Review Article

Conceptual Architecture for a Critical Realist Synthesis of a Universal School-based Mindfulness Intervention

Pamela Abbott[1], Lucia D'Ambruoso[1], Rachel Shanks[1], Kibur Engdawork[2], Awoke Mihretu[2]

1. University of Aberdeen, United Kingdom; 2. Addis Ababa University, Ethiopia

This paper aims to establish the conceptual architecture for a Critical Realist synthesis of universal school-based mindfulness interventions (SBMIs). While SBMIs have demonstrated benefits in mental well-being, there is a lack of clarity on underlying mechanisms, contexts, and sustainability. A Critical Realist synthesis integrates ontological depth, epistemological reflexivity, and methodological pluralism to develop explanatory frameworks for complex social phenomena. Grounded in Bhaskar's critical realism, the synthesis adopts a stratified ontology that distinguishes between the real (underlying structures and mechanisms), the actual (events and processes), and the empirical (experiences and observations). This depth ontology enables the identification of causal mechanisms that operate across different levels of reality, including structural, cultural, and agential domains. Epistemologically, the synthesis embraces a fallibilist position, recognising that knowledge is socially and historically situated. It employs epistemic relativism to account for diverse perspectives while maintaining ontological realism. Methodologically, the synthesis employs a retroductive approach, combining qualitative and quantitative data to identify causal pathways and emergent properties. An iterative process involves theory refinement through abductive reasoning, retroduction, retrodiction and judgemental rationalism to determine the most plausible transdisciplinary explanation for the findings. The explanatory theory draws on Archer's Morphogenic approach, which theories the dynamic relationship between structure, agency and social change; Pearlin's theory of stress, which theorizes the dynamic relationship between social structures, social institutions, and psychological processes in mental health; and Bonell et al.' s.' theory of the school environment, which examines the interaction of institutional, social interactional, and intrapersonal processes in explaining how the social environment impacts on students' wellbeing. The programme theory was developed using a Laminated System analysis, which considered micro, meso, and macro-level interactions and was based on a targeted literature review. A Critical Realist synthesis advances theoretically informed and practically relevant insights for complex social interventions and policy evaluation by systematically identifying causal mechanisms and their contingent conditions. The review will inform policy, school practices, and intervention design, ensuring mindfulness programmes are context-sensitive and sustainable.

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Introduction

The primary purpose of this paper is to set out in detail the conceptual architecture for our Critical Realist literature synthesis of universal school-based mindfulness interventions (SBMIs)[1]. While Critical Realist literature reviews are becoming more common, the underpinning conceptual architecture is rarely set out in detail. This paper fills that gap. We set out our metatheory stance regarding structures, agency, and causation, which shapes how we understand reality, causation, and knowledge based on Bhaskar's dialectical Critical Realism[2]. We follow this with a discussion of our methodology and how it aligns with our meta-theory. We then discuss our explanatory frameworks (middle-range theory), which integrates Margaret Archer's Critical Realist Morphogenic approach[3] with Pearlin's sociological theory of stress[4][5], Bonell et al.'s integrated theory of how the school environment impacts on student health[6], and our middle range Critical Realist theory of how SBMIs transform pupils' mental wellbeing. The methods we will use to conduct the Critical Realist synthesis of the literature on SBMIs are in the review protocol presented elsewhere[1].

A Critical Realist synthesis is a rigorous literature review that systematically analyses existing evidence to develop a more robust and nuanced theory-driven exploratory understanding of complex interventions. It identifies the underlying causal mechanisms influencing outcomes, ultimately informing policy and practice. Unlike traditional systematic reviews summarising the evidence, a Critical Realist synthesis starts with a theory or set of theories about how interventions might work. Then, it uses the literature to test and refine those theories. The primary aim is to move beyond describing outcomes to understand how, why and for whom interventions work (or do not work) in specific contexts. It recognises that interventions are not universally effective and that outcomes are influenced by the particular contexts in which they are implemented. The goal is to generate practical knowledge for policymakers and practitioners, enabling them to design and implement more effective interventions.

The neglect of research on the mechanisms that mediate SBMIs and positive outcomes, and other factors that may moderate impact, including social mechanisms and implementation factors, has been identified as a significant gap in the literature on SBMIs, the filling of which needs to be prioritised[7][8][9][10][11][12][13][14][15]. The lack of attention to social mechanisms, the processes that arise from interactions between individuals and their social environments, shape behaviours, relationships, and social dynamics in the school, which influence individual outcomes and collective changes, is especially noticeable[13]. Intervening mechanisms can support positive impact(s) or constrain/partially constrain positive impact(s). They can influence intervention delivery and pupil engagement and/or drive changes in school culture and structure, making mindfulness intervention more sustainable[16][17][18]. Understanding *how* SBMIs bring about positive changes in pupils' wellbeing is therefore essential to advance knowledge on how best to develop, adapt and implement SBMIs to optimise outcomes[7][11][12]. A Critical Realist synthesis enables us to identify, test, and refine existing theories to provide an understanding of how SBMIs work. It examines how pupils' and teachers' responses to SBMIs can activate generative mechanisms

that can lead to positive changes, how they work, for whom and in what circumstances, and how they can be optimised for different school environments.

Mindfulness has been conceptualised as a trait (disposition), a skill, and a state[19] that makes individuals more aware, attentive, and less reactive to thoughts and emotions on a day-to-day basis[20]. Epigenetic research suggests that mindfulness may be negatively and positively influenced by living conditions and enhanced through mindfulness practices[21][22][23]. as something that can be developed and enhanced through practice like any other skill[24][25]. Mindfulness can then be conceptualised as an entity of mind (a mechanism) that individuals can activate and use when faced with a challenging or stressful situation[26]. Learning mindfulness can give individuals the tools to do this. However, to realise these benefits, pupils need to engage with the intervention and practise mindfulness, using mindfulness skills when they experience challenges in their daily lives[27].

Mindfulness was initially developed as a psychiatric tool to treat adults with various forms of psychological distress and practised in a secular or non-religious manner[28][29]. However, it has been adapted for use in schools to foster pupil and teacher mental, behavioural, and emotional health, enhance concentration and academic performance, promote emotional regulation, foster resilience, develop a more positive view of self, improve prosocial behaviour and peer relationships, and to promote mental wellbeing[30][31][32][33][34]. It has moved from being a clinical to a public health promotion intervention[35].

As a health promotion intervention in schools, mindfulness has most frequently been introduced as a universal intervention, taught to all pupils regardless of status. The literature most frequently reports on interventions that are taught to whole classes or year groups as a weekly lesson for between eight and 12 weeks to promote pupils' wellbeing, with a dearth of research on the long-term impact of these interventions[36][37][38][39]. These types of interventions have been criticised for being technologies of the self, medicalising the inherent ups and downs in everyday life, and making pupils responsible for their own mental wellbeing and self-management[37][40][41]. There is a risk that this type of SBMI may erase from view the structural, systemic, and contextual causes of individual suffering, including poverty, ineffectual welfare policies, family violence, racism, gender discrimination, etc., providing only temporary amelioration as root causes of suffering are not addressed[42].

Less frequently reported in the literature are whole-school interventions that integrate mindfulness principles throughout the school environment, benefiting students, teachers, and staff[43][42]. As well as changing individual-level processes, they aim to change structural relationships and the school and classroom cultures which condition pupil (and teacher and school administrator) behaviour[17][32][42][44][45][46][47][48]. School mindfulness interventions have, it has been argued, the potential not only to promote individual wellbeing but to *transform the structure and culture of schools* so that they become health-promoting schools, enabling pupils and teachers to thrive[16][32][37][45][49][50][51].

The SBMI literature, as evidenced in systematic reviews and meta-analyses, indicates reasonably strong evidence that SBMIs have positive impacts on pupil wellbeing, at least in the short term, in some contexts with small to medium effects[10][11][12][15][52][53][54][55]. However, as with other complex health, social and educational interventions, they do not work for everyone in all circumstances, and there is scant knowledge about how they work[15][38].

The primary response to concerns about research on SBMIs has been to call for more of the same but to improve study rigour. This means having more randomised controlled trials (RCTs) with active controls, ensuring that the curriculum includes a core programme of mindfulness skills, that facilitators are adequately trained, and that interventions are taught with fidelity[37][56][57]. However, doing more of the same research, even with greater rigour, will not overcome the fundamental limitations of positivistic enquiry. Conventional/piecemeal evaluation fails to understand how interventions work, for whom and under what circumstances. They assume it is necessary to get the intervention right, the right syllabus, appropriately trained and experienced facilitators, the correct dose, taught with fidelity and rigour, and high-quality RCTs to evaluate outcomes. Rigour is important. However, focusing on observable phenomena and empirical regularities often ignores the underlying mechanisms and structures that generate the observed surface-level patterns and correlations. This means the findings lack explanatory power; correlations do not explain how and why something happens, which is essential for transformative change. They oversimplify reality by focusing on what can be measured and observed, failing to capture the depth and complexity of social phenomena, assuming that it is possible to control all potential influences on outcomes in open systems apart from the intervention.

As an alternative to systematic and scoping reviews and meta-analyses, we are doing a Critical Realist synthesis of the literature to test a programme theory of how, for whom and under what circumstances SBMIs promote pupils' mental wellbeing, recognising that context matters and that all knowledge is fallible. A Critical Realist program theory is a middle-range theory[58] that seeks to understand how, for whom and under what circumstances the intervention worked (or did not work) by identifying the generative mechanisms triggered by actors' responses to the intervention. It recognises that complex underlying generative mechanisms, structures, and contextual factors influence outcomes and that there may be complex and non-linear casual pathways. Critical Realist synthesis aims to integrate insights from causal histories to uncover 'demi-regularities', recurring patterns of contextual structures, interventions, agency, mechanisms, and outcomes across space and time[59]. By identifying these patterns, researchers can offer guidance on the requisite conditions to maximise the likelihood of interventions having positive impacts; that is, the contexts in which agents' responses to the intervention activate mechanisms that change the context through morphogenesis (a non-linear process of change) that has positive outcomes[3]. By extension, findings from Critical Realist research can *enable social transformations* that improve human wellbeing by uncovering the structural features, including changes, necessary at all levels of reality to maximise the potential for interventions to work[60][61].

Aims, Objectives and Research Questions

Our Critical Realist Synthesis aims to provide a comprehensive, nuanced understanding of how, for whom, and under what circumstances SBMIs work (or don't) by analysing underlying mechanisms, contextual influences, and the interplay of individual and structural factors.

Objectives

1. Conduct a systematic literature search to identify research on universal SBMIs and to provide a descriptive review of the included studies, focusing on:
    1. study designs, populations, interventions, and reported outcomes;
    2. influences of contextual factors on implementation and effectiveness (e.g. policy and financial support, community and parental support, socioeconomic status of the local community, pupil demographics, school climate, school management and staff support for the intervention);
    3. factors influencing engagement with the intervention and outcomes (e.g. content of the intervention, facilitators and their training, fidelity of delivery, and reception by pupils);
    4. reported moderators and mediators distinguishing between proximal and distal outcomes;
    5. Conduct a focused analysis of whole-school mindfulness interventions, examining their implementation, mechanisms, and long-term impacts on school culture and pupil outcomes, as these have greater potential for sustainability.
2. Use the Laminated Systems approach[1] to identify the academic disciplines that can contribute to a transdisciplinary theory of how SBMIs work, for whom, and under what circumstances, and the mechanisms reported in the literature as driving change. Synthesise psychological theories of development and mechanisms underpinning mindfulness interventions (e.g., self-regulation, stress reduction). Explore psychological theories of change (ToC) discussed in the literature and assess their alignment with Critical Realist perspectives.
3. Identify and prioritise studies with rich, detailed data suitable for Critical Realist synthesis, focusing on in-depth discussions of mechanisms, contexts, and outcomes.
4. Analyse the identified studies using the Intervention-Context-Agency-Mechanisms- Analysis (ICAMO) tool.
5. Synthesis findings from the descriptive review, theoretical analysis, and ICAMO-based Critical Realistanalysis using retroduction to test and refine our programme theory of how SBMIs work, for whom, and under what circumstances explaining the mechanisms, contextual factors, and processes shaping effectiveness in promoting pupils' mental well-being, and broader developmental outcomes.

Outcomes

1. A detailed background paper summarising the psychological theories, mechanisms, and ToCs underpinning SBMIs, together with mechanisms from other disciplines, identified as potentially contributing to a transdisciplinary theory of how SBMIs work, for whom and under what circumstances.
2. A synthesised dataset categorising studies by intervention type, contexts, outcomes (proximal and distal), and implementation factors.
3. Context-sensitive causal explanations of how mindfulness interventions work, for whom, and under what circumstances.
4. A refined middle-range Critical Realist theory explaining the interaction between mindfulness interventions, school contexts, and pupils' agency in producing outcomes.
5. Practical guidance for designing, adapting, and implementing mindfulness interventions, focusing on whole-school approaches and fostering enabling conditions for success.
6. Contributions to the Critical Realist literature, particularly in applying the ICAMO framework to school-based interventions and extending Archer's Morphogenic approach to incorporate adaptation of Pearlin's stress theory and Bonell et al.'s school climate theory.

Research Questions

1. What are the underlying mechanisms through which SBMIs influence pupils' mental wellbeing and broader development outcomes?
2. How does pupils' agency activate these mechanisms, and what existing mechanisms facilitate and constrain their activation and emergence?
3. How are SBMIs implemented in different school settings, and what challenges and facilitators influence fidelity, acceptability, and sustainability?
4. How do contextual factors (e.g., school environment, socio-cultural influences) shape the success of mindfulness interventions, and how do these variations, in context, affect the activation of mechanisms and the outcomes achieved?
5. What impacts do mindfulness programs have at multiple levels (individual, classroom, school-wide)?
6. What are the reported proximal and distal outcomes of SBMIs, and how do specific mechanisms and contextual factors moderate these outcomes?
7. What factors contribute to the variability of mindfulness program outcomes across schools and student populations?
8. What mechanisms and processes are activated in whole-school interventions, how do these shape school-wide cultural and behavioural changes, and how do the outcomes differ from those of other universal interventions?

9. How do ICAMO configurations vary across studies, what patterns can be identified, and how do these configurations align with our middle-range theory?
10. How do SBMIs influence the morphogenic cycle and the classroom/school climate?
11. What conditions are necessary to optimise the long-term impact of SBMIs on pupils' wellbeing, and what insights can be drawn to guide stakeholders in designing and implementing context-sensitive and sustainable SBMIs?
12. What are the limitations of current research and directions for future studies?

Conceptual Architecture: Critical Realism as a Meta-theoretical Framework

A. Introduction to The Conceptual Architecture

Our conceptual framework supports us in answering the meta-theoretical questions. All projects are framed and influenced by certain design decisions and choices, whether or not researchers are aware of making and/or recording these decisions and choices, including acknowledgement of their influence[62]. These include philosophical principles, social ontology, theory, methodology, and methods. These elements of the conceptual architecture are interconnected and evolve together as the framework develops. The first three principles are: (1) the meta-theory that provides a guide for how we should go about doing research and informs; (2) our programme theory, a theory about how the things we study work, with both informing; (3) the methodology which provides a structured approach to how we identify and analyse empirical evidence to generate and refine explanations. We follow these three sections by discussing our Critical Realist program theory, developed through a selective review of the literature on SBMIs. We conclude with the methods section, which describes how we will conduct the literature review.

Two meta-theories underpin SBMI research, the Cartesian and the post-Cartesian[56]2. In our research, we adopted a third meta-theoretical position, Critical Realism, as developed by Roy Bhaskar[63] and, more specifically, the Morphogenetic approach developed by Margaret Archer[3]. The dominant meta-theory in the mindfulness literature is Cartesian, based on the philosophical principles of Descartes, which tends towards dualism (mind/body split), reductionism, and a mechanistic view of the world (Table 1). It emphasises that individuals are autonomous, and development is often seen as a linear process driven by internal mechanisms. In mindfulness research, this means investigating how mindfulness practices affect mental processes separately from physical wellbeing, adopting a sceptical approach, that is, questioning the reliability of empirical data, analysing whether the framework is logical and coherent, and investigating whether foundational assumptions of the theory are justifiable or need revision. It uses objective, quantitative methods (with the preferred method being RCTs) to

measure change and examines change in reductionist and atomistic terms. It focuses on outcomes based on psychometric tests, measuring predicted changes in mindfulness (usually trait), cognition, emotional control, behaviour change, self-confidence and/or prosociality. Mindfulness is generally seen as a tool that individuals can use to improve themselves, a technology of self.

Post-Cartesian meta-theories, by contrast, critique Cartesian dualism, emphasising holism, contextualism and culture, subjective experience, complexity, interdisciplinary collaboration, and ethical and social implications. They see development as embedded in social and cultural contexts, emphasise the co-constructive role of relationships, language and environments in shaping children's experiences and recognise the dynamic interplay between individuals and their social worlds. From this stance, mindfulness is a *social practice* learned socially through interaction with others in a given environment. Mindfulness interventions need to be tailored and adapted to different school environments. Research adopting a post-Cartesian approach combines qualitative and qualitative research[56], often justified by pragmatism. There is a commitment to solving 'real world' problems and using methods appropriate for answering the research questions[64].

As a meta-theory, Critical Realism serves as a middle ground between positivism (which often assumes that reality can be fully known through observation and measurement) and interpretivism (which focuses on subjective understandings). Critical Realists argue that, while absolute truth may be unattainable, there is a social reality independent of our understanding. Scientific inquiry can uncover partial truths (demi-regularities) by investigating deeper causal mechanisms and their interactions within social contexts.

Critical Realism combines methods to uncover and understand the underlying causes and mechanisms that shape observable phenomena. Rather than simply describing what happens, Critical Realist methodology seeks to explain why and how events occur by

exploring underlying causes and conditions. Rather than seeing causation as linear, Critical Realism views it as contingent on contextual factors, meaning that mechanisms may have different effects in different contexts. In a Critical Realist Approach to SBMIs, the intervention would be viewed as operating in a stratified reality, where its effects are mediated by social structures (e.g. school climate, cultural norms), material resources, and individual agency. It would recognise that interventions can work differently depending on how pupils respond to the intervention and differentially activate underlying mechanisms. It would evaluate interventions by considering empirical outcomes and complex dialectical interactions between the intervention, agency, the activation and emergence of new mechanisms, and how existing context mechanisms moderate emergent mechanisms.

Aspect	Cartesian	Post-Cartesian	Critical Realism
Ontology	Dualistic – separates mind and matter. Mental and physical states are not related.	Non-dualistic – emphasises interconnections between mind and body and contextuality	A stratified and emergent reality exists independently of our understanding of it. Non-dualistic.
Epistemology	Positivist – objective knowledge can be obtained through empirical methods. A mechanistic worldview.	Constructivist – knowledge is co-constructed between observer and observed.	Epistemic relativism- knowledge of reality is fallible, developed through scientific enquiry and analysis.
Nature of Causality	Linear and deterministic, direct cause-effect relationships.	Relational and non-linear, causality is textual and emergent.	Complex generative mechanisms. Casualty is emergent and can involve multiple interacting layers.
Role of Mindfulness Interventions	A tool to improve objective outcomes like attention, emotional regulation, and behaviour.	A transformative practice that affects personal and social contexts and has the potential to transform schools so they promote pupil and teacher wellbeing.	An intervention that may (in some contexts) activate deeper processes leading to observable and latent change in personal, social, cultural and institutional contexts, potentially transforming individuals and schools.
Evaluation Focus	Measurable outcomes using standardised measures, e.g. behavioural changes, changes in wellbeing. Context is seen as secondary to individual factors.	Experiential outcomes, subjective experiences and context-specific impacts.	Examines both observable outcomes and underlying generative mechanisms. Reflexivity in understanding how researchers' and educators' positions influence intervention design and outcomes.
Research Methods	Quantitative methods. Emphasis on control, generalisability, and direct causation using RCTs to approximate laboratory conditions and measure cause and effect. It is possible to control for possible influences other than the intervention.	Mixed methods and qualitative research.	Critical Realist evaluation Mixed methods emphasising triangulation, i.e. exploring causal mechanisms through qualitative and qualitative data. Social systems are open and complex, making it a challenge, if not impossible, to replicate laboratory conditions.
Strengths in Evaluation	Clear recallable results. Provides objective data on effectiveness and identifying generalisability in large populations	Captures the subjective, contextual-dependent nature of mindfulness	Explanatory depth and systemic insights. Capture a deeper understanding of generative mechanisms, enabling an

Aspect	Cartesian	Post-Cartesian	Critical Realism
		impacts. Rich, contextual insights.	understanding of how mindfulness interventions work, for whom and under what circumstances. Provides actionable insights for improving intervention design and implementation.
Limitations	Ignores broader contextual and relational dynamics, internal and external to the school. Oversimplification of the complexity of mindfulness and its diverse impacts. Assumes uniformity in response to interventions.	Subjective biases can affect findings and cause a lack of generalisability. Prioritises description over causal explanation. Neglects deeper structural factors external to the school.	Complex to design and analyse. Complexity makes it challenging to identify generative mechanisms.

Table 1. Cartesian, Post-Cartesian and Critical Realist Meta-Theories

There are two fundamental differences between Critical Realism and the dominant psychological meta-theories. While the dominant approach asks if the intervention works, Critical Realism provides an account of the causal history of the outcomes of interventions in given contexts[63][65]. A Critical Realist synthesis aims to integrate insights from causal histories to uncover 'demi-regularities', recurring patterns of contextual structures, interventions, agency, mechanisms, and outcomes across space and time[59]. By identifying these patterns, researchers can offer guidance on the requisite conditions to maximise the likelihood of interventions having positive impacts; that is, the contexts in which agents' responses to the intervention activate mechanisms that change the context through morphogenesis (a non-linear process of change) that has positive outcomes[3]. By extension, findings from Critical Realist research have the potential to *enable social transformations* that improve human wellbeing by uncovering the structural features, including changes, necessary at all levels of reality to maximise the potential for interventions to work[66][60][61]. While the Cartesian approach emphasises the importance of following the formula, Critical Realism emphasises the importance of complexity, emergence, contextual conditions and generative mechanisms, reflective practices and an iterative, adaptative approach during delivery. It is about discovering the nature of things that are not immediately apparent or obvious and that make things happen[66].

B. Philosophical Principles: Ontology, Epistemology and Ethics

Bhaskar put forward three foundational principles of Critical Realism: ontological realism, epistemological relativism, and judgmental rationality. The distinction between the transitive and intransitive dimensions allows Critical Realism to sustain a fundamental separation between ontology and epistemology. Critical Realism is ontologically realist, epistemically relativist, and judgementally rational. It separates structure and agency and is committed to understanding how to improve people's lives, emphasising social justice[67][63][61]. It acknowledges the existence of a mind-independent, structured and changing reality. However, it acknowledges that reality is a social product that is not independent of those who produce it. Our understanding of reality is shaped by social and cultural contexts, making our understanding of reality inherently fallible[43]. We are born into a context with a real existence, but our knowledge of it is relative to human subjective factors, which influence the construction of that knowledge[68][69].

Ontological realism is the first foundational principle. Critical Realists identify three overlapping ontological domains: the empirical, the actual, and the real[63]. The empirical refers to what is observed, experienced, and understood; the actual includes events and processes that occur, whether observed or not; and the real consists of the enduring mechanisms and structures that generate observable events and outcomes (Table 2. While higher-level properties can emerge from lower-level processes, these emergent properties cannot be fully explained or predicted solely by those lower-level processes. For example, for SBMIs, pupils' feelings of emotional control and improved learning emerge from interactions between biological, psychological, and social processes. Changes in brain structure alone cannot fully explain these outcomes; they are shaped by broader social and material environments, as well as intrapersonal and interpersonal behavioural and social dynamics[70][71]. Change is not linear but the outcome of the complex interaction of the context with its existing structures and mechanisms and emerging mechanisms that are activated by agency[3][26]. Change is dialectical; it is the outcome of the interplay of opposing forces or contradictions, the dynamic relationship between structure and agency, and mechanisms at different levels of reality[2]. In understanding change, it is crucial to understand absence and negativity as a real presence to ask what is absent that is essential for enabling a SBMI to trigger transformative change.

Domain	Description	Examples in Mindfulness Interventions
Empirical	What is directly experienced or observed, including sensory data and immediate observations?	• Observable changes: improved classroom behaviour, enhanced attention, reduced conflicts. • Measured outcomes: better academic performance; fewer absences. • Reports: teacher/pupil reflections.
Actual	What happens in the world, whether it is observed or not?	• Internal process: reduced stress emotional regulation during mindfulness practices. • Programmatic factors: delivery quality, duration, and consistency of mindfulness sessions.
Real	Underlying structures and mechanisms that cause the empirical and actual events are inferred through observation, theory, and analysis.	• Neurobiological: changes in brain structure/function. • Psychological: emotional resilience; improved attention. • Social: supportive school culture and policies.

Table 2. Depth Ontology and Mindfulness

Reality is multidimensional and interconnected. In Critical Realism, the Laminated System is a way of conceptualising reality's multi-layered and emergent nature. Each layer has hierarchical levels from the sub-human level to the macro level. The Four Planes of Social Being is a framework for understanding the multidimensional nature of human existence and social life. Together, they provide a way of understanding and transforming social reality and the potential for emancipatory change by identifying intervention points and social transformation (Table 3)[70][71].

Layers	Ontological stratification is divided into three hierarchical layers, the real being the deepest and most fundamental. Layers help explain how causal mechanisms (in the real) operate to produce observable phenomena (empirical) though events (actual). And emergence (empirical).
Levels	Describes the hierarchy or scale within systems, from the sub-human through the micro to the micro. In SBMIs, from the sub-human (Biology and Psychosocial processes) and the social, from the micro- of face-to-face interaction, through the meso-, organisational or community level, to the macro-level of larger societal or systemic structures and processes.
Planes	The Four Planes of Social Being are the differentiation of structures into the dimensions of social being. They are interdependent and provide the ontological scaffolding for understanding human action and setting the conditions and limits within which agency operates. They are in a dialectical relationship. They shape and constrain each other and operate at every layer of reality. The Four Planes are: (1) the plane of material transactions, with the natural world, biological, material and ecological conditions; (2) the inner being, intrapersonal process including subjectivity, reflectivity, and the capacity for thought, emotion, and self-awareness; (3) interpersonal interactions and relationships; and (4) social structures, institutions, norms, rules and cultures.

Table 3. The Complexity of Reality

Laminated Systems are a way of conceptualising reality's muti-layered and emergent nature. Nature is stratified, and we live in a laminated system of strata formed by the emergent mechanisms generating multiple levels of analysis, with the whole being more than the sum of its parts[72][66][73][43][74]. Academic disciplines operate at different ontological levels, each corresponding to specific levels of reality, physical, biological, social, and cultural, and each has its emergent properties and mechanisms. At the level of actual relations, strata overlap and interact and affect each other in complex ways. Higher-level mechanisms are routed in, and emergent from, more basic ones; that is, they have properties which are not reducible to their lower-level parts. For example, physiological changes induced by mindfulness practices may lead to psychological benefits, which can, in turn, enhance interpersonal relationships and improve societal well-being. By identifying different laminae relevant to the research, researchers can apply theories, methods, and insights from various disciplines to address each level[66][75].

The Laminated System and the Four Planes of Social Being explain how phenomena interact across dimensions of human existence, but mechanisms make things happen[76]. Mechanisms can be present at the real or actual levels but not necessarily active at the empirical level. Mechanisms are activated by human agency, and once activated, they may interact and combine to generate new mechanisms and emergent outcomes. SBMIs, individual,

relational, and social mechanisms operate simultaneously across different levels, interacting to create emergent outcomes. At an individual level, mindfulness, for example, enhances emotional regulation by helping pupils develop awareness of emotions and manage them effectively. By practising mindfulness, a pupil who previously reacted impulsively to frustration learns to pause and breathe before responding, reducing disruptive behaviours. At a relational level, mindfulness fosters empathy and improves peer interactions through practices like mindful listening. Pupils learn to pay attention non-judgmentally during group activities, leading to fewer conflicts and stronger peer relationships. The collective adoption of mindfulness principles at the social level shifts the school culture towards being more supportive. Integrating mindfulness into policies and routines reduces teacher burnout and fosters a positive environment for all members of the school community. Mechanisms are emergent, meaning they interact and form new mechanisms that cannot be reduced to their components. For example, the cultural shift towards a more mindful and supportive school environment arises from individual practices, mutual reinforcement, and collective modelling of mindful behaviours. Already active mechanisms may constrain emergent mechanisms. For example, the collective adoption of mindfulness is constrained by an anti-school culture.

Through attention to mechanisms, the Critical Realist standpoint supports enhanced and appropriate understandings of cause and effect. Mechanisms may not be activated uniformly in all schools due to differing contexts. The mechanisms already at play in a school can constrain or enable pupils to engage with the mindfulness intervention and reinforce, weaken or neutralise mechanisms triggered by pupils practising mindfulness[76]. Existing mechanisms that could reinforce the mechanisms activated by pupils' engagement with mindfulness include, for example, positive reinforcement from teachers praising students for emotional and behavioural control as well as academic success; a pro-school peer culture with pupils identifying with the school and its cultural values; and parental and community support for the school promoting wellbeing as well as academic success. These and other mechanisms interact to amplify, for example, the psychological benefits of mindfulness for pupils. Mechanisms that could inhibit mechanisms being activated include, for example, pupils who are sleep-deprived and stressed may struggle to achieve emotional regulation; cultural resistance, community or parental values that conflict with mindfulness practices; an anti-school peer culture that encourages pupils not to engage with mindfulness practices; and stressors, such as teacher burnout, high community stress, or government policies emphasising academic outcomes over school health and wellbeing goals. These mechanisms can interact and create powerful influences on the success of the SBMI. Researchers and practitioners must identify contextual enablers and barriers to address such challenges, adapting interventions to align with structural and cultural conditions.

To understand the potential for change, it is crucial to recognise absence and the dialectical relationship between Laminated Systems, the Four Planes of Social Being, and generative mechanisms[70][2]. Reality is structured by what is present and what is absent. Absence is not simply the opposite of presence but is a fundamental part of the

dynamic interplay that shapes reality. Absence can be neutral, beneficial, or harmful, but recognising it is crucial for understanding the possibility of transformation. Change occurs by addressing absences, gaps, constraints, or unfulfilled potentials. The ongoing interaction between structures, mechanisms and agents across the Four Planes of Social Being is dialectical. Transformations occur through contradictions, negations and the resolution of absences. The reflexive agency plays a key role in recognising absences and actively engaging in their transformation within Laminated Systems of causality. Reflective agents bring about change through their interaction with structures and culture.

The second foundational principal of Critical Realism is epistemological relativism[67][71][77]. Critical Realists argue that it is possible to be ontologically realist and epistemologically relativist[66]. They reject naïve realism, that is, to believe our perception of the world reflects it precisely as it is, unbiased and unfiltered. Bhaskar refers to this as the epistemic fallacy, the tendency to conflate ontology (what is) and epistemology (what we can know). Furthermore, our emotions, past experiences, gender and cultural identities, and disciplinary backgrounds can all influence how we perceive the world so that our perceptions resemble reality rather than reflect it. Critical realists argue that there is a disjuncture between reality and our understanding of it and that forces (mechanisms) operating in the real are not immediately transparent to us. This is why we must seek knowledge and why science and other knowledge are fallible. Scientific knowledge advances through continuous corrections, refinements, and radically new insights, uncovering previously unknown mechanisms[75].

Judgemental rationality is the third foundational principle of Critical Realism[67][71][77]. However, while Critical Realism is epistemically relativist, this does not translate into judgemental relativism but judgemental rationality, that is, to assess the truth of competing claims to knowledge[67][66]. The real-world limits knowledge so that not all knowledge claims are equally plausible. Critical Realists' criterion for judging the validity of one candidate theory above another is explanatory power, the ability of one theory to explain not only the aspects of reality explained by the other candidate theories but also some additional features[66]. This is combined with immanent critique, identifying internal inconsistencies or inconsistencies between theory and practice in competing theories, and uncovering false beliefs[67][71][77].

Emancipatory objectives form part of a Critical Realist research agenda; Bhaskar's explanatory critique links understanding with emancipation[2][71]. If a social structure systematically produces suffering, injustice, or misrecognition, this implies a moral and political imperative to change it. The starting point for Critical Realist research is that improvement of society is possible and that scientific research should include identifying how mechanisms can be altered to ameliorate harmful or enhance beneficial effects[75][61]. Emancipatory change occurs through agential reflexivity, where individuals and groups develop a critical awareness of structural constraints and mobilise for transformation. The morphogenetic cycle (structural conditioning → social interaction → structural elaboration) provides a framework for understanding how emancipatory movements can emerge and

reshape social structures. Emancipation involves identifying *absences* (unrealised human freedoms, unmet needs) and transforming reality by removing constraints that inhibit human flourishing[70][2].

Methodology

In this study, methodology refers to the principles and stages of explanatory Critical Realist applied research, as outlined by Bhaskar. It encompasses the logic of abduction, retrodiction, resolution, and interdisciplinarity, which guide how we develop, refine, and test causal explanations. We combine this with Archer's morphogenic cycle, which provides the framework for understanding the process of social change and the interplay between structure and agency. Together, they provide a robust framework for interdisciplinary research analysing reality's dynamic, stratified and interconnected nature with a strong emphasis on transformation, emancipation, and the role of human agency.

Archer's morphogenetic approach provides a methodology for analysing the relationship between structure, culture, and agency over time (Figure 1). It focuses on:

1. The pre-existence of structures and cultural systems before individual action.
2. The interaction between structure, culture, and agency during a given period (morphostasis or morphogenesis).
3. The emergence of new or transformed structures and cultures resulting from agency.

Her emphasis is on human reflexivity, our ability to deliberate and act in ways that reproduce or transform social structures.

An intervention, such as a SBMI, triggers agential responses, and there is a complex interaction between the existing mechanisms and the mechanisms activated by agents' responses to the intervention (Figure 1). It is informed by dialectical reasoning, contradiction (between the context and the intervention - antithesis), reflective agents as mediators, dynamic change through the activation of new mechanisms by reflexive agents, and the interaction of new mechanisms with existing mechanisms. This dialectic can facilitate or suppress the emerging mechanisms at multiple levels as new mechanisms combine and move upwards to higher levels and outcomes (synthesis).

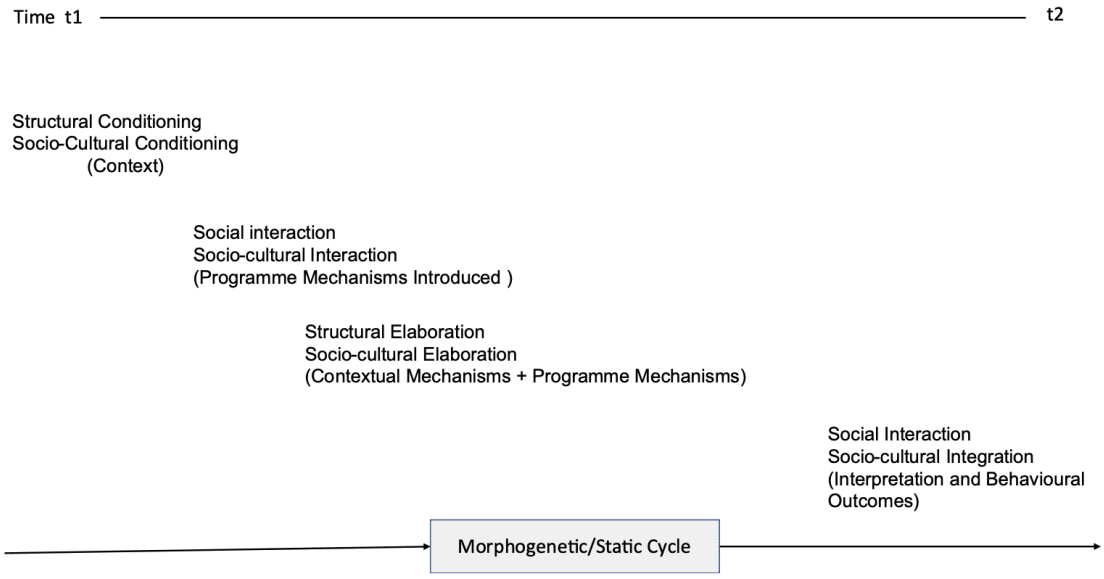

Figure 1. Morphogenic Cycle

Based on Archer[3]

In preparation for the data analysis, we will use the ICAMO analytic tool to extract from the selected documents the contexts (and situations) in which agents' responses to the intervention activated mechanisms and outcomes. This includes material (biological), intrapersonal, social interactional and structural outcomes.

Our research analysis follows Bhaskar's Critical Realist RRRIREI(C) model (Resolution, Abductive Redescription, Retroduction, Retrodiction, Elimination, Identification of Antecedents, and Correction), which provides a structured approach for conducting applied interdisciplinary explanatory research[77]. The framework consists of seven key stages, guiding the research process from initial disciplinary insights to refining a transdisciplinary programme theory (Table 5). This enables a progression from surface-level observations to deeper causal explanations by systematically uncovering the underlying mechanisms and structures that generate observable phenomena. The Four Planes of Social Being and the Laminated System provide tools for analysing how different levels of reality interact and shape one another, focusing on totality and transformative praxis. Together, they help to operationalise the Critical Realism commitment to understanding the deep structures of social reality and the potential for emancipatory change.

A Laminated System approach is used to identify the disciplines that can contribute theories and mechanisms for explaining how SBMIs work, for whom and under what circumstances. Through abduction, the possible underlying mechanisms are identified using disciplinary explanations. Researchers hypothesise and test explanations through retroduction and retrodiction, concluding with elimination, identification of antecedents, and correction to refine and validate theoretical insights. The model also facilitates the transition from disciplinary

research to interdisciplinary collaboration and, ultimately, transdisciplinary theory development. It achieves this by integrating the Laminated System and Four Planes of Social Being[43][66], providing a robust framework for analysing complex, multi-layered social phenomena, such as SBMIs[43][66][70][72][73][78][79].

	Resolution	**Redescription**	**Retroduction**	**Retrodiction**	**Elimination**	**Identification of Antecedents**	**Correction**
Activity	Identification of the disciplines and the relevant mechanism that can contribute to developing an explanation of how SBMIs work.	Map existing literature and use abduction to reinterpret SBMI impacts through disciplinary theories.	Tracing back to the underlying generative mechanisms that explain observed SBMI outcomes.	Identifying how different mechanisms reinforce, moderate, and condition one another to affect the outcome.	Use judgemental rationalism to eliminate theories which lack explanatory power, coherence, and/or empirical adequacy.	Analyse historical, structural, and contextual conditions necessary for mechanisms to operate and use judgemental rationalism to identify the most comprehensive middle-range transdisciplinary theory.	Iteratively refine the SBMI programme theory through empirical validation and theoretical insights.
Outcome	Establish foundational disciplinary insights and relevant explanatory mechanisms.	Identify disciplinary theories to explain the impact of SBMIs.	Hypothesis for the deep structures that must exist for the observed effects to occur.	Developed and tested middle-range transdisciplinary theories.	Theories that have explanatory power, coherence, and /or empirical adequacy.	Transdisciplinary theory of how SBMIs work.	Strengthened middle-range transdisciplinary theory

Table 4. 7 Stages of Explanatory Critical Realist Applied Research

Based on: Bhaskar[77]

Theoretical Framework

Our theory operationalises philosophical principles, is explanatory, and guides the overarching theoretical understanding of how SBMIs work, offering a framework to analyse processes of change and stability. We draw on three middle-range theories[3] to develop our theoretical framework, forming the basis of our Critical Realistmiddle-range programme theory. The three theories we draw on are Archer's Morphogenic Approach[3][80], Pearlin's Theory of the Social Causes of Depression[4][5] and Bonell et al.'s Integrated Theory of How the School Environment Impacts Student Health[6].

A. Archer's Morphogenic Approach

Archer's Critical RealistMorphogenetic Approach provides the framework for understanding how mindfulness interventions work in schools. Recognising that structures are not fixed or immutable but can be transformed through human agency, she adds to Bhaskar's approach the importance of culture in conditioning people and reflexivity in undertaking social change and social stability. She argues that it is necessary to distinguish between agency and structure and between social structure and culture. People (as individuals and groups) are conditioned by the contexts in which they are born, but they can change social structures and culture through individual and collective agency[3][80].

Archer argues for analytical dualism, the temporal sequencing of agency and structure, preconditions, actions and outcomes[3]. When they exercise agency, individuals reflect on their actions and engage in dialogue to make decisions, form opinions, and understand their motives. They think about and critically evaluate their actions and circumstances in relation to the broader social context. Our ability to deliberate enables us to act in ways that reproduce or transform social structures. There are four modalities of reflexivity: communicative reflexivity (confirmed by others before action); autonomous, self-contained internal conversations leading to direct action; meta-reflective conversations by those who are critically reflective about their internal conversations and critical to effective action in society; and fractured reflective, internal conversations that intensify distress and disorientation rather than leading to purposeful courses of action[80][81].

Agents bring about change by activating generative mechanisms that shift underlying social structures, patterns of social relationships, and culture. The outcome of an intervention results from people's interpretations and responses to the intervention in an open system where there is a complex interaction of a plurality of generative mechanisms, in addition to the intervention itself, which combine and interact and produce outcomes. These mechanisms are embedded in social, organisational, and cultural contexts, operate at multiple levels, including individual, interpersonal, and organisational, and can support or inhibit change. Change is not linear, and the outcome of an intervention can be change (morphogenesis) or no change (morphostasis). Mindfulness interventions may give agents the tools to trigger individual, relational and social mechanisms, thereby changing

the structural and cultural context in which they live their lives. Still, other mechanisms may constrain or partially constrain these mechanisms. Mechanisms are *emergent*; that is, mechanisms may combine to form new mechanisms that are not reducible to the mechanisms from which they were formed.

Archer and Critical Realism, more generally, have been criticised for focusing on material and social structures and providing little space for the mind's internal processes, such as emotions, cognition, and psychological mechanisms, positioning them as intermediaries between biological and social factors rather than a domain with their emergent causal powers[82][26]. Booker[82] argues that psychological constructs, such as self-efficacy, should be considered ontologically real and possessing causal powers. By applying Bhaskar's criteria for reality to self-efficacy, Booker demonstrates how psychological mechanisms function as generative forces in human behaviour, influencing individuals' internal conversations and leading to agency. Integrating this psychological analysis into Archer's Critical Realist account of structure and agency provides a more comprehensive understanding of human action. Norrie argues that Bhaskar's Four Planes of Social Being, where intrapersonal processes (psychological) are one plane, provides the space to recognise how psychological dispositions emerge dialectically from and influence social and material conditions. He argues that psychological dispositions are a potential everyone has. For example, we all can be mindful. Still, the extent to which this potential is realised depends on social and material conditions and our ability to activate it in response to challenges.

A second concern is that Archer does not differentiate between structure and institutions[83][84][85]. Institutions are the sites where agency and structure interact. Structures, by contrast, are abstract and overarching, as the underlying patterns, mechanisms and relationships that enable and constrain human action. They are the broad and abstract range of societal elements that provide the enabling and constraining conditions within which social institutions operate and are located in the real. Social institutions are specific, organised entities or systems within society that embody and operationalise structures. They are more concrete manifestations of underlying structures, including formal organisational systems, cultures, and established practices, and they are located in the actual. They provide a site where structure and agency interact, such as a school (as part of the education system) and are more amenable to change than structures. Structures shape institutions, institutions reproduce or transform structures, and institutions perpetuate structures. For example, the education system is a structure. It is a deeper, underlying arrangement that shapes and sustains multiple schools across society. As an institution, a school mediates the effects of broader educational, economic structures, and cultural forces and actively enacts and modifies them.

To address these concerns of conflating structures and institutions and neglecting internal processes, we incorporate into our framework Pearlin's theory of stress which theorises the dynamic relationship between social structures, social institutions, and psychological processes in mental health[4][5], and Bonell et al. l's.' theory of the school environment, which examines the interaction of institutional, social interactional, and intrapersonal processes in explaining how the social environment impacts on students' health[6]. Both incorporate psychological

processes in their models and the mediating role of social institutions. Neither are self-identified Critical Realists, but their models are compatible with Critical Realism.

B. Pearlin's Theory of the Social Causes of Depression

Pearlin's stress process model clearly distinguishes structures and institutions and identifies how psychological dispositions emerge dialectically from, but also influence, social and material conditions[4][5]. Social context, including poverty, instability, unemployment, neighbourhood disorganisation, and lack of social support, as well as social characteristics, including social class, age, gender, race, and ethnicity, directly influence exposure to stress. Social support networks are the social resources people can call on to help them when confronting a challenge. They can mitigate the immediate impacts of stress and help build resilience, acting as a buffer against future stressors. For example, supportive relationships with family, friends, or community organisations can help individuals reframe challenges and access resources to manage stress more effectively. The risk of depression is then not random but socially patterned; most people experience challenges in their daily lives, but only some become depressed.

Pearlin theorises the pathways (from social/structural conditions and social characteristics through stressful life events to mental health outcomes like depression) by examining the mechanisms that individuals can activate in response to experiencing stressors. He distinguishes between stressors (proximal triggers like family violence or job loss) and the broader structural or cultural contexts that give rise to these stressors (social causes). Family violence, for example, is a stressor, not a social cause. It is a situational or immediate stressor that can disrupt an individual's psychological well-being. The social causes of family violence include systemic factors like poverty, unemployment, cultural norms, and societal attitudes toward gender and power dynamics. These social structures and processes create environments where people are more likely to experience violence. Living in a social context that is stressful, where individuals encounter many stressors and where there is a lack of social support, can put someone at greater risk of becoming depressed, as can the accumulation of stressors across the life course.

Stressors do not directly cause depression, but agents' responses to them can activate intrapersonal processes (e.g., emotional reactions, changes in self-esteem, resilience, and coping mechanisms) that can lead to positive or negative mental health outcomes. Like Archer, Pearlin argues that individuals respond to external challenges by exercising agency. In exercising agency, they reflect on the external challenge and then act. Their interpretation and actions can leave things as they are. That is, they do not become depressed, or they may be overwhelmed by the stressors and become depressed. Agents can activate personal and psychological mechanisms that enable them to cope with stress, such as resilience and emotional regulation or mechanisms of stress dysregulation. They can also activate social support, which can mitigate the risks of depression.

Pearlin's theory provides a conceptual model for understanding how life stressors can lead to depression with the social and the psychological in dynamic interaction. SBMIs may give pupils the tools to activate mechanisms to

cope with challenges and stressors in their daily lives. In other words, students' agency in response to a SBMI may give them the tools to activate dispositional mindfulness and other psychological mechanisms that can enable them to overcome challenges faced in daily life. The theory recognises that the causes of depression are external to the individual but also provides a way of understanding the psychological process that a SBMI may activate when individuals experience stress.

C. Bonell et al.'s Integrated Theory of How the School Environment Impacts Student Health

Bonell's theory emphasises the interplay between social structures, social environments (schools), and pupils' and teachers' agency and wellbeing, highlighting how institutional practices can shape mental health resiliency and agency[6]. Schools exist within a broader social and cultural framework, including educational policies, community norms, socio-economic factors, and cultural values. These elements shape the school's priorities, resources, and general approach to education. District leaders and government bodies can influence whether and how a health promotion programme is delivered, for example, through educational and health policies that support health-promoting schools and resources for implementing interventions to implement the policies. Suppose a school's role in health promotion aligns with the community's values. In that case, it may be more readily accepted and integrated than if the community is resistant, valuing academic curricula, for example, over what is regarded as 'non-academic' subjects.

Schools are social institutions that mediate between social structures and pupils' wellbeing. Schools as institutions have a structure and a culture that conditions the behaviour of its members. This provides the framework within which agency is exercised by teachers, school managers, other employees, and pupils[6]. The structure of a school includes a hierarchy of authority and power, disciplinary systems, resource allocation policies, staff capabilities, and educational policies that shape how a health-promoting programme can be implemented. The culture of a school includes the values of school managers and classroom teachers, parents and the broader community, and pupils, and conditions how mindfulness is perceived and accepted. It impacts pupils' motivation, engagement, sense of belonging, staff morale, and collaboration. The success of a programme will depend on the structural and cultural context and the extent to which the response to the intervention by school managers, teachers, pupils, and parents transforms the structural and cultural context of the school as well as individual capabilities and motivation[6]. Structural changes provide the necessary time, space, and policies. In contrast, cultural changes ensure the practice is valued, respected, and integrated into the school's everyday life, with staff and pupils engaging with the intervention. Together, they can create a holistic approach that transforms the entire school environment into one that promotes pupil wellbeing.

However, central to the success of a health programme is pupil engagement. That is, they are willing and able to learn mindfulness and use it to regulate their emotions and behaviour. Pupils can choose to adopt and act out various roles before an audience of peers and teachers but with agency constrained by emerging psychological

dispositions, by the economic, cultural and social capital they possess, by gender and ethnicity, and by the school as a social institution[6]. Teachers' responses are influenced by the school's norms and styles of feedback and peers by the local norms, including attitudes toward school and academic achievement. Health-promoting schools promote student commitment to the school's 'instructional' (the way it enables students to learn) and 'regulatory' (behavioural norms) orders[6]. Mindfulness, integrated into the school environment, can enhance both the school climate and individual pupils' development, supporting cognitive and emotional development through its impact on attention, emotional regulation, and neuroplasticity.

D. Critical Realist Programme Theory on the Impact of Mindfulness Curriculum on Pupils' Mental Wellbeing.

Our Critical Realist middle-range programme theory (Figure 2) is based on an initial gleaning, purposive, theoretically informed synthesis of relevant literature undertaken as part of developing the research protocol[1][86]. It explains how SBMIs foster wellbeing through emergent mechanisms within a structured but adaptable school-context. Our framework integrates Archer's Morphogenic approach, Pearlin's Theory of Stress Reduction, and Bonell et al.'s Integrated Theory using the ICAMO Framework to explain how SBMIs promote a pupil's mental wellbeing. Archer's Morphogenic Approach explains how pupil agency develops over time in response to structured contexts (e.g. school culture and policies) and how individual reflexivity mediates responses to interventions. Booker's arguments add to this by highlighting intrapersonal processes, such as cognitive and emotional adaptations, as mediating mechanisms in learning. Pearlin's Stress Process Model clarifies how pupils experience stress and cope in school settings, emphasising the role of resources (e.g., support mindfulness) in mitigating stress. Bonell's Theory of the School Environment frames the school as a social system where emergent mechanisms at the individual and collective levels influence overall school climate and well-being. The CIAMO framework explains how pupils' engagement with mindfulness activates intrapersonal mechanisms such as emotional and behavioural regulation. These changes cascade into interpersonal mechanisms (peer relations, classroom dynamics), influencing social interaction. Over time, through morphogenesis, these shifts lead to an improved school climate that sustains wellbeing and academic success.

Using a laminated systems approach, we identified Biology, Psychology, Education, Sociology, Political Science, Economics, and Public Health as relevant disciplines, recognising that biological predispositions, personal history, cultural practices, and socioeconomic conditions could influence the impact of the intervention. Biology and Psychology work at the foundation (pre-social) levels of the Laminated System, explaining individual-level mechanisms, while the other disciplines work at higher levels, addressing broader, collective and structural dimensions[75].

This framework enabled us to examine mindfulness as an individual practice that interacts with and is influenced by various aspects of social and material life[70][71]. In SBMIs, the Material dimension focuses on the physical resources and environmental factors that influence mindfulness practices, including spaces, time, and resources for mindfulness interventions to be practically viable, as well as the biological factors, including how mindfulness practices can change the brain. The Intra-personal dimension concerns each participant's subjective experience in the mindfulness programme, including motivations, beliefs, and personal histories. Students' and teachers' receptivity to mindfulness varies based on factors such as stress levels and openness to mindfulness practices. The Interpersonal dimension focuses on social interactions and relational dynamics, including those between teachers and students, among peers, and between school staff and families. Evaluating this plane highlights how the social fabric of a school affects the acceptance and practice of mindfulness. The Structural and Institutional dimensions consider the institutional policies, school culture, and broader societal structures that shape the context in which mindfulness interventions occur. For example, the school's approach to discipline, the educational system's stance on mental health, or funding policies influence how mindfulness programs are integrated and sustained.

Our literature review concluded that SBMIs may give agents (pupils, teachers and other school staff) tools to activate individual, relational and social mechanisms. Regular mindfulness practice (e.g., mindful breathing) can enhance emotional regulation by helping pupils develop greater awareness of their emotions and how to manage them. Students who previously reacted impulsively to frustration pause and breathe before responding, reducing disruptive behaviour in the classroom. Mindful listening can improve empathy by enabling pupils to pay attention without judgment during group activities. Students listen more attentively to their classmates, which leads to fewer conflicts during group work and stronger peer relationships. As the SBMI and its implementation influence the school community, there may be a cultural shift towards a supportive school environment. Integrating mindfulness principles into policies and daily routines enables a culture to develop where pupils, teachers and other staff feel supported and less stressed, leading to improved wellbeing and reduced teacher burnout.

The Laminated System's approach enables us to see SBMIs through a multi-layered lens that captures the interdependencies across the different levels, the neurobiological, the psychological and the social (Education, Sociology, Political Science, Economics, and Public Health), avoiding reductionism. Research can move beyond simplistic cause-effect relationships, recognising that SBMIs are influenced by a complex web of mechanisms operating across individual and structural domains and that generative mechanisms at different levels interact in complex ways to produce change. In the context of school-based interventions (like mindfulness), individual and collective experiences interact to deliver complex outcomes. The SBMI can mediate the dialectic, helping individuals transcend habitual patterns (stability) and fostering new forms of adaptive cognition, emotional regulation, and behaviour change (metamorphosis). For example, pupils regularly practise mindfulness and develop increased prefrontal cortex activity (biological) and reduced cortisol levels (physiological), helping them stay calm during peer disagreements. A calm state allows pupils to use mindfulness communication techniques

(social), resolve conflicts constructively and strengthen peer relationships. Over time, these improved relationships have the potential to reduce stress levels, further supporting pupils' physiological, biological and psychological wellbeing and creating a positive feedback loop across all levels. Furthermore, the interaction of mechanisms across levels produces emergent outcomes. A calmer classroom climate develops as pupils and teachers adopt mindfulness practices and the culture of the school shifts towards empathy, patience, and mutual respect, which cannot be reduced to changes at any single level but arises from the interplay of biological, physiological and social mechanisms across the Laminated System to bring about complex and multi-layered changes.

Our programme theory hypothesises that a whole school SBMI is most likely to have a positive impact, that is, to promote the mental wellbeing of pupils and transform the structure and culture of the school so that improvements in wellbeing are sustained when the context is characterised by:

1. Supportive structural, institutional and cultural contexts at global, national and community levels, including positive relationships with pupils' families and local communities.
2. Educational and health funding, policy priorities and access to services for promoting school pupil wellbeing.
3. Supportive school institutional and cultural contexts include a strong school leadership that prioritises pupil wellbeing, adequate resources and support for in-service teacher development, teachers who are supportive of and capable of delivering interventions to promote pupil wellbeing, and a positive school climate.
4. A mindfulness curriculum that is culturally adapted to the school context can be incorporated into the school curriculum, with teachers trained to deliver mindfulness and supported in delivering the intervention.
5. Pupils and teachers are prepared to engage with the mindfulness intervention and make sense of their experiences.

In this context:

1. The mindfulness curriculum will give pupils tools that they can use to activate cognitive, emotional, psychological, cultural, motivational and social mechanisms that enable them to self-regulate their emotions and behaviour, become more engaged in schoolwork, more resilient, and more empathetic and compassionate.
2. Practising mindfulness will enable teachers to activate emotional regulation mechanisms that reduce stress levels and increase resilience, enabling more positive interactions with pupils.
3. Through upward emergence, intrapersonal changes in pupils and teachers will foster improved peer-to-peer and pupil-teacher relations and a supportive environment (interpersonal mechanisms), transforming classroom and school cultures (structural mechanisms). Classrooms are calmer with positive peer-to-peer and pupil-teacher interaction, fostering a safer, supportive, nurturing classroom and a caring school environment.

In the longer term, integrating mindfulness into the school curriculum is hypothesised to create a virtuous cycle whereby the emergent capabilities of pupils and their teachers transform group dynamics, institutional relationships, and culture. Pupils are hypothesised to feel more in control of their emotions and learning, fostering intrinsic motivation, and there is a school-wide shift to a calmer and more compassionate environment, reducing stress and increasing pupils' commitment to the school and pro-school behaviour, thereby promoting the wellbeing of all members of the school community. The sustainability of the transformation is hypothesised to be assured by integrating mindfulness not only into the curriculum but also into the culture and relationships in the school, which are supported by the external context.

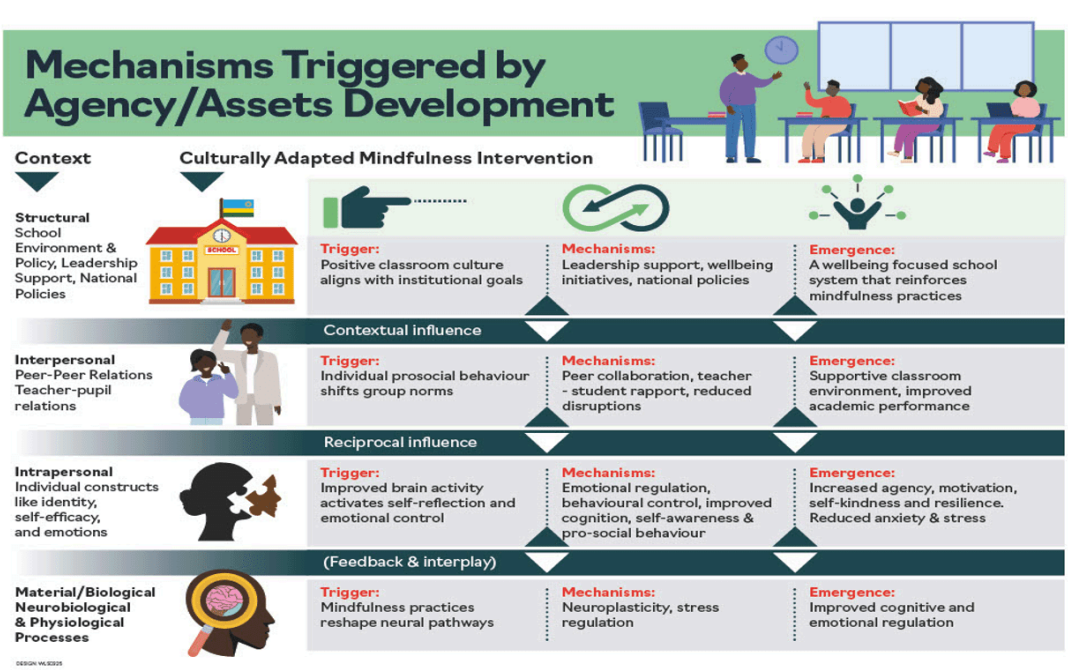

Figure 2. Critical Realist Initial Middle-range Programme Theory for Refining through a Critical Realist Literature Synthesis[4]

DESIGN: WLS032Methods

Methods

The methods used for carrying out a Critical Realist synthesis designed to test and refine our programme theory are set out in detail in the protocol[1]. The methods comprise five steps and follow the Critical Realist seven stages of explanatory Critical Realist applied research: Resolution, Redescription, Retrodiction, Elimination, Identification, and Correction in Stage 4 (see Table 5 above). We use the ICAMO analytic tool based on Archer's Morphogenic approach to extract data for analysis for the Critical Realist synthesis.

Appendix

Critical Realist Terminology/Key Tenants and their Ontological/Epistemological Basis as Used in the

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Article[5]

Absence	Understanding the importance of what is not there, absences, e.g. a lack of resources, a lack of commitment to mindfulness, and a lack of engagement with mindfulness, can have causal effects, shaping the outcome of the intervention.
Agency	The power of individuals to engage in meaningful actions. Agents have causal powers because they respond to the intervention and, within their context, can trigger mechanisms that change the context.
Abduction	Reinterpreting events into a conceptual framework, inferring the best possible explanation of the outcomes, moving from observation to underlying causes and identifying potential causal mechanisms. It involves an iterative process of moving between observation, hypothesis generation, further investigation, and hypothesis refining.
Causal powers	Causal powers are the capacities of entities at different levels to bring about change. Understanding causality requires examining the interplay between different layers of reality. This approach resists simplistic cause-and-effect explanations by recognising that multiple causal powers, operating at different levels (biological, psychological, and social), often combine to produce outcomes.
Complexity	The intricate and interdependent nature of the social system is complex; social reality is not simply a collection of individual events or actors but a web of relationships, structures, mechanisms and emergent properties that interact in dynamic and often unpredictable ways. The outcomes from health and social interventions result from the complex interaction of generative mechanisms in an open system. Therefore, change is non-linear, emergent and involves feedback loops.
Context	The contexts set limits to the efficacy of a programme intervention. 'Structures' are material, physical, human resources, and associated practices. 'Culture' is the realm of intersubjectivity, social values/ideas, and ideational influences. Contexts are dynamic and can change through agency triggered by the intervention. However, the same causal mechanisms can produce different outcomes in different contexts.
Context Mechanisms	The resources and restrictions embedded in the social and organisational (relational) structure can influence the outcomes and must be identified. They can be physical, social, interpersonal, intrapersonal, or conceptual. They have causal powers and include social structures, cultural structures, institutions, conventions, norms, and values. While they may not be observable, they can be retroduced from what is observed.
Critical Naturalism	A rejection of a positivist account of science.

Culture	Intersubjectivity, ideas and ideational influences are an emergent set of shared meanings, values, norms and practices that shape and are shaped by social structures and human agency, possessing causal powers that influence how people understand, interpret and act in the world.
Demi-regularities	Partial event regularities indicate that an intervention in some contexts triggers mechanisms that result in the same outcome but not universally or with complete regularity. Demi-regularities suggest that while specific trends or behaviours are common, they are not deterministic or absolute because other contextual factors, contingencies, or causal mechanisms influence them.Bottom of Form
Depth Ontology	Reality is stratified into three domains. 1. The Empirical: experiences of what happens; 2. The Actual: things that occur independently of whether we observe them or not; 3. The Real: which is beyond our direct observation. It consists of the underlying, unobservable, and often hidden structures and mechanisms that shape the actual. The Real domain includes these structures, causal mechanisms and powers operating within and across the Four Planes of Social Being. The Actual domain consists of events and processes within these Four Planes, and the Empirical domain includes what individuals experience across the Four Planes. Ontological depth allows Critical Realists to examine what happens and why it happens, emphasising the importance of unobservable mechanisms.
Dialectics	Dialectics refers to the interplay of opposing forces or contradictions that drive transformation. The dynamic relationship between structure and agency, mechanisms at different levels, and stability and change. Contradictions drive transformation, and resolving contradictions can lead to new emergent mechanisms. Lower-level mechanisms can combine to produce higher-level changes, influencing the lower levels in a recursive transformation process.
Emergence	The ability of generative mechanisms to combine to create something new cannot be reduced to the generative mechanisms from which it emerged. Higher levels of reality, e.g., the classroom climate, emerge from lower levels of reality, which are psychological processes that emerge from neurological processes. Complex systems exhibit new properties, patterns and behaviours that arise from the interactions and relationships between these components. The whole is greater than the aggregation of its constituent parts.
Ethical Naturalism	Social inquiry is inherently tied to ethical and normative questions because understanding social structures often involves addressing justice, power, and inequality issues. Critical realism advocates for ethical naturalism, where social research seeks to explain the world and informs action to improve it.
Explanatory Critique	Analysis that reveals how certain social phenomena (e.g. sub-optimal mental wellbeing, anti-school culture) are routed in structures and mechanisms that can be transformed. It involves moving beyond description to uncover underlying causes.

Epistemic Fallacy	Questions about what exists and what its properties are reduced to what we know of what exists. CR argues that it is a mistake to assume that all questions about what exists must be framed or answered in terms of what we can know or experience. Avoiding the epistemic fallacy allows science and social inquiry to aim to understand the structures and causal mechanisms of the world, not just the patterns of our knowledge or observations.
Epistemic Relativism	Knowledge is fallible and theory-laden; there is no direct access to reality. While reality exists independently of human knowledge, our understanding of it is always partial, situated, and shaped by the theories, concepts, and perspectives we use. Knowledge is socially produced, and scientific inquiry is a process of approximation toward a better understanding of the underlying structures of reality. All knowledge is subject to revision and refinement as new evidence or better theories emerge.
Four Planes of Social Being	The Four Planes enable us to understand how individuals interact within different dimensions of social reality. They provide a comprehensive framework for analysing human experience. The Material Plane refers to the physical, biological, and environmental aspects of existence. It includes the body, brain, and the material conditions shaping human experience. The Intra-Personal Plane refers to the inner world of individuals: their thoughts, emotions, beliefs, and subjective experiences. The Interpersonal Plane involves relationships, communication, and social interactions between individuals. It covers how people relate to each other. The Social Plane encompasses broader social structures, institutions, and cultural practices that shape individuals and groups. It looks at how social systems, norms, and roles influence experiences. The four planes correspond to different 'laminates' in the laminated system. No single plane fully determines social life.
Generative Mechanisms	Generative mechanisms are the underlying causal powers activated by the experiences, interpretations, and responses to interventions (or other events) by actors that can change the context. Mechanisms at lower levels can combine to create new mechanisms at higher levels. They exist independently of our knowledge and may not always be observable.
Institution	Institutions are in the actual strata; they are more concrete, observable, and easier to change than social structures. They are codified rules, norms and conventions that define relational positions and relations of power and authority and guide social practice and behaviour. They create a relatively stable set of expectations that shapes how individuals are (able) expected to act based on their roles and positions and have causal powers.
Generative Mechanisms	The generative mechanisms are the underlying causal powers activated by the experiences, interpretations, and responses to interventions (or other events) by actors that can change the context. They exist independently of our knowledge and may not always be observable. Critical realism is concerned with generative causality, unlike positivist views, which focus on regularities and observable relationships (e.g., A causes B if A and B always co-occur). It seeks to explain how and why things happen by uncovering the underlying structures and processes and explaining how they produce the observed outcomes from the intervention.

Judgmental Rationalism	The evaluation of competing explanations to identify the one that has the most credible explanation, the one that is most practically adequate.
Laminated System	The Laminated System describes how causal powers from multiple sources interact across different dimensions. The social world is understood as an open, complex, stratified system of objects that make things happen. Seven levels, from the Global to the sub-individual level, influence each other: natural material transactions, intrapsychic structures, interpersonal relationships, social structures, practices and networks, spatiotemporal contexts, and transcendental or cosmic. In the context of mental wellbeing research, it means acknowledging the distinct but interconnected biological (material transactions), psychological (intrapsychic) and social levels (interpersonal and structural).
Middle-Range Theory	Middle-range theories lie between untestable grand theory and concrete description. They are theories that can generate hypotheses that can be tested and refined through empirical research.
Morphogenic Approach	There are three primary causal powers: structure, culture, and agency. Structure and culture necessarily predate the actions that transform them. Individuals and social structures interact over time, leading to social change or the maintenance of the status quo. This dual aspect of structure and agency allows for an understanding of how society shapes agents and how agents can change structures. This approach avoids downward conflation when structure and culture are mistakenly interpreted as the outcomes of individual actions, ignoring the structural factors that influence these actions and upward conflation when it is inferred that structural change can be understood through collective behaviours without considering individual actions that contribute to these.
Non-reductionist Causality	Causal powers are the capacities of entities at different levels to bring about change. Understanding causality requires examining the interplay between different layers of reality. This approach resists simplistic cause-and-effect explanations by recognising that multiple causal powers operate at different levels (biological, psychological, and social) and often combine to produce outcomes.
Ontic Fallacy	The ontic fallacy is not recognising that our research is mediated by the limits of our knowledge and the influence of our culture and norms.
Ontological Realism	The world exists independently of our perceptions, beliefs, and theories. It has an independent reality.
Open System	A (social) system where multiple causal factors interact in complex and contingent ways and influence each other means that it is impossible to isolate variables as in laboratory conditions. The multiplicity of mechanisms other than the ones triggered by the intervention means that what happens may not necessarily be what was envisaged. Causal regularities (like those seen in natural sciences) are rare in social sciences due to the complexity and variability of social interactions and structures. Critical Realism emphasises that social and natural phenomena occur in *open systems* where multiple factors interact. This perspective avoids reductionism by acknowledging that any given phenomenon

	results from the interplay of various mechanisms and is subject to broader social, historical, and environmental conditions. Thus, a reductionist explanation that isolates a single cause (e.g., a biological factor for a social behaviour) would be considered insufficient.
Retrodiction	Involves explaining the impact of the mindfulness intervention based on an understanding of underlying structures and mechanisms using existing theories and knowledge to make sense of the outcomes. The evaluation of the outcomes of mindfulness interventions involves examining how mechanisms identified mainly by cognitive scientists and psychologists can be integrated into an interdisciplinary Critical Realist theory of how universal mindfulness interventions in schools work.
Retroduction	Inferential thinking –moving from observing patterns to hypothesising about underlying structures and mechanisms, asking what makes the observable phenomena possible and what the real must be like for these phenomena to occur.
Structures	Structures are underlying, unobservable mechanisms and forces that shape social reality, acting as enabling and constraining factors for human action, existing independently of our knowledge.
Transcendental Realism	An assumption that the objects of our investigation exist independently of human beings.
Transitive and Intransitive Dimensions	The intransitive dimension is the physical and social world we inhabit; things are as they are and are not constituted by our understanding of them and are independent of how we describe them. The transitive is the theories and discourses we hold in order to understand our world.

Statements and Declarations

Conflicts of Interest

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All authors have read and approved the article's final version and take joint ownership.

ORCID iD

- Pamela Abbott (0000-0002-5013-343X)
- Lucia D'Ambruoso (0000-0002-8505-3368)
- Rachel Shanks (0000-0002-7895-5136)
- Kibur Engdawork (0000-0002-7893-3121)
- Awoke Mihretu Sisay (0000-0002-5956-114X)

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Data Availability

No data was used to write the article.

Footnotes

[1] This approach is discussed in more detail below, how we used it for the literature review is discussed in more detail in[86], and a guide to the Critical Realist terminology we have used in this article can be found in Appendix 1.

[2] There is potentially a third meta-theory not identified by Roser et al.[56], the Neo-Aristotelian[87]. This would be the position of positive psychologists who may study the potential of SBMIs to promote pupils' flourishing (eudaemonia) and wellbeing. Such an approach would be holistic and realist, theological (for a purpose), non-dualistic, and recognise that wellbeing is multidimensional, and use mixed methods to assess the outcomes of the intervention. The main limitation is the risk of subjective interpretation of results.

[3] According to Merton middle-range sociological theories operate at an intermediate level of abstraction, sitting between grand theories (e.g., structural functionalism, Marxism, Weberian, symbolic interactionism) and specific empirical observations. They are designed to address specific phenomena or problems, providing explanations that can guide research and be tested empirically.

Middle-range theories are pragmatic and focused on specific aspects of social life, avoiding the broad generalizations of grand theories while still offering explanatory power.

[4] This is a redrawn version of the Programme theory in[1] to show more clearly how we hypothesis a SBMI works, including structural conditioning, pupils agency in response to the mindfulness triggering mechanisms that dialectically interact across the Four Planes of Social Being and the Laminated System and through emergence transform individuals and the school as an institution enabling individuals and the school community as a whole to thrive.

[5] The authors have written this table to provide definitions of critical realist terms as they understand them and as used in the article. They have been developed and refined by us and are not, as written, directly attributable to any sources. For a more detailed exposition of critical realist terminology see[88].

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