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Art-Based Interventions and Creative Problem-Solving in Anxious Children: A Scoping Review of Mechanistic Pathways

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Abstract: Anxiety is among the most prevalent mental health conditions in childhood, often impairing adaptive coping and executive functioning. Art-based interventions have attracted growing clinical interest as non-verbal therapeutic modalities that may simultaneously reduce anxious symptomatology and enhance creative problem-solving capacities. Yet the precise psychological mechanisms linking these two outcomes remain poorly mapped in the literature. This scoping review systematically surveys peer-reviewed evidence on the mechanistic pathways through which structured art-based activities influence creative problem-solving in children aged 5 to 12 years with anxiety. Three candidate pathways are examined: symbolic externalisation, which disrupts rumination by creating cognitive distance from distress; autonomic regulation, whereby creative flow promotes parasympathetic activation and restores executive bandwidth; and agency restoration, through which open-ended artistic choice-making rebuilds self-efficacy and transfers to problem-solving contexts. Consistent with Arksey and O'Malley's framework, studies were eligible if they involved children aged 5 to 12 with clinically elevated or diagnosed anxiety, reported a structured art-based intervention, and measured problem-solving, cognitive flexibility, or related outcomes. Evidence from randomised controlled trials, controlled studies, and meta-analyses broadly supports each pathway, though mechanistic isolation remains rare. This review identifies critical gaps, including the absence of developmental-stage stratification, minimal longitudinal follow-up, and a lack of dismantling designs that test individual mechanisms. Recommendations for future research and clinical implementation are discussed.

Keywords: Art therapy; childhood anxiety; creative problem-solving; externalisation; executive function; autonomic regulation; agency; scoping review

I. INTRODUCTION

Anxiety disorders represent the most common category of psychopathology in childhood, with prevalence estimates ranging from 6.5% to 20% across community samples [1]. Beyond subjective distress, pediatric anxiety exerts measurable costs on executive functioning, cognitive flexibility, and adaptive coping, collectively constraining a child's capacity for creative problem-solving [2]. Because anxious cognition preferentially allocates attentional resources to threat-related stimuli, children with high trait anxiety show documented deficits in divergent thinking, tolerance of ambiguity, and generative ideation, all of which are core components of creative problem-solving [3].

Art-based interventions, encompassing drawing therapy, expressive painting, clay modelling, and structured visual projects, have gained clinical traction as low-barrier, developmentally appropriate modalities for addressing internalising symptoms in paediatric populations [4]. Unlike verbal therapies that depend on children's capacity to articulate complex internal states, art-based activities provide a non-verbal channel through which emotional content can be externalised and symbolically processed [5]. The medium thereby circumvents developmental constraints in emotional language while creating a contained space for experimentation, failure tolerance, and generative exploration [6].

Despite a growing empirical base, the field has not yet systematically mapped the psychological mechanisms through which art-based activity produces gains in creative problem-solving specifically among anxious children. Most existing reviews aggregate outcomes across diverse clinical populations or conflate problem-solving with broader cognitive functioning [7]. Crucially, the question of whether anxiety relief and problem-solving improvement are driven by the same features of an art intervention, or by separable mechanistic pathways, has not been addressed. The present scoping review addresses this gap by charting the available evidence around three theoretically grounded candidate mechanisms: symbolic externalisation, autonomic regulation, and agency restoration.

A scoping review design, following Arksey and O'Malley's framework as updated by Levac and colleagues, was selected because the primary aim is to map the terrain of a nascent literature rather than to synthesise effect estimates [8]. The review asks: what mechanistic pathways have been proposed or empirically tested to explain how art-based interventions influence creative problem-solving in anxious children aged 5 to 12?

II. BACKGROUND

A. *Childhood Anxiety and Executive Constraints*

Anxiety in children is characterised by hypervigilance to threat cues, elevated physiological arousal, and attentional bias toward danger-relevant stimuli [2]. These features impose a heavy load on working memory and inhibitory control, the same executive resources that underpin flexible, generative thinking [3]. Children meeting criteria for separation anxiety disorder, generalised anxiety disorder, or social anxiety disorder consistently perform below age-matched peers on measures of divergent thinking and problem-solving inventories [9]. The relationship appears bidirectional: impaired problem-solving reduces children's confidence in managing novel challenges, which in turn amplifies anxious responding and avoidance [10].

B. *Art-Based Intervention Modalities*

The term art-based intervention encompasses a heterogeneous family of structured activities that employ visual and material media as primary therapeutic or educational tools [4]. School-based art therapy typically involves sessions led by a trained therapist targeting identified pupils with behavioural or emotional difficulties. Drawing therapy protocols assign specific thematic tasks, such as depicting a feared situation or an imagined resolution, to guide symbolic processing. Open-ended project activities, such as community gallery programmes and classroom arts flow sessions, prioritise process over product and explicitly encourage experimentation [11].

Digital media and tele-art protocols, including directed mandala drawing and Zentangle practices, extend access to hospitalized or geographically constrained populations [12].

C. *Theoretical Frameworks*

Three theoretical constructs organise existing mechanistic proposals in the literature. First, symbolic externalisation, rooted in psychodynamic and expressive therapy traditions, holds that the act of representing an internal emotional state through a material medium creates cognitive distance from the threat appraisal, disrupts ruminative cycles, and re-engages reflective processing [5]. Second, autonomic regulation theory, drawing on stress-inoculation and attentional restoration frameworks, proposes that immersive creative engagement elicits parasympathetic activation and a focused flow state, which reduces physiological arousal and thereby restores the executive bandwidth necessary for divergent thinking [13]. Third, agency restoration theory, grounded in self-determination and self-efficacy models, posits that the open-ended decision-making inherent in artistic creation rebuilds a sense of perceived control that generalises to problem-solving contexts [6].

III. METHODS

A. *Scoping Review Framework*

This review follows the five-stage framework proposed by Arksey and O'Malley and refined by Levac et al. [8]. The stages are: (1) identifying the research question; (2) identifying relevant studies; (3) study selection; (4) charting the data; and (5) collating, summarising, and reporting results. Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines were observed where applicable [14].

B. *Eligibility Criteria*

Studies were eligible if they: (a) involved children aged 5 to 12 years with clinically elevated anxiety scores on a validated instrument or a diagnosed anxiety disorder; (b) described a structured, facilitated art-based intervention using visual or material media; (c) reported an outcome pertaining to creative problem-solving, cognitive flexibility, divergent thinking, or a closely related construct; and (d) were published in a peer-reviewed journal in English between 2015 and 2025. Case reports, opinion pieces, and editorials were excluded. Studies addressing only passive art exposure (museum visits without structured activity) were also excluded.

C. Search Strategy

Electronic searches were conducted in PubMed, PsycINFO, CINAHL, ERIC, and the Cochrane Library. Search terms combined MeSH headings and free-text keywords across three concept clusters: (1) art-based intervention ("art therapy", "drawing therapy", "expressive arts", "creative activity"); (2) childhood anxiety ("anxiety disorder", "separation anxiety", "school anxiety", "pediatric anxiety"); and (3) problem-solving or cognitive outcomes ("problem solving", "cognitive flexibility", "divergent thinking", "executive function", "creative thinking"). Reference lists of included studies and relevant systematic reviews were hand-searched for additional sources.

D. Data Charting

Data were extracted independently by two reviewers using a standardised charting form capturing: author(s) and year; country; study design; sample characteristics (age, diagnosis, N); intervention type, duration, and frequency; outcome measures employed; primary findings; and proposed or tested mechanism. Discrepancies were resolved by discussion. Extracted data were then inductively grouped by mechanistic pathway to enable narrative synthesis.

IV. RESULTS

A. Overview of Included Evidence

The search yielded evidence from randomised controlled trials, controlled pre-post studies, meta-analyses, and prospective cohort studies spanning school-based, clinical, and community settings. Sample sizes ranged from N = 30 in single-site controlled trials to pooled cohorts of several hundred in meta-analytic work. Age ranges spanned the target window of 5 to 12 years, with some studies extending slightly into early adolescence. Media employed included drawing, painting, sculpture, clay work, mandala and Zentangle structured drawing, digital art tools, and multi-modal expressive protocols combining visual, movement, and narrative elements.

B. Pathway 1: Symbolic Externalisation

Symbolic externalisation is the most frequently invoked mechanism in the reviewed literature. The core claim is that rendering an internal emotional state as a visual object creates representational distance, enabling the child to observe and reflect on a previously overwhelming experience rather than being consumed by it [5]. Bosgraaf and colleagues describe this process as disrupting ruminative distress cycles by re-engaging evaluative cognition, with the physical artwork serving as a stable external anchor for otherwise fluid internal states [15].

Kavoussi and colleagues provide the most direct empirical test to date of this pathway's effect on problem-solving [16]. In their controlled study of 30 girls diagnosed with separation anxiety disorder, a structured drawing therapy protocol produced significantly higher posttest scores on the Heppner and Petersen Problem-Solving Inventory relative to a non-intervention control group. The effect was accompanied by gains in self-concept and interpersonal adjustment, suggesting that the externalisation process supports a broader reorganisation of self-related cognition rather than a narrow skill transfer.

Moula's systematic review of school-based art therapy similarly identifies externalisation as a primary mechanism, noting that the symbolic representation of anxiety-related content allows children to approach feared scenarios with greater cognitive flexibility and generative exploration [4]. However, Moula also flags a methodological limitation that recurs across this literature strand: few studies include process measures that track the externalisation mechanism in real time, relying instead on pre-post outcome differences to infer its operation.

C. Pathway 2: Autonomic Regulation

The second pathway proposes that sustained engagement in creative activity induces a focused flow state characterised by reduced cortical arousal, attentional narrowing on the task, and parasympathetic dominance [13]. This autonomic shift is theorised to clear the executive bandwidth ordinarily consumed by anxious hypervigilance, thereby freeing resources for divergent and generative cognition.

Cheour and colleagues provide the most direct support for this mechanism in a primary school cohort, reporting that arts flow activities produced measurable gains in self-regulation and reduced classroom stress indicators, with the authors attributing these effects to the attentional absorption characteristic of flow states [17]. Veraksa and colleagues independently observed that baseline executive functioning moderated response to art-based project activity in a preschool sample (N = 36), suggesting that the autonomic regulation pathway may be particularly potent for children with sufficient initial executive capacity to enter and sustain a flow state [18].

Tele-art protocols employing structured repetitive drawing tasks, specifically Zentangle and mandala completion, have demonstrated significant reductions in state anxiety and improvements in attentional control in paediatric samples facing chronic illness or pandemic-related stress [12]. The repetitive, rhythmic nature of these tasks is consistent with autonomic regulation theory: the predictable motor engagement reduces sensory unpredictability and supports physiological settling. Notably, these studies measure attention and distress tolerance as proximal outcomes, and infer problem-solving capacity gains rather than measuring them directly.

D. Pathway 3: Agency Restoration

Agency restoration theory holds that the open-ended decision-making structure of art-based activities, wherein no single correct outcome exists, allows children to experience and internalise a sense of volitional control [6]. For anxious children, who characteristically exhibit elevated external locus of control and low perceived self-efficacy, repeated experiences of autonomous creative choice may generalise to broader problem-solving contexts by rebuilding confidence in one's capacity to generate and evaluate solutions.

Zhang and colleagues' multi-centre meta-analysis, pooling six randomised controlled trials and reporting a significant reduction in pediatric anxiety symptoms (SMD = -1.42, 95% CI [-2.33, -0.51]), identifies autonomy-supportive features of interventions as moderators of effect size [7]. Programmes that provided explicit choice in media, theme, and process produced larger anxiety reductions than those with prescriptive protocols, consistent with the hypothesis that agency is a therapeutically active ingredient.

MacDonald's evaluation of the Culture Dose for Kids community gallery programme provides qualitative corroboration, documenting that non-prescriptive open-ended creative projects mitigated fear of mistakes and bolstered resilience and willingness to experiment in anxious children [11]. Malboeuf-Hurtubise and colleagues similarly report that tele-art protocols that preserved participant choice in visual output produced stronger gains in distress tolerance than more structured directive protocols, though the sample was clinically mixed rather than restricted to anxiety diagnoses [12].

E. Methodological Limitations in the Existing Literature

Across all three mechanistic pathways, several recurrent methodological limitations constrain interpretive confidence. First, sample sizes in individual studies are predominantly small, with most falling below $N = 50$, limiting statistical power and generalisability [4]. Second, the literature exhibits high heterogeneity in intervention dosage, ranging from single sessions to 12-week programmes, making cross-study comparison difficult [7]. Third, longitudinal maintenance data beyond immediate post-treatment assessment are rare; no study in the reviewed corpus tracked problem-solving outcomes beyond six months post-intervention [15]. Fourth, and most critically for the mechanistic focus of this review, no study employs a dismantling design that isolates individual pathway contributions by systematically varying the externalisation, autonomic, or agency components of an otherwise identical intervention [4].

V. DISCUSSION

A. Synthesis of Mechanistic Evidence

The three candidate pathways, symbolic externalisation, autonomic regulation, and agency restoration, are not mutually exclusive. A plausible integrative account holds that a well-designed art-based intervention activates all three in sequence or in parallel: the act of representing a feared internal state (externalisation) initiates cognitive distance; the sustained engagement required to complete the work promotes flow and physiological settling (autonomic regulation); and the open-ended decision structure throughout the session reinforces perceived control (agency restoration). However, the present corpus does not permit empirical adjudication of this integrative model. Each pathway has been supported by at least one direct study and several indirect indicators, but none has been experimentally isolated.

B. Developmental Stratification

A conspicuous absence in the reviewed literature is stratification by developmental stage within the 5 to 12 age range. The symbolic and linguistic demands of externalisation may differ substantially between a 5-year-old with limited metacognitive capacity and a 10-year-old with developed theory of mind and emotional vocabulary. Similarly, the flow threshold for autonomic regulation may be lower in younger children due to shorter attentional spans, and agency restoration may carry greater salience in middle childhood when autonomy needs intensify per self-determination theory. Future research should test pathway-specific hypotheses within, rather than across, developmental stages.

C. Implications for Clinical Practice

Despite mechanistic uncertainty, the convergent evidence supports several practical recommendations for clinicians and educators. First, interventions that preserve participant choice in media and process are likely to engage the agency restoration pathway and should be preferred over wholly prescriptive protocols for anxious children. Second, session lengths sufficient to support attentional absorption (generally 45 minutes or more) are more likely to engage the autonomic regulation pathway than brief structured tasks. Third, clinicians can explicitly harness the externalisation pathway by inviting children to represent the source of their worry before transitioning to a resolution-focused creative phase, mirroring the structure observed in effective drawing therapy protocols [16]. Incorporating validated problem-solving measures alongside anxiety symptom scales as routine outcomes would also accelerate the evidence base.

VI. CONCLUSIONS

This scoping review maps three mechanistic pathways through which art-based interventions may enhance creative problem-solving in anxious children: symbolic externalisation, autonomic regulation, and agency restoration. Controlled trials, meta-analyses, and prospective studies provide convergent, if indirect, support for each pathway. The evidence is strongest for externalisation as the pathway most directly tied to problem-solving outcomes, with Kavoussi et al.'s controlled trial offering the clearest empirical footprint. Autonomic and agency pathways are well-supported for anxiety reduction but require outcome measures closer to creative problem-solving to confirm their contributions.

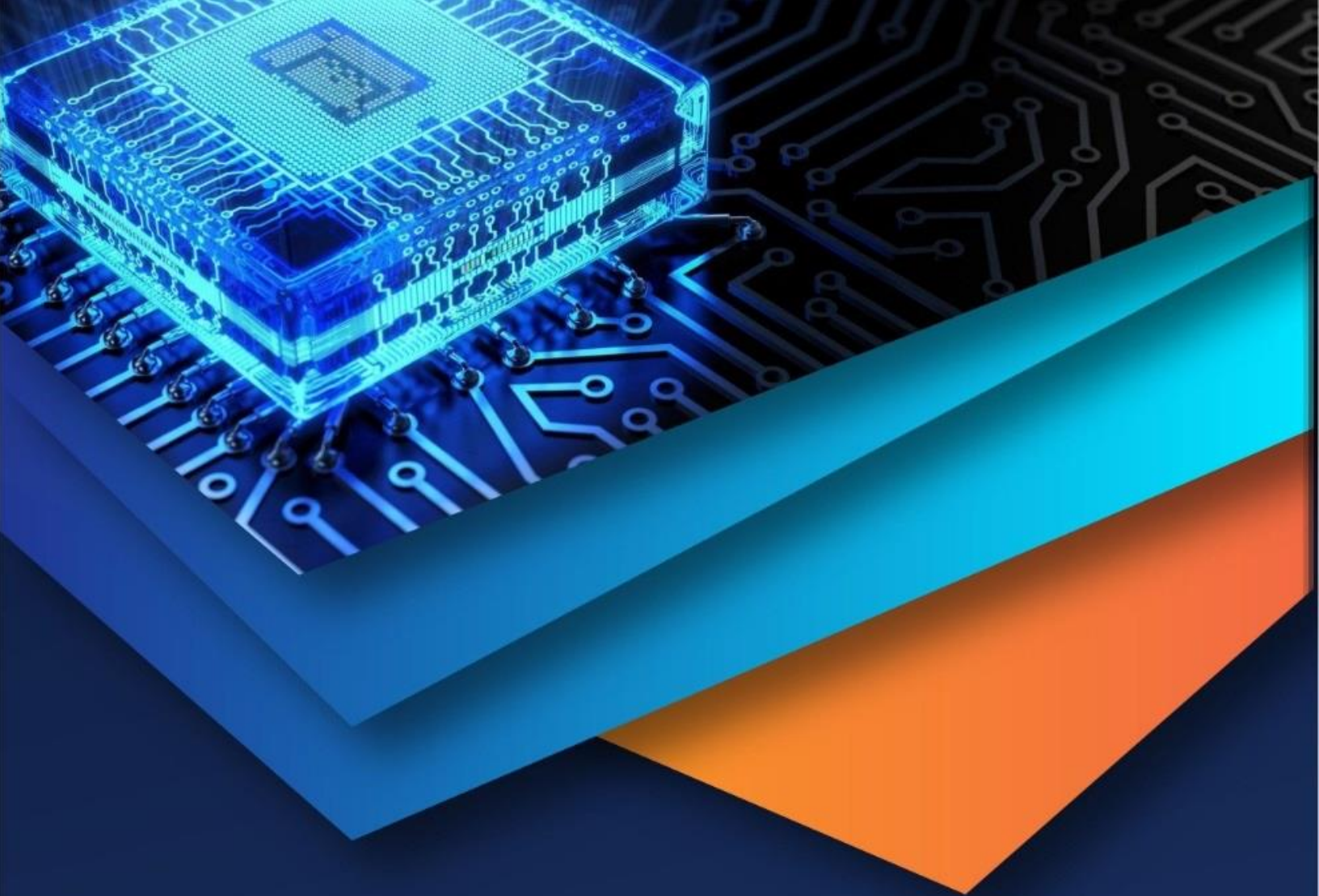
The field requires dismantling designs, developmental stratification, and longitudinal follow-up to move from mechanistic mapping to mechanistic confirmation. Until such evidence accumulates, clinicians are encouraged to design interventions that engage all three pathways simultaneously: through representational thematic tasks (externalisation), sustained immersive sessions (autonomic regulation), and open-ended media choice (agency restoration). The present review provides a structured framework and an explicit research agenda to guide that next generation of empirical work.

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