworks with ongoing

EP involvement. Practical evaluation is essential. Logic models, fidelity measures, and theories of change can support the iterative assessment of both outcomes and implementation processes, thereby strengthening the evidence base for sustainable practice.

Looking ahead, EPs must adapt to increasing demands for systemic, psychologically informed approaches to SR and wellbeing. Collaboration with local authorities should focus on scalable, contextually relevant delivery models. Incorporating implementation science into core EP functions is essential for supporting sustainable change. Evidence-based practice extends beyond efficacy in ideal conditions to include approaches that can be embedded, adapted, and maintained in real-world schools. For EPs, this involves not only promoting interventions but also actively supporting their integration across research, context, and practice.

8.12 Chapter Summary

Chapter 8 summarised findings from both phases of the study, highlighting that the research equally aimed to understand implementation processes and detect early signs of effectiveness. The chapter situated the intervention within the broader concept of SR, encompassing cognitive, emotional, behavioural, and physiological dimensions. This expanded perspective influenced both the design and interpretation of the intervention, particularly given that the breath-based method focused on a single SR pathway: physiological downregulation. It was noted that while improvements in calmness were observed, the strength of these findings is limited because they are based on a single complete dataset, with variable fidelity across classrooms. Rather than overstating significance, the discussion emphasised how teacher beliefs, confidence, and engagement shaped the quality, consistency, and data collection of implementation. These interpersonal and contextual factors interacted with structural challenges, including time constraints, competing curricular priorities, and the difficulty of establishing new routines in busy school environments. The chapter framed these insights within implementation science, demonstrating that success depends as much on practitioner readiness, school climate, and contextual fit as on the intervention content. Limitations such as selective participation, inconsistent fidelity, and the lack of physiological measures were acknowledged. The chapter concluded by positioning the study as a learning project that illuminates how embodied SR practices can be implemented in real classrooms, informing future research and practice toward scalable, sustainable, and context-sensitive approaches.

8.13 Closing Reflection

This study aimed to explore the feasibility of a teacher-led, breath-based intervention to support SR in primary classrooms. The findings, although limited by scale and context, demonstrate that even brief, embodied practices can promote calm, engagement, and awareness when implemented within supportive systems. By framing MBC within implementation science and EP practice, this research helps to understand how small, feasible interventions can contribute to broader systemic change. It concludes by showing how teacher-led, theory-informed practices can influence both child regulation and classroom culture. These insights provide a foundation for future exploration of embedded, scalable, and context-responsive SR interventions, enhancing the capacity of educational systems to support children's regulatory development.

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Appendix A: Summary of Key Models and Theories of SR

CR: Cognitive Regulation

ER: Emotional Regulation

BR: Behavioural Regulation

PR: Physiological Regulation

Model/theory	Author	Core focus	CR	ER	BR	PR
Self-Control Model	Kanfer &Karoly (1972)	Forethought, performance, reflection, integration of motivation & behavioural execution	yes	yes	yes	No
Social Cognitive Theory	Bandura (1986)	SR is shaped by self-efficacy, social feedback, and environment	yes	yes	yes	no
Self-Regulated Learning Model	Zimmerman (1990)	Learners as active agents using metacognitive and motivational strategies	yes	yes	yes	no
Goal Systems Theory	Kruglanski et al. (2002	Interconnected goal pursuit, conflict resolution, and strategic adaptation	yes	yes	yes	no
Strength Model of Self-Control	Baumeister et al. (2007)	SR as a finite resource, ego depletion, impact of overuse	yes	yes	yes	Yes (fatigue/effort)
Self-Determination Theory	Deci & Ryan (2000)	Role of basic needs (autonomy, competence, relatedness) in sustaining motivation and regulation	yes	yes	yes	no
Hierarchy of Control	Powers (1973)	Feedback loops between goal levels; lower-level behaviours serve higher goals	yes	yes	yes	Yes (system feedback)
Affect as Feedback	Carver & Scheier (1990, 1997)	Feelings arise from feedback error in goal progress, motivating adjustment	yes	yes	yes	Yes (arousal feedback)
Common-Sense Model (Health SR)	Leventhal et al.	Emotional and cognitive representations of illness influence coping and SR	yes	yes	yes	Yes (health based)
Adaptable Learning Model	Boekaerts & Niemivirta	Classroom context and student goals shape SR strategies and coping	yes	yes	yes	no
Neurocognitive Hierarchical Model	Blair & Raver (2015)	SR develops hierarchically: genes → physiology → emotion → attention → executive function	Yes	yes	Yes	Yes (core feature) More linear than developmental (EF is a key feature)
Neurodevelopmental Model of SR	Nigg (2017)	SR an ongoing modulation of internal states via physiological and cognitive mechanisms	yes	yes	yes	Yes (central role)
Hierarchical Psychobiological Model	Blair & Ku (2022)	SR as a dynamic, recursive interaction across genetic, physiological, emotional, cognitive, and behavioural layers	yes	yes	yes	Yes (central role) Bidirectional, focus on contextual adaptation)
Interoception and SR	Craig (2009); Zelazo et al.	Awareness of internal bodily signals (e.g., heart rate) supports cognitive-emotional regulation	yes	yes	yes	Yes (core focus)
Polyvagal Theory	Porges (1995, 2007)	Autonomic state (via vagus nerve) shapes capacity for SR; **felt safety is** foundational	Limited – cognition constrained by ANS state	yes	Behaviour depends on ANS mode (e.g., fight/flight vs. social)	Core – regulation depends on vagal function and autonomic flexibility
Embodied Theories of SR	Fogel (2009); Damasio (1999); Tsakiris (2017)	SR emerges from **interoception, sensorimotor awareness**, and body-environment interaction.	Emergent cognition arises from bodily states	yes	yes	Yes interoception and body signals shape regulation

Appendix B: Letter to Head Teacher

[Date]

Dear Head Teacher,

I am writing to invite class teachers of Primary 4-7 in your school to participate in a pilot study exploring self-regulation. The study aims to investigate the effectiveness of a daily breath practice in improving self-regulation. The purpose of the pilot study is to lay the groundwork for a larger scale project investigating breath work. The aim is to gain valuable insights assess the feasibility of the research design and make any necessary adjustments before commencing a full-scale study. By implementing a pilot study, I aim to test the methodology, assess practical considerations, refine research variables, determine sample size, and validate research procedures.

While universal interventions typically do not require consent, due to the nature of the research and the fact that data will be gathered directly from children, obtaining consent will be necessary. It will be the researcher's role to ensure and manage the consent process appropriately.

The impetus for researching this topic is that a recent audit indicated an increase in number of Educational Psychology Consultations where self-regulation difficulties among children was the main theme. There is also a growing interest in mind-body interventions in education; however, the evidence supporting their effectiveness remains unclear.

Recognizing the influence of breath on the mind and body, I am motivated to explore the use of breath as a tool for self-regulation. Through my research, I aim to understand how conscious breathing techniques can promote relaxation, reduce stress, and enhance emotional regulation. I hope to contribute to the development of an effective breath-based classroom intervention that can empower children to use breath as a tool to help manage their well-being.

The study will be led by myself Ali Mathers, an Educational Psychologist. I am studying towards the Doctorate in Educational Psychology at the University of Strathclyde. The study will be supervised by Dr Clare Daly (Programme Director, University of Strathclyde), and agreement has been sought from Aberdeenshire Council for the study to take place.

I have attached a Participant Information Sheet for Head Teachers and class teachers along with a consent form. This outlines the commitment and explains the purpose of the study, what information will be gathered and how the information will be used.

I would be grateful if you would consider passing this information on to the primary 4-7 teachers. If you choose to pass this information, it is assumed that you will allow the class teachers the time to attend the intervention workshops and for the research to be carried out.

I would appreciate if in agreement with passing the information on to the class teachers you could also return the sign and return the form at the bottom of this letter.

Should you wish to discuss this further I could arrange a meeting to discuss the study and next steps in more detail.

Thank you for considering the information included in this letter. Please do not hesitate to contact the researchers using the details on the attached Participant Information Sheet if you have any questions in the meantime.

Best wishes,

Appendix C: Letter to Class Teachers

[Date]

Dear class Teacher,

I am writing to invite class teachers of Primary 4-7 to participate in a pilot study exploring self-regulation. The study aims to investigate the effectiveness of a daily breath practice in improving self-regulation. The purpose of the pilot study is to lay the groundwork for a larger scale project investigating breath work. The aim is to gain valuable insights assess the feasibility of the research design and make any necessary adjustments before commencing a full-scale study. By implementing a pilot study, I aim to test the methodology, assess practical considerations, refine research variables, determine sample size, and validate research procedures.

The impetus for researching this topic is that a recent audit indicated an increase in number of Educational Psychology Consultations where self-regulation difficulties among children was the main theme. There is also a growing interest in mind-body interventions in education; however, the evidence supporting their effectiveness remains unclear.

Recognizing the influence of breath on the mind and body, I am motivated to explore the use of breath as a tool for self-regulation. Through my research, I aim to understand how conscious breathing techniques can promote relaxation, reduce stress, and enhance emotional regulation. I hope to contribute to the development of an effective breath-based classroom intervention that can empower children to use breath as a tool to help manage their well-being.

The study will be led by Alison Mathers, an Educational Psychologist who is studying towards the Doctorate in Educational Psychology at the University of Strathclyde. The study will be supervised by Dr Clare Daly (Programme Director, University of Strathclyde), and agreement has been sought from Aberdeenshire Council for the study to take place.

I have attached a Participant Information Sheet for class teachers. This outlines the commitment and explains the purpose of the study, what information will be gathered and how the information will be used.

I would be grateful if you would consider being involved in participating in this research. In being passed this information the head teacher has agreed the time and commitment in taking part.

If you have any further questions or require additional information about the breath exercises or the pilot study in general, please do not hesitate to contact the researchers using details below. I could arrange a meeting to discuss the study and next steps in more detail.

Thank you for considering the information included in this letter.

Best wishes,

Appendix D: Participant Information Sheet for Staff

Participant Information Sheet for Teaching Staff

Name of department: School of Psychological Sciences and Health

Title of the study: An investigation into the effectiveness of daily controlled breath exercises as an intervention to improve self-regulation within primary school children.

Introduction

My name is Ali Mathers and I am researcher at Strathclyde University on their Doctoral Program. This information sheet will tell you more about the research and my role as a researcher.

My supervisor assisting me with my research is Dr Clare Daly.

The purpose of this information sheet is to share information about the pilot study so you can make an informed decision about whether you will take part.

What is the purpose of this research?

The research aims to explore the effectiveness of using breathing exercises daily within the classroom. The focus will be on self-regulation. Self-regulation refers to the ability to manage one's own emotions, behaviours, and attention in order to effectively cope with the demands of the environment. It is a key component of emotional and social development and impacts learning significantly.

There is a growing body of research supporting the effectiveness of mind-body approaches for self-regulation in children. This approach focuses on the connection between the mind and body and how they work together to manage emotions and behaviours. The research will investigate the use of breathing exercises as an effective tool for improving self-regulation in children. Incorporating breath techniques as a universal intervention into educational settings could be a simple and time effective way to help children develop self-regulation skills that can benefit them in all aspects of their lives.

A key feature of the research is implementation. Implementation is a critical aspect of an educational intervention and refers to the process of putting a planned intervention into action. Effective implementation is important because it can significantly impact the success of the intervention and ultimately effect the outcomes.

Important information to know.

It should be noted that there are no religious connotations associated with the breathing exercises. The intention behind the breathing practices is completely focused on promoting physical and mental wellbeing. The focus is solely to provide children with tools to help promote self-regulation.

Do you have to take part?

As a class teacher stages P4-7 you are being invited to be part of this pilot study. You do not need to take part in this research. Participation is entirely voluntary you can choose not to take part and there is no detriment if you do not take part. Given taking part is voluntary you have the right to withdraw at any time without any consequences or explanation. If you are interested in joining this pilot study, please email me on alison.mathers@strath.ac.uk

What will I have to do?

To ensure leadership support for the implementation of the intervention permission has been sought from the head teacher to approach class teachers. However, that does not presume or imply in any way that will agree to take part. Your participation remains entirely voluntary. You will be asked to attend 5 sessions altogether. The format will include:

1. **Attend workshops (weeks 1,2&3)**

Each workshop will be approximately 1½ hours. They will be in person at Midmill Primary school. The sessions will run in the afternoon.

The first three workshops will run weekly and allow time and space for personal reflection. The workshops will cover in order the topics of self-regulation, mind body connections and breath (see attached objectives of the workshops). The sessions will provide information as well as interactive activities which will allow you to consider application of the material in a practical way.

Prior to attending all three of the workshops, you will be asked to fill out a short online questionnaire. At the end of each workshop, you will be asked to fill out another short online questionnaire.

2. **Have a go in the classroom.**

Following the third workshop (where implementation will be considered and discussed), you will be encouraged to take the training and implement the breath exercises into the classroom.

Prior to commencing the breath exercises

- Permission and consent will have been sought from the parents / carers of the pupils in your class.
- To obtain consent from the children you will be briefed on this. This will be done at the very beginning of the intervention. Despite the complexity it may seem to convey, the actual process of obtaining consent is straightforward.
- A questionnaire that pupils will be encouraged to fill out will be done prior to implementing the breath exercises.

You will then "have a go" for two weeks. Daily you will be encouraged to keep track of whether you did / didn't do the breath exercises as on the implementation plan. A breath diary will be given at the end of workshop 3. This will not impose a significant burden on workload and will be a tick box exercise.

3. **The follow up workshop**

The fourth workshop (a fortnight after the breath workshop approximately **week 6**) will be gathering feedback on the breath exercises and considering factors for implementation. This session will provide peer support and allow participants to ask questions, share reflections and discuss the reality of the intervention. A key focus will be on the researcher providing support to the class teachers.

This will have allowed you to practice the breath exercises with your class. At the follow up workshop feedback about your thoughts on how accessible and acceptable the breath exercises are. What you thought went well and how feasible implementation is. You will be asked your opinion about what is required to continue take the intervention forward into the classroom and if you are keen to proceed. Notes will be taken anonymously. A summary will be shared, in session four of what the group reflected.

4. **The 5th session: invitation to attend a focus group.**

Following the intervention to run for 4 weeks you will be invited to attend a focus group. By bringing together those who participated in the project the focus group aims to facilitate an interactive discussion that explores different viewpoints, generates in-depth insights, and uncover valuable information about your experience. Your involvement will be entirely voluntary and information with be anonymised and completely confidential.

Why have you been invited to take part?

You have been invited to take part as a member of the local authority teaching staff. I believe that your involvement as a teacher brings a practitioner's perspective to the research, bridging the gap between research and practice. Your active engagement throughout the research process enhances the validity, relevance, and practicality of the findings. It will ensure the intervention is as effective as it can be.

The criteria for teachers to take part is:

- Fully qualified teaching staff in primary 4-7

What information is being collected in the project?

During this first part of the research information will be gathered during the process of this research.

- Pre and post workshop data will be gathered.
- Pre and post confidence about delivering the intervention will be gathered.
- Implementation data: your views around the accessibility, acceptability and feasibility of the intervention will be gathered.
- Daily diary – simple tick exercise. Anything else you noticed/ thoughts you have can be included.
- A focus group for teachers
- Self-regulation measures from children pre and post
- Diary for children if they have noticed anything/ wish to draw a picture of how they felt.
- A focus group for children

All data will be written up as part of the overall research project.

Who will have access to the information?

The researcher and the chief investigator will all have access to the summarized data. We will then store the notes in a secure cloud within the University Drive that only I have access. The information you provide during the study will be anonymised and all identifying information will be removed. No information that could identify you, or your school, will be shared by the researchers. Anonymised information gathered during the study will be included in a thesis submitted to the University of Strathclyde.

Where will the information be stored and how long will it be kept for?

Information gathered during the study will be stored securely within the University of Strathclyde.

All personal data will be processed in accordance with data protection legislation. Please read our Privacy Notice for Research Participants for more information about your rights under the legislation.

What happens next?

If you have any questions or would like to receive more information, please email me on alison.mathers@strath.ac.uk . If you are willing to participate, please complete the attached consent form on the next page and email it back to me. I will then send you the dates and times of the workshops. If you do not wish to participate in the research, I would like to thank you for reading this and for your attention.

You are welcome to provide feedback on any aspect of this research once the research is complete to myself alison.mathers@strath.ac.uk . A summary of the research will be made available to any interested parties at the end of the study. Please contact me if you wish a copy of the research summary.

Researchers contact details:

If you have any questions about the research my contact details:
alison.mathers@strath.ac.uk

My supervisor at the University of Strathclyde is Dr Clare Daly (clare.daly@strath.ac.uk).

This research was granted ethical approval by the University of Strathclyde Ethics Committee.

If you have any questions/concerns, during or after the research, or wish to contact an independent person to whom any questions may be directed or further information may be sought from, please contact:

Secretary to the University Ethics Committee
Research & Knowledge Exchange Services
University of Strathclyde
Graham Hills Building
50 George Street
Glasgow
G1 1QE
Email: ethics@strath.ac.uk

Consent Form for Teachers

Name of department: School of Psychological Science and Health
Title of the study: An investigation into the effectiveness of daily controlled breath exercises as an intervention to improve self-regulation within primary school children

- I confirm that I have read and understood the Participant Information Sheet for the above project and the researcher has answered any queries to my satisfaction.
- I confirm that I have read and understood the Privacy Notice for Participants in Research Projects and understand how my personal information will be used and what will happen to it (i.e., how it will be stored and for how long).
- I understand that my participation is voluntary and that I am free to withdraw from the project at any time, up to the point of completion, without having to give a reason and without any consequences.
- No personal data will be taken about you for this study.
- I understand that anonymised data (i.e., data that do not identify me personally) cannot be withdrawn once they have been included in the study.
- I understand that any information recorded in the research will remain confidential and no information that identifies me will be made publicly available.
- I consent to being a participant in the project.

(PRINT NAME)	
Signature of Participant:	Date:

Appendix E: Participant Information Sheet for Parents and Carers

Name of department: School of Psychological Sciences and Health

Title of the study: An investigation into the effectiveness of daily controlled breath exercises as an intervention to improve self-regulation within primary school children.

Introduction

My name is Ali Mathers and I am researcher at Strathclyde University on their Doctoral Program. This information sheet will tell you more about the research and my role as a researcher. Your child's class teacher has been invited to participate in a pilot study exploring the effectiveness of doing daily controlled breathing exercises within the classroom. The purpose of this information sheet is to share information about the pilot study so you can make an informed decision about whether your child will take part.

What is the purpose of this research?

The study aims to explore the effectiveness of using breathing exercises daily within the classroom. The focus will be on self-regulation. Self-regulation refers to the ability to manage one's own emotions, behaviours, and attention to effectively cope with the demands of the environment. It is a key component of emotional and social development and impacts learning significantly.

The study aims to explore how using breathing in the classroom children will be able to develop an awareness of how breath may be used as a self-regulatory tool to support learning and wellbeing. It is hoped the research will provide further information about whether doing it daily is effective in supporting learning and what children think about it.

There is a growing body of research supporting the effectiveness of mind-body approaches for self-regulation in children. This approach focuses on the connection between the mind and body and how they work together to manage emotions and behaviours.

This intervention is to be a universal intervention – this is considered a proactive approach to support the overall wellbeing and academic progress of all pupils. It is not targeted at any child specifically but is designed to benefit the whole class.

Important information to know.

The breathing exercises that will be done are being used purely for relaxation and well-being. They are not tied to any religious beliefs or practices. Our focus is solely on providing your child with tools to help self-regulation.

Why have you and your child been invited to take part?

Your child's class teacher has volunteered, and they are keen to participate in the study. This study aims to explore the effectiveness of breathing exercises in primary 4-7 all teachers have been invited to take part.

What will your child do in the project?

During the study, your child will have the opportunities to learn and try out breathing exercises and to learn and experience the effect it can have on our mind and body. This will be in the classroom guided by the class teacher. It will be included in part of the daily classroom life. The researcher will work with the class teacher initially on how and when to deliver the exercises.

Your child will be asked to complete a short pre and post questionnaire exploring their views using child friendly language about self-regulation and how they manage it. This will be done before the intervention and at the end of the intervention. During the intervention your child will be offered to opportunity to draw or write how they feel before and after the breathing exercises. Following the intervention, they may also be invited to take part in a focus group to discuss their views with a small group of classmates. This will be voluntary.

Does my child have to take part?

No participation is entirely voluntary, and it is your decision whether your child takes part. If you choose not to consent your child will continue to participate in all school activities. This will include routine learning and play experiences. You may withdraw your consent at any time by contacting the researcher.

Following the intervention with consent your child may be invited to the focus group this should be highlighted at the end of this form during the consent section.

Should consent not be given for the focus group your child may still take part in the daily breathing exercises in the classroom.

What are the potential risks to your child in taking part?

Self-regulation and wellbeing interventions are routine part of the curriculum. If you believe that your child cannot participate in breathing exercises due to any health reason, it is important to consult with a healthcare professional for proper guidance. Please refer to the consent component of this form.

As such, there are no additional risks to your child taking part in this study.

What information is being collected in the project?

The researcher will gather information about:

- The frequency and duration of lessons
- Pupil's thoughts and views on learning experiences of the breath exercises.
- Pupil's experiences around how they felt before and after the breathing exercises.

Who will have access to the information?

Your child's class teacher will continue to gather information to monitor how the breathing exercises are proceeding. The researcher will gather some additional information as described above, to evaluate the effectiveness of the breath exercises.

Any information gathered about your child by the researchers during the study will be kept entirely confidential and will not be shared with anyone else.

Information provided by your child, or about your child, during the intervention will be anonymised and all identifying information will be removed. No information that could identify your child, or your child's school, will be shared by researchers.

Anonymised information gathered during the study will be included in a thesis submitted to the University of Strathclyde. The researcher may also seek to publish anonymised results in the form of journal articles or presentation at conferences.

Where will the information be stored and how long will it be kept for?

Information gathered during the study will be stored securely within the University of Strathclyde. Any personal information about your child will be retained for 10 years, then destroyed securely. Anonymised information will be retained indefinitely.

Please also read our Privacy Notice for Research Participants.

What happens next?

If you agree to your child's participation in this research study, please return the attached consent form to [school] by [date].

If you would prefer that your child does not participate in the study, you do not need to take any further action.

If you would prefer that your child participates but cannot be asked for the focus group, please indicate below.

Who can I contact if I have concerns about my child?

You can contact the researchers at any time, using the contact details below. You can also speak to a member of staff from your child's school.

Young Minds provides advice and support for children, young people are their families via their website (Parents Mental Health Support | Advice for Your Child | YoungMinds) and Parents Helpline (0808 802 5544).

Contact Details

Thank you for reading this information. If you have any further questions regarding the study, please contact the researchers using the details below.

Researcher	**Chief Investigator**
Ali Mathers Educational Psychologist and Doctorate Student Doctorate in Educational Psychology	Dr Clare Daly Programme Director Doctorate in Educational Psychology
University of Strathclyde Graham Hills Building 50 George Street Glasgow G1 1QE	University of Strathclyde Graham Hills Building 50 George Street Glasgow G1 1QE
Email: **alison.mathers@strath.ac.uk**	**Email:** clare.daly@strath.ac.uk
Telephone: 07961514737	**Telephone:** 0141 522 4400

This research was granted ethical approval by the University of Strathclyde Ethics Committee.

If you have any questions/concerns, during or after the research, or wish to contact an independent person to whom any questions may be directed or further information may be sought from, please contact:

Secretary to the University Ethics Committee
Research & Knowledge Exchange Services
University of Strathclyde
Graham Hills Building
50 George Street
Glasgow
G1 1QE

Telephone: 0141 548 3707
Email: ethics@strath.ac.uk

Consent Form for Parents/ Carers

Name of department: School of Psychological Science and Health

Title of the study: An investigation into the effectiveness of daily controlled breath exercises as an intervention to improve self-regulation within primary school children.

- I confirm that I have read and understood the Participant Information Sheet for parents / carers for the above project and the researcher has answered any queries to my satisfaction.
- I confirm that I have read and understood the Privacy Notice for Participants in Research Projects and understand how my child's personal information will be used and what will happen to it (i.e., how it will be stored and for how long).
- I consent that my child can participate in breathing exercises and has no underlying health condition. Should I have concerns I will seek advice from a healthcare professional before engaging in any breathing exercises.
- I understand there are no religious connections to the breath exercises.
- I understand that my child's participation is voluntary and that I am free to withdraw them from the project at any time, up to the point of completion, without having to give a reason and without any consequences.
- No personal data will be taken about them for this study.
- I understand that anonymised data (i.e., data that do not identify my child personally) cannot be withdrawn once they have been included in the study.
- I understand that any information recorded in the research will remain confidential and no information that identifies my child will be made publicly available.
- I consent to my child being a participant in the project.
- I consent to my child being asked to participate in a focus group.

(PRINT NAME)	
Signature of Participant:	Date:

Appendix F: Participant Information Sheet for Pupils

N.B. This form will be adapted to include visual supports to meet the needs of the participant group. Specific needs are not known at this time. This form can be read with adult support.

Introduction

My name is Ali Mathers and I am currently undertaking a research project with the University of Strathclyde. I also work for Aberdeenshire Council. This information sheet aims to tell you more about our research so that you can decide if you want to be involved. We would like to invite you to be involved in our research.

Firstly, I want to explain what research is. Research is like being a detective. Scientists and researchers have questions about things, and they want to find answers. They can do experiments some other times they ask questions or look at things very closely to learn more. It is like solving a puzzle or discovering new things, and can help us understand the world better.

I want to explain what self-regulation is. It is a cool thing that we have inside us. It's all about being in control of our emotions, thoughts, and actions. It's like being the boss of ourselves. When we practice self-regulation, we can better handle tough situations, stay calm, and make good choices. It's kind of like a superpower that helps us feel balanced and in charge pf how we react to things. Self-regulation also helps us focus on our tasks and stay on track. When we are doing our schoolwork, it's easier to pay attention and not get distracted by other things. We can keep our minds focused and do our best work.

Our research is looking at how doing some breathing exercises may help us feel calm and more in control of our emotions as well as help us concentrate (more self-regulated). It is like doing magic tricks for our mind and bodies. Learning how to do breathing exercises can teach us how to regulate our emotions and find inner peace. It's almost like pressing a reset button for our feelings.

Just like athletes warm up before a game or musicians practice their instruments, we can practice breathing exercises to make ourselves feel better. The best part is, we can do them anytime and anywhere.

Our research is looking at how teachers in school can do the breathing exercises alongside learning in the classroom. We want to find out if this helps us think and feel calmer when we do our learning. We would like to know if this is something that is easy to do and if it makes a difference to your time in school. We would like your help with this.

My supervisors name is Clare Daly, she helps me make my research is the best it can be.

Important information to know.

These breathing exercises are just about trying to help you feel calm and relaxed. They don't have anything to do with religion or any beliefs. They're like a special tool to help you feel better.

What is this research for?

We understand that sometimes it can be difficult to self-regulate and stay focused in the classroom. We know that some children and young people find it easier than others and what helps one person can be different from another. We are going to see what the research says about doing breathing exercises, but we would like to know what children think.

Remember it's okay if it feels challenging at first. Just like anything new it takes practice. Your class teacher will help with this.

Do you have to take part?

No, you don't have to take part if you don't want to. You can change your mind too. If you don't want to take part, you can still do all of the same activities as your class.

All young people under the age of 16 will need your parent or carer's permission to be part of the research. If you say that you wish to be part of the research the school will contact your parent or carer and will give them information about the research and will ask them to give their permission. Unfortunately, if your parent or carer does not give permission you will not be able to be part of this research.

What will you be asked to do?

- You will be asked to take part in some breathing exercises with your class teacher.
- You will be asked to answer some questions before and after the breathing exercises project.
- You will be given a daily diary – and if you want you can draw or write down what you think about the breathing exercises.
- After the project is finished you might be asked to take part in a group discussion called a focus group.
- What is a focus Group?
- This is a group where I will ask you questions about the breath exercises. This will only happen if this is something you want to do. If you don't want to be in the focus group, you don't have to be.
- What happens if I don't want to take part in the focus group? Can I still do the intervention? Yes absolutely. The focus group is only a small part of the research and happens at the end of the breath exercises. You can take part in all the breathing exercises but not be in the focus group.
- In the focus group if you want to take part, I will ask you some questions about what you liked and didn't like about the breath exercises.
- It would be nice if you could share your thoughts about the breathing exercises because it helps us understand what you thought and how you feel about the breath exercises. Your voice is really important, and it is really good to hear what you have to say. This can really help future thinking about breathing exercises.
- Remember though if you want to do the breathing but not answer any questions that is ok.

What will I do?

Your class will spend some time learning about the brain and body and trying some breathing exercises in the classroom with your class teacher.

The researcher will help the class teacher with the questionnaires before you start the project and then when you finish. Only if you want to be asked and if you don't that's ok.

What happens to my information?

The researcher will keep all of the information she gathers safe and she won't share it with anyone else. Any information about you will be anonymised (this means your name will be removed so that no knows that it is about you)

No, you don't have to take part if you don't want to. You can change your mind too. If you don't want to take part, you sill still do all of the same activities as your class.

Do I have to take part in the project?

No, you don't have to take part if you don't want to. You can change your mind later too.

If you don't want to take part, you will can still do all the same activities as your class with your parent/ carer's permission.

Can I ask questions about the project?

Yes, you can ask class teacher or researcher questions at any time during the project.

Who can I talk to if I have any worries?

You can talk to your class teacher or another adult in school at any time. You can also talk to the researcher at any point in the study.

You can also call Child Line on 0800 1111 to talk about your feelings at any time.

What happens next?

If you would like to take part in the project, please complete the consent form. You can ask an adult to help you write your answers. After this we will ask your parents / carers permission.

Thank you!

Appendix G Pupil Consent Form

My name is: ____

Today's date is: _____________________________________

I agree to wanting to take part in the breathing exercises and asking my parents/carer for permission for me to do so	Yes	No
I know why I am doing breathing exercises.	Yes	No
I know that there will be questions that I can answer if I choose to.	Yes	No
I know what information will be collected during the breathing exercises project.	Yes	No
I know that I can change my mind about taking part.	Yes	No
I know I don't have to answer questions or keep the diary.	Yes	No
I know that there will be a focus group.	Yes	No
I know that I can choose to do the focus group.	Yes	No
I know that I don't have to do the focus group but can still do the breath exercises.	Yes	No
I know that at any time I can choose not to do the breath exercises.	Yes	No

Appendix H Self-Regulation Workshop

Slide 1

TOPIC 1: SELF REGULATION

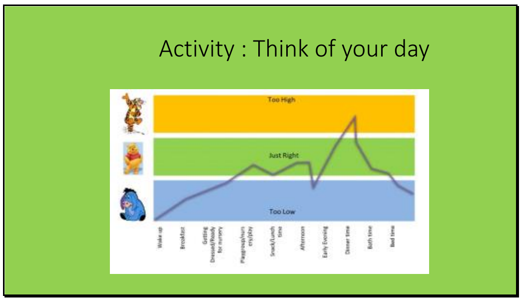
ALI MATHERS

Slide 2

- Raise awareness of what self-regulation is
- Raise awareness of the need to be self-regulated
- Develop an understanding of how we develop self-regulation
- Raise awareness of what co-regulation is
- Consider the benefits of regulation within the classroom

Slide 3

Slide 4



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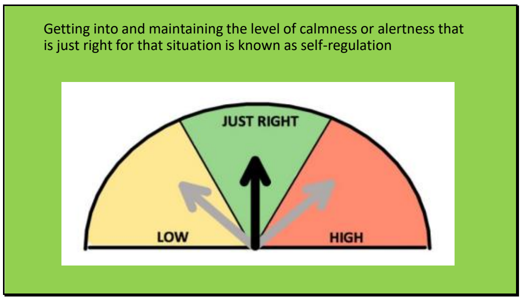


Slide 6

Think of a time…..

- Now we defined it think of a time you felt regulated/ dysregulated, what were you trying to do, how well did you do it? (Considering how key it is to everything we do)

Slide 7

3 key components of self-regulation: (made simply)

- Emotional regulation
- Executive functioning
- Sensory regulation (internal unconscious factors)

Slide 8

Emotional regulation

- What is Emotional regulation?
- Ability to control emotions … to meet your goal
- Quote – Aristole – anger!
- Understanding other's perspectives are also used in regulating emotion.
- (What helps you keep emotionally regulated? Time where you maybe weren't (caution could be difficult) What is effected by the feelings of being emotional)

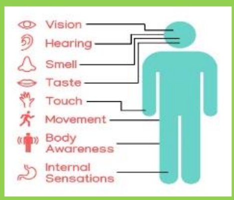
Slide 9

Executive functioning

Executive function is like the command / control centre that oversees actions and mental operations

Slide 10

The internal sensory regulation (internal factors that effect self-regulation)



Slide 11

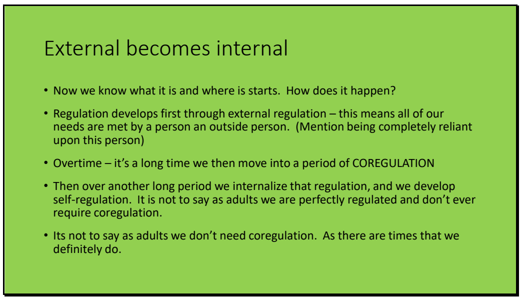
What do we do ?

- **What do we do / not do when we are self-regulated? Who can relate?**
- A cashier who stays polite and calm when an angry customer is berating him for something he has no control over
- A child who refrains from throwing a tantrum when she is told she cannot have the toy she desperately wants
- A couple who's in a heated argument about something that is important to both of them deciding to take some time to cool off before continuing their discussion, instead of devolving into yelling and name-calling.
- A student who is tempted to join her friends for a fun night out but instead decides to stay in to study for tomorrow's exam.
- When trying to lose weight and you meet a friend at a restaurant and you stick with the "healthy options" menu instead of ordering one of the favourites not so healthy options

Slide 12

Slide 13

Slide 14

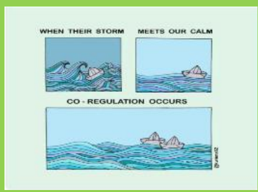


Slide 15

What is coregulation?

Slide 16

Title

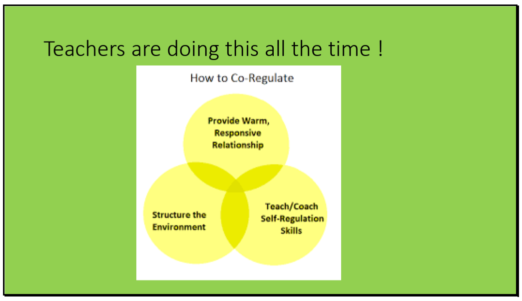


Slide 17

It has to be experienced

- Regulation therefore isn't a one-time occurrence. Our ability to regulate and find our balance, is developed through life. It is not simply taught through a textbook e.g. reading a book about yoga but never actually getting onto a yoga mat.
- Coregulation has to be **experienced** in relationships in order for us to develop the ability to manage stressors and face challenges. We learn to self-regulate through experiences in supportive environments and relationships.

Slide 18



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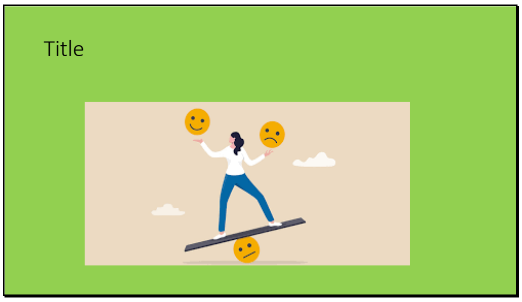

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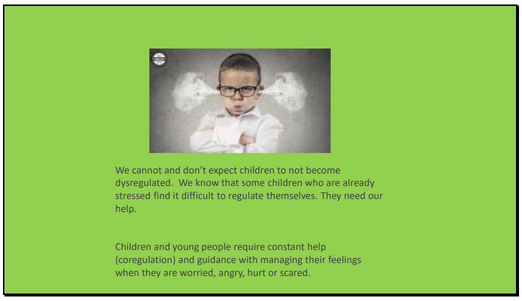


Slide 21

This is me !!

Slide 22

In that very moment . . . . .

Slide 23

What do you do currently – all the time

Slide 24

What it might look like

Slide 25

What simple thing can we do in any one moment ?

Appendix I MBCs Workshop

Slide 1

TOPIC 2: MIND BRAIN BODY

ALI MATHERS

Slide 2

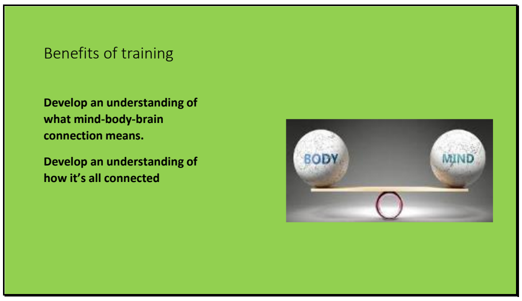
HOW ITS ALL CONNECTED

Slide 3

KEY LEARNING OBJECTIVES

- Raise awareness of what is meant by a mind body connection.
- Raise awareness of the benefits of mind-body awareness
- How it relates to self-regulation
- Develop an understanding of how we can foster mind body practices
- Raise awareness of the impact of stress
- Consider the benefits of mind body practices within the classroom

Slide 4



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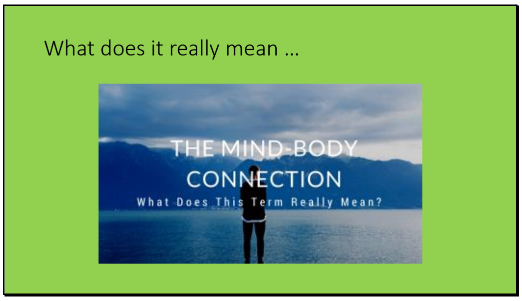
Slide 6



Slide 7

Why is it important for teachers ?

Slide 8

A self regulated mind and body

Slide 9

A self-regulated mind-body demonstrates a balanced and harmonious integration of thoughts, emotions and physiological responses. It might look like:

- Emotional awareness and Regulation
- Physiological Calmness
- Mindful presence
- Cognitive flexibility
- Resilience and adaptability
- Improved wellbeing
- Positive interactions

Slide 10

How does psychological experiences impact physiological functions and how do physical states influence mental and emotion well-being.

Slide 11

An e.g. of what you could say to the child

Slide 12

Thinking of self-regulation and how the mind and body work holistically in self-regulation to create a harmonious balance that promotes well being

Slide 13

Slide 14

Appendix J Breath Workshop

Slide 1

TOPIC 3: BREATH

ALI MATHERS

Slide 2

Learning objectives

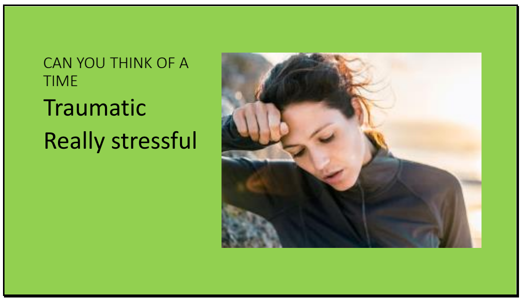
- To raise awareness of breath and breathing
- Raise awareness of the effects of different breathing patterns
- Develop an understanding of how we can control breath and the effect that has upon us.
- Developing a breath practice and what might it look like.
- Consider the benefits of developing a breath practice.

Slide 3

BREATH

Slide 4

Slide 5



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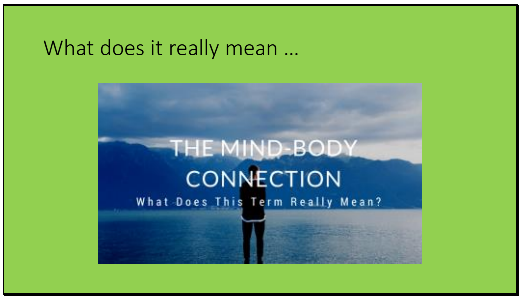

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Slide 8

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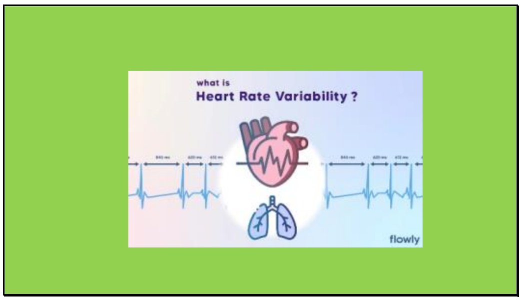
Slide 10



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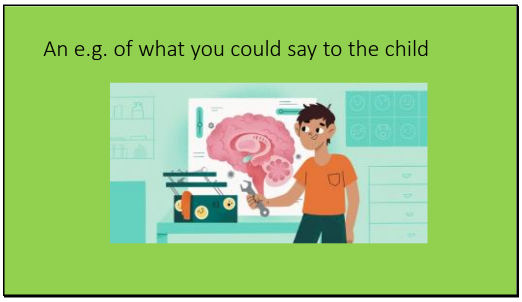

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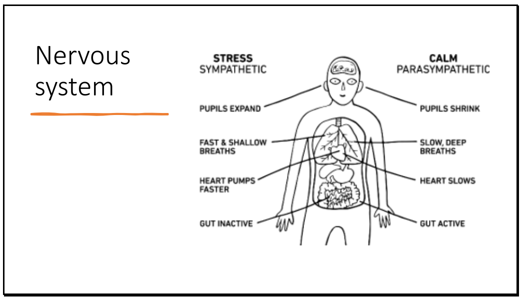

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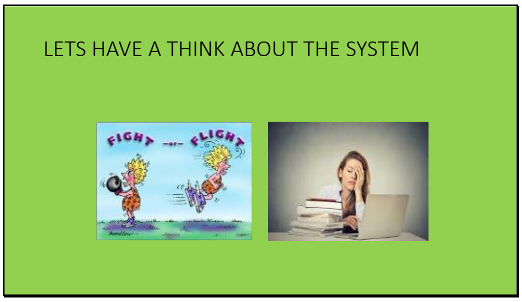

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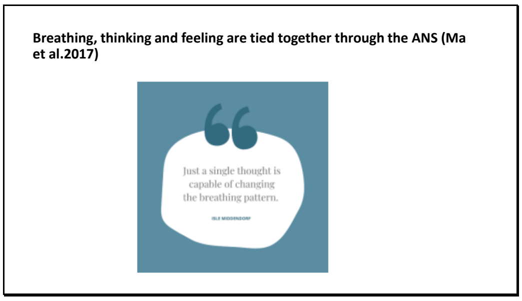

Slide 16

There are many ways of breathing. We know that different rhythms of breathing change your physiology. Breath then is a direct route to shape your ANS.

Slide 17

As we focus our attention onto our breath, we are naturally becoming more mindful. Coupling mindfulness and breathing involves cultivating your experience in the present moment

Appendix K Activities for Breathing

EXERCISE 1

Can use a plastic bottle with water / sand glitter etc

Demonstrating the amygdala on alert scatters information shake bottle and mix up solution

The settling of the solution is the calming mind – eventually the bits of information flow in a clear direction – some of them to the PFC for thoughtful decision making

Discuss – time when felt worried, stressed, frightened your mind was working like a shaken bottle? What helped you think more clearly ?

EXERCISE 2

Brain operates like an orchestra, with thousands of instruments playing – each part playing its own tune but they are all working together to create a beautiful piece of music. Imagine the PFC is the orchestra leader. Imagine the amygdala is the musicians who play to express their feelings but who must also follow the directions of the conductor. Imagine the hippocampus is the sheet of music which is the musicians can refer to in order to help them remember the notes they must play.

Think of a time your amygdala alerted you to real danger – e.g. a ball flying towards you or maybe something like smelling smoke (discuss)

Think of a time your amygdala then made you nervous / worried about something e.g. reading out loud a poem , playing your fist football match

How did these reactions effect you ? Your ability to think ?

Imagine the situation that you are walking to school and a cat runs out in front of your car.

How does your body react?

How does your body feel?

What are you thinking?

Who was in charge ? Was it the wise leader (PFC)? The security guard (amygdala) or the memory saver (hippocampus) Next we will find out how we can help calm the amygdala when there is no danger

When we use our breathing it can help take some control back and can calm us down. When breathing is deliberately regulated (we think about it and control it) the brain is primed to THINK first and PLAN a response..

Like everything learning something new can be fun but it can also be tricky. However, the more we do it the better we get and if we do often enough it becomes like a habit. E.g. going to the gym and working the muscles by lifting weights – bicep becomes bigger. The more we do something the stronger our connections in the brain become and it feels easier.

CORE PRACTICE BREATHING with children. Points to remember:

- Expect as little as 30 seconds at start aim for up to 3-5 mins.
- Set aside 5 minutes at key points in day – aim 3 x a day but 2 times as a minimum.
- First thing in morning, after break, before or after lunch, end of day are times of transition. However, its entirely over to individual teacher.

The practice what to do to engage:

- Linking a sound that may link to the practice may help (chime ..) at the start and end of practice. At end open eyes when sound fades.
- To prepare them ask them to sit comfortably (at desks upright, feet flat. On floor crossed legged or indeed if want and can lie down)
- Resting hands on laps comfortably
- Close their eyes. If possible. If not – looking down at their hands
- Preparing them to combine some mindful listening with the breathing practice – can link the breath to the brain – we are trying to calm the amygdala so our prefrontal cortex can work efficiently.
- For all the systems to work really, we want to try and breath 6/7/8 times a minute – this will take practice, and some will manage easier than others. It is simply a rough guide.
- Remind students that it can feel awkward to start with but like anything as they do it and practice their brain will get better at it and they will feel more comfortable.

- You might want to highlight that it can be difficult keeping attention focused on breathing without thinking of other things. That's ok when you notice the mind wandering use the fishing hook analogy and hook it back onto the breath.
- Announce to the class the schedule of the breath practice – when you are going to do it daily. Offer it up that if anybody feels they'd like to use it at another time they are welcome – or if they think the class may benefit from it. Have a method for the class to communicate to you. "From now on we are going to do breath practice 3 times a day. What are other times of the day might you want to practice focusing on your breath to stay calm and make good decisions"

Pre practice activity

LINK brain breath mind – quick reminder (depth and amount of time spent is optional)

Physiology check (optional – heart rate – find pulse) this can be done once a week (as not everyone can find pulse easily and takes up time)

Feelings check – optional (daily if possible)

Data gathering – tbc

CORE PRACTICE – WHAT TO SAY STEP BY STEP

Remind class this is going to be CORE practice. (video of me)

Ask students to sit comfortably – if want to lie down this is ok

Close your eyes (or if they don't like that look down so not visually distracted)

Ask them to pay close attention to their breathing. Feel the air coming in through nose and then fill your chest and belly. Calmy and slowly let the breath leave your belly, chest then nose.

Shoulders dropped and relaxed. Think about the air coming into the body and the air going out of the body

Bring your attention to the breath and try to keep your mind on your breathing.

Your mind will wander and think of other things. Every time you notice it – hook it like a fishing rod back to the breathing

We are going to try and keep our breathing slow and make inhaling and exhaling even and steady.

CLASS CONNECTION ACTIVITIES:

- Think of a job that requires stillness where you have to mindfully breathe and listen carefully? E.g. wildlife photographer – think of the environments they may be in e.g. watching the snow leopard in the mountains.
- Think of other jobs where you have to be really still and completely focused.
- What about being completely focused in sport?
- Drawing of you before and after doing your breathing
- Where at home might you be able to practise your breathing?
- When at school might breathing be the most helpful? Why is this?

Appendix L: Questionnaires Pre and post: Teachers

SELF-REGULATION PRE-TRAINING QUESTIONNAIRE

Participant Name / Number:		School Name / Number:	

This questionnaire is a tool to gather information before the start of the training. This questionnaire is designed to collect data that will help the researcher understand participants needs, expectations, prior knowledge. The information gathered from a pre-training questionnaire can help tailor the training program to meet the participants individual and collective needs.

This questionnaire will use a Likert scale, where you'll rate statements on a scale from 1-5, with 1 indicating "strongly disagree" and 5 indicating "Strongly agree."

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

Please rate your agreement:

I have a good understanding of the topic self-regulation.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

I feel confident in my ability to apply the knowledge and skills related to self-regulation.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

I am motivated to learn more about self-regulation.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

I feel the topic is relevant to my work as a teacher.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

I have previously received training or CPD related to self-regulation.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

SELF-REGULATION POST-TRAINING QUESTIONNAIRE

Participant Name / Number:		School Name / Number:	

The post-training questionnaire with a Likert scale is a tool used to gather feedback and evaluate the effectiveness of a training program after it has been completed. The questions are related to the training content, delivery and outcomes.

This questionnaire will use a Likert scale, where you'll rate statements on a scale from 1-5, with 1 indicating "strongly disagree" and 5 indicating "Strongly agree."

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

Please rate your agreement:

The training provided me with a better understanding of self-regulation.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

The training helped me further my knowledge and develop new skills related to self-regulation.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

I feel more confident in my ability to apply the knowledge and skills related to self-regulation.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

The training increased my motivation to learn more about the topic.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

I feel that self-regulation is now more relevant to my work as a teacher.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

Participant Name / Number:		School Name / Number:	

This questionnaire serves as a tool to gather information before the training begins. It is designed to collect data that will help the researcher understand participants' needs, expectations, and prior knowledge. The information obtained from the pre-training questionnaire can then be used to tailor the training programme to address both the individual and collective needs of the participants.

This questionnaire will use a Likert scale, where you'll rate statements on a scale from 1-5, with 1 indicating "strongly disagree" and 5 indicating "Strongly agree."

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

Please rate your agreement:

I have a good understanding of the topic mind body connections.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

I feel confident in my ability to apply the knowledge and skills related to mind body connections.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

I am motivated to learn more about mind-body connections.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

I feel the topic is relevant to my work as a teacher.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

I have previously received training or CPD related to mind body connections.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

MIND BODY CONNECTIONS POST-TRAINING QUESTIONNAIRE

Participant Name / Number:		School Name / Number:	

The post-training questionnaire with a Likert scale is a tool used to gather feedback and evaluate the effectiveness of a training program after it has been completed. The questions are related to the training content, delivery and outcomes.

This questionnaire will use a Likert scale, where you'll rate statements on a scale from 1-5, with 1 indicating "strongly disagree" and 5 indicating "Strongly agree."

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

Please rate your agreement:

The training provided me with a better understanding of Mind body connections.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

The training helped me further my knowledge and develop new skills related to mind body connections.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

I feel more confident in my ability to apply the knowledge and skills related to mind body.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

The training increased my motivation to learn more about the topic.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

I feel that mind body connections is now more relevant to my work as a teacher.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

BREATH REGULATION EXERCISES PRE-TRAINING QUESTIONNAIRE

Participant Name / Number:		School Name / Number:	

This questionnaire is a tool to gather information before the start of the training. This questionnaire is designed to collect data that will help the researcher understand participants needs, expectations, prior knowledge. The information gathered from a pre-training questionnaire can help tailor the training program to meet the participants individual and collective needs.

This questionnaire will use a Likert scale, where you'll rate statements on a scale from 1-5, with 1 indicating "strongly disagree" and 5 indicating "Strongly agree."

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

Please rate your agreement:

I have a good understanding of the topic breath regulation.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

I feel confident in my ability to apply the knowledge and skills related to breath regulation.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

I am motivated to learn more about breath regulation.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

I feel the topic is relevant to my work as a teacher.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

I have previously received training or CPD related to breath regulation.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

BREATH REGULATION POST-TRAINING QUESTIONNAIRE

Participant Name / Number:		School Name / Number:	

The post-training questionnaire with a Likert scale is a tool used to gather feedback and evaluate the effectiveness of a training program after it has been completed. The questions are related to the training content, delivery and outcomes.

This questionnaire will use a Likert scale, where you'll rate statements on a scale from 1-5, with 1 indicating "strongly disagree" and 5 indicating "Strongly agree."

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

Please rate your agreement:

The training provided me with a better understanding of breath regulation.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

The training helped me further my knowledge and develop new skills related to breath regulation.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

I feel more confident in my ability to apply the knowledge and skills related to breath regulation.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

The training increased my motivation to learn more about the topic.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

I feel that breath regulation is now more relevant to my work as a teacher.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

Appendix M: Focus Group: Teachers' Readiness/Pre-Implementation

Perception of workshops

Experience/ components / useful / anything could have been done better

Knowledge, skills, confidence, relevance

Timing / small group / bigger group/ before school/ after school

Practice of Breathing Exercises

Who is ready for the classroom?

How do you feel about implementing

What needs to happen

When can we fit them

Routines and transitions (prompt if needed)

Readiness check

What supports

Measures what we need to do and how we do it.

Appendix N: Readiness to Implement Questionnaire

Readiness to Implement QUESTIONNAIRE

Participant Name / Number:		School Name / Number:	

The post intervention questionnaire with a Likert scale is a tool used to gather feedback and evaluate the effectiveness of the overall training program and how you feel about intervention delivery.

This questionnaire will use a Likert scale, where you'll rate statements on a scale from 1-5, with 1 indicating "strongly disagree" and 5 indicating "Strongly agree."

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

Please rate your agreement

I have a good understanding of the intervention**.**

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

I am confident about implementing the intervention in my classroom.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

I have the resources I need or know where I can get them.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

The support and the training have equipped me for the intervention.

1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

I think I am prepared for the intervention and don’t see any challenges
1 = Strongly Agree

2 = Disagree

3 = Neutral

4= Agree

5 = Strongly Agree

Appendix O: Pupil Diary

<u>Pupil Log Book</u>

When I did the breathing exercises

How I felt before and how I felt after

Any other comments I have

Name:

School:

Class:

Date

How did I feel before the exercise?

- 😊 Happy
- 😐 Calm
- 😕 Anxious
- 😠 Angry
- 😢 Sad
- 😬 Stressed
- 😴 Tired
- 🤔 Other: ______________________

✍ My work

Paying attention in class is easy 👍 👎

I can stop myself doing things that are not allowed 👍 👎

😮 💨 After breathing exercises

How did I feel after the breath exercises?

- 😊 Happy
- 😐 Calm
- 😕 Anxious
- 😠 Angry
- 😢 Sad
- 😬 Stressed
- 😴 Tired
- 🤔 Other

Draw / write answer.

What did I like about the breathing exercises today?

What would make the breathing exercises better?

Any other comments or drawings about the exercises?

Appendix P: Teacher Diary

The purpose of this diary is to record if the breath exercises in the classroom were carried out at the proposed time.

After each lesson, please tick and if possible, any note/ words of observations these can be at time of exercises or indeed at any point in the day.

MONDAY	Mark X if completed	Observations during exercises (Hard to settle / managed well etc)	Observations during the day
Morning			
snack			
lunch			
TUESDAY			
Morning			
Snack			
Lunch			
WEDNESDAY			
Morning			
snack			
lunch			
THURSDAY			
Morning			
Snack			
Lunch			
FRIDAY			
Morning			
snack			
lunch			
MONDAY			

Appendix Q: User Rating Profile: Teachers

Appendix 20
teachers usage prfil

Appendix R: Focus Group Prompts: Children

Prompts

Thank you for speaking with me today. I am going to ask you some questions about what you have learned at school this year. I'd like to hear about the breathing exercises you have been practising in your classroom. If you agree, I'd like to record the interview. This will help me remember what you have said and make some notes later. I have some questions, and you may also have some questions, which is fine. Also, if you want to tell me anything else about the breathing exercises, that is okay too. There are no right or wrong answers, and you can share your thoughts on what you have learned.

- Can you tell me about the breathing exercises you did in class?
- Did you like the breathing exercises in class? If not why not?
- Did you notice any changes in how you felt after doing the breathing exercises?
- Did you have a favourite time of the day to do breathing exercises?
- Did the teacher explain why breathing exercises could be helpful? Do you think they were? When?
- Have you used breathing exercises outside the classroom?
- Is there anything you would change or add to the breathing exercises to make them better?
- Do you have any ideas how your teacher could make the breathing exercises more fun?
- Would you like to continue doing breathing exercises in class or at home?