Intervention towards Disruptive Behavior among ADHD Students: A Systematic Literature Review

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ABSTRACT

Attention Deficit Hyperactivity Disorder (ADHD) is a widely recognized neurodevelopmental disorder characterized by difficulties in attention regulation, hyperactivity, and impulsivity traits that often lead to disruptive behavior (DB) in educational settings. This Systematic Literature Review (SLR) synthesizes recent empirical evidence (2020–2024) on non-pharmaceutical interventions aimed at managing disruptive behaviors among students with ADHD. Drawing from seven selected studies, the review identifies three major thematic domains: (i) intervention efficacy and implementation strategies in school settings, (ii) teacher training and fidelity in behavioral intervention delivery, and (iii) psychosocial and multimodal approaches involving families and community support. Effective strategies identified include self-monitoring tools, executive functioning (EF) training, and parent-teen skill-building models. Teacher centred programs such as PBMIR and technology-enhanced interventions like CLS-R-FUERTE further demonstrate the role of structured support in improving behavior and learning outcomes. The findings highlight the importance of holistic, scalable, and context-sensitive interventions that integrate behavioral, cognitive, and relational components. Limitations in existing studies and the small number of eligible articles signal the need for further large-scale, longitudinal research. This review offers practical insights for educators, clinicians, and policymakers aiming to support ADHD students through collaborative, evidence-based practices.

Keywords: ADHD, disruptive behavior, non-pharmaceutical intervention, teacher training

INTRODUCTION

Attention Deficit Hyperactivity Disorder (ADHD) is a developmental disorder that affects how people pay attention, control their impulses, and manage hyperactivity. These symptoms can lead to challenges in school, social settings, and work, making it difficult for individuals to function effectively in daily life (American Psychiatric Association, 2022). Among children with ADHD, disruptive behaviors such as aggression, non-compliance, and excessive verbal or physical impulsivity are commonly observed, further exacerbating difficulties in educational settings (Ngo, 2020; Peak et al., 2023). These behaviors pose substantial challenges not only for students with ADHD but also for educators, creating barriers to effective learning and classroom management (DuPaul et al., 2019).

In recent decades, various interventions have been introduced to address the disruptive behaviors associated with ADHD, including pharmacological treatments and behavioral interventions (Mechler et al., 2022; Stein, 2023). Among the non-pharmacological approaches, physical activity-based interventions such as stretching exercises have emerged as a promising avenue to manage ADHD symptoms and improve student behavior. Stretching, often integrated into broader physical activity routines, is believed to enhance self-regulation, reduce hyperactivity, and promote emotional regulation, which may ultimately alleviate disruptive behaviors (Shepherd, 2023; VanArnhem, 2024).

Despite the growing interest in stretching interventions, systematic reviews that synthesize evidence specifically examining their effectiveness in managing disruptive behaviors among ADHD students remain scarce. Among the diverse non-pharmacological approaches explored in the literature, physical activity including stretching has been examined as a complementary strategy to manage ADHD symptoms. However, this review broadly examines behavioral and psychosocial interventions, which have demonstrated wider empirical support in recent years. Studies focusing on this intervention modality often provide conflicting results, highlighting the need for a comprehensive understanding of the potential benefits and limitations of various approaches in this context (Zhang et al., 2022; Liu et al., 2024). Therefore, this systematic review aims to assess the efficacy of stretching interventions in reducing disruptive behavior in students with ADHD by evaluating recent empirical evidence and identifying critical gaps in the literature.

The increasing prevalence of ADHD globally, coupled with the educational challenges faced by students with this disorder, underscores the urgency of identifying effective, accessible interventions. While pharmacological treatments remain a first-line approach, non-pharmacological strategies, such as sports or stretching, offer a promising complementary option that aligns with current trends emphasizing holistic, non-invasive interventions (Mohd Arshad Yahya & Mohd Firdaus Abdullah, 2020; Sharma et al., 2023). This review, which examines studies published over the last five years, aims to provide updated insights into the potential of stretching as a therapeutic intervention for ADHD-related disruptive behavior.

By integrating the latest evidence, this review aims to guide future research and provide practical recommendations for educators and clinicians working with students with ADHD. Ultimately, the goal is to provide a clearer understanding of how stretching can be utilized as a viable intervention to support students with ADHD in managing disruptive behaviors and enhancing their overall well-being in educational settings.

LITERATURE REVIEW

Behavioral challenges in the classroom can significantly impact the academic engagement and learning progress of students diagnosed with ADHD. To address these challenges, the Caught Being Good Game (CBGG) has been introduced as an evidence-based intervention designed to reinforce positive behavior within a structured learning environment. This study examines the efficacy of CBGG in enhancing Academically Engaged Behavior (AEB) and mitigating Disruptive Behaviors (DB) among students with ADHD. A multiple-baseline design was employed across three elementary classrooms to evaluate the effectiveness of the intervention systematically. The results revealed a significant improvement in AEB among all participants following the implementation of CBGG, alongside a substantial reduction in DB. These findings suggest that integrating CBGG into classroom management strategies may be a practical approach to minimizing behavioural disruptions, thereby optimizing instructional time and enhancing overall student engagement (Alkahtani, 2024).

Children with ADHD and Oppositional Defiant Disorder (ODD) face significant academic and behavioral challenges, necessitating evidence-based school interventions. Hanisch et al. (2020) developed the Coaching for Elementary School Teachers of Children with Attention Deficits or Disruptive Behavior Problems (SCEP), integrating functional behavior assessment into a structured, modular training model. Teachers received a one-day workshop, followed by biweekly coaching sessions, to enhance their behavioral management strategies. A within-subject control design (N = 60) demonstrated SCEP's effectiveness in reducing disruptive behaviors (d = 0.42–0.6) and increasing teachers' use of praise and confidence (d = 0.58). These findings underscore the value of individualized, functionally based interventions within multi-tiered behavioral support systems.

Teacher-led behavioral interventions effectively support students with ADHD and disruptive behaviors, yet consistent implementation remains a challenge. This study pilots the Positive Behavior Management Implementation Resources (PBMIR), a theory-driven support package designed to enhance teacher adherence to behavioral strategies. Using a two-group randomized controlled trial, the study compares teachers who receive PBMIR with those who do not, assessing fidelity, student outcomes (including ADHD symptoms, impairment, student-teacher relationships, and academic performance), and teacher perceptions of PBMIR's feasibility. If effective, PBMIR could inform the development of scalable interventions to improve ADHD management in school settings (Lawson et al., 2023). Separately, McKenna et al. (2023) evaluated the use of

Self-Monitoring (SM) in conjunction with Goal-Setting (GS) to reduce disruptive behaviors among five elementary school students with ADHD, employing a multiple-baseline design. Results indicated that SM-GS was more effective than SM alone, with sustained behavioral improvements following the intervention. Teachers moderately endorsed the intervention for classroom use, suggesting its potential as a structured behavioral management tool.

On the other hand, Haack et al. (2024) assessed the CLS-R-FUERTE program's effectiveness in digitally enhancing ADHD and ODD interventions through a school-clustered RCT across eight public schools in Mexico (N = 163; students aged 6–12, parents, teachers, clinicians). The six-week intervention integrated clinician training, student-parent skills sessions, teacher support via Daily Report Cards (DRCs), and digital resources. Results showed significant symptom reductions, improved adaptive functioning, high fidelity, and intense user satisfaction, underscoring the scalability of digital mental health interventions. Harrison et al. (2022) critiqued conventional ADHD accommodations (such as breaks, prompting, and sensory strategies) for lacking essential self-management components that foster independence. Their study (N = 15) compared four intervention strategies, finding that prompting and self-management improved engagement and reduced disruptive behavior, despite student preference for passive accommodations. These findings underscore the importance of autonomy-focused interventions. Alternatively, Holdaway et al. (2020) examined the month-to-month effectiveness of the DRC in 37 student-teacher dyads (K–5). While initial improvements in behavior and academics were observed, gains plateaued over time. Emerging trends suggest that teacher consistency in enforcing rules serves as a moderating factor, underscoring the importance of fidelity in implementing behavioral interventions.

Correspondingly, Labrador-Roca et al. (2020) examined the impact of Physical Education (PE) teachers' interventions on students with ADHD, analyzing 681 behavioral incidents and 397 interventions across 42 lessons. While Behavior Modification Techniques (BMT) like praise effectively reinforced positive behavior, direct instructions, expulsion, and punishment were also used to manage disruptive behavior. Despite 68% of behaviors changing post-intervention, all strategies showed similar effects on undesirable behaviors, suggesting a need for refined, evidence-based approaches in PE settings.

Kuklinski et al. (2023) evaluated the cost-effectiveness of First Step Next (FSN) versus FSN combined with Home-Based (HB) for addressing disruptive behaviors. Using cost-effectiveness ratios, they found FSN + HB to be a more viable investment, particularly for students with comorbid ADHD and Conduct Disorder (CD). Sensitivity analyses reinforced its economic advantage, advocating for integrated school-home interventions as a sustainable solution for behavioral management. However, the study highlights the financial burden of supporting students with dual diagnoses, emphasizing the need for strategic allocation of resources in educational settings.

RESEARCH OBJECTIVES

This systematic review aims to:

1. Examine the effectiveness of non-pharmaceutical interventions in reducing disruptive behaviors among students with ADHD.
2. Evaluate how different types of non-pharmaceuticals impact students' behavior and academic performance.
3. Identify key factors that influence the success of non-pharmaceutical interventions in educational settings.
4. Assess the implementation challenges and facilitators of non-pharmaceutical interventions in schools.

Research Questions:

1. How effective are non-pharmaceutical interventions in managing disruptive behaviors among ADHD students?
2. What types of non-pharmaceutical interventions show the most promise for ADHD behavior management?
3. What are the key implementation factors that affect the success of non-pharmaceutical interventions?

MATERIAL AND METHODS

A. Preliminary Identification

The systematic review process began with a thorough three-phase approach to identify relevant studies. Initially, a comprehensive set of keywords was developed, drawing on multiple authoritative sources, including thesauri, dictionaries, encyclopaedias, and existing research literature. These carefully chosen keywords were systematically combined into precise search strings, which were then applied to two major academic databases: Scopus and Web of Science (as detailed in Table 2). This initial search yielded a preliminary dataset of 127 papers across both databases. This structured approach ensured a comprehensive and rigorous capture of relevant literature during the identification phase of the review process.

Table 1 the Search Strings

Scopus	TITLE-ABS-KEY ('intervention' AND 'disruptive AND behaviour' AND 'adhd' AND 'student') AND PUBYEAR > 2019 AND PUBYEAR < 2025 AND (LIMIT-TO (SUBJAREA , "PSYC") OR LIMIT-TO (SUBJAREA , "SOCI") OR LIMIT-TO (SUBJAREA , "MEDI") OR LIMIT-TO (SUBJAREA , "HEAL")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (OA , "all")) Search at: 11 Nov 2024
Wos	https://www.webofscience.com/wos/woscc/summary/1df5fdce-8087-4e9e-886f-ff679f75f687-012458a4c3/relevance/1 Search at: 11 Nov 2024

B. Screening

During the screening phase of the Systematic Literature Review (SLR), research items were evaluated for alignment with the predefined research questions, with a focus on interventions for disruptive behavior in students with ADHD. Duplicate publications were removed, and studies were screened according to the inclusion and exclusion criteria. In the initial screening, 112 publications were excluded, followed by a detailed evaluation of 15 papers (see Table 2). Peer-reviewed research articles were prioritized for their practical recommendations and insights. At the same time, book chapters, conference proceedings, and in-press publications were excluded. The review considered only English-language articles published between 2020 and 2024. Ultimately, six publications were removed due to duplication.

C. Eligibility

In the eligibility phase, nine articles were selected and thoroughly reviewed to ensure alignment with the study's research aims and inclusion criteria. Titles and key content were examined to confirm their relevance. Note that two reports were excluded as they lacked empirical evidence of intervention, leaving seven articles for final review (see Table 2).

Although a total of 127 articles were initially identified, only seven met the stringent inclusion criteria of being empirical, peer-reviewed studies that examined specific non-pharmaceutical interventions for disruptive behavior among ADHD students. This narrow scope ensures a focus on evidence-based strategies while highlighting the need for further empirical research in this area.

Table 2 the Selection Criterion is Searching

Parameter	**Accepted**	**Omitted**
Linguistic Medium	English	Non-English
Publication Period	2020–2024	< 2020
Source Type	Journal (Article)	Conference, Book, Review
Completion Status	Final	In Press

Subject Area	Psychology, Social Sciences, Health Professions.	Besides Psychology, Social Sciences, Health Professions.
Country	All countries	-

D. Data Compilation and Interpretation

This study employed an integrative analysis to assess and synthesize various research designs, including quantitative, qualitative, and mixed-methods approaches, in order to identify core themes and their corresponding subthemes. Thematic development began with data collection, followed by a systematic review of seven selected studies. Key assertions and relevant content were extracted to analyze intervention strategies for managing disruptive behavior in students with ADHD. Methodologies and findings were critically examined, and thematic patterns were collaboratively refined. Subsequently, a structured log was maintained throughout the interpretation process to ensure consistency, with any discrepancies addressed through discussion, resulting in a well-defined thematic framework.

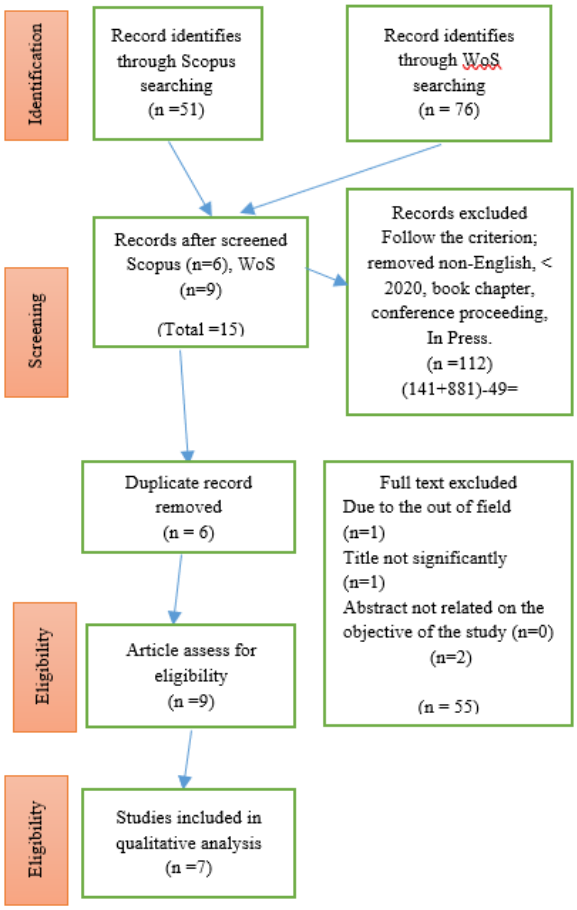

Fig. 1. Example of an image with acceptable resolution Flow Diagram of the Proposed Searching Study (Moher D, Liberati A, Tetzlaff J, 2009)

E. Data Analysis Procedure

An integrative thematic analysis was conducted to synthesize findings across studies. The process involved several key steps to ensure transparency and rigor in theme development:

- **Data Extraction**: Key information from each study such as intervention type, participant characteristics, research design, outcome measures, and reported limitations was extracted using a standardized matrix.
- **Initial Coding**: Two independent reviewers conducted open coding of extracted data, focusing on intervention strategies, implementation methods, and outcome patterns. Codes were assigned inductively based on recurring elements identified within and across studies.

- **Theme Development**: The initial codes were organized into categories and clustered into broader themes. These themes reflected conceptual groupings such as intervention efficacy, teacher implementation, and psychosocial approaches.
- **Consensus Building**: To enhance the reliability of the thematic framework, discrepancies in coding and theme interpretation were resolved through consensus meetings among the reviewers. This iterative process ensured consistency and analytical depth.

This approach enabled a structured synthesis of diverse methodological designs including quantitative, qualitative, and mixed-method studies and allowed for the emergence of nuanced insights across educational and behavioral intervention research for students with ADHD.

OUTCOMES AND INSIGHTS

Disruptive behavior refers to actions that disrupt social environments, learning processes, or daily routines, and it is often associated with students diagnosed with ADHD. Individuals with ADHD tend to exhibit behaviors such as impulsivity, difficulty focusing, and challenges in regulating emotions, which can lead to disturbances for themselves and others. These behaviors typically stem from difficulties in managing executive functions, such as planning and behavioral control, which are core characteristics of ADHD. In this study, a total of seven articles were selected and analyzed through advanced search methods. These three themes were identified.

Theme 1: Intervention Efficacy and Strategies for ADHD in Educational Settings

ADHD is considered a commonly diagnosed neuropsychiatric disorder in childhood. Typically, ADHD is one of the most commonly diagnosed neuropsychiatric disorders in childhood, with student behavior in classrooms being significantly influenced by teacher interventions. Labrador-Roca et al. (2020) examined the impact of educational interventions in PE settings, analyzing 681 behavioral incidents and 397 teacher interventions across 42 sessions involving six PE teachers and six students with ADHD (aged 8–12 years). Their findings categorized ADHD-related behaviors into three desirable (social skills, emotional regulation, and peer/teacher-related interactions) and four undesirable behaviors (hyperactivity, impulsivity, attention deficit, and disruptive behaviors, such as disobedience, tantrums, and boredom). Teachers predominantly employed BMT, such as praise and attention, to reinforce positive behaviors. At the same time, direct verbal instructions, expulsion, and punishment were used to address and mitigate negative behaviors. The study reported that 68% of behaviors changed after the intervention, whereas 32% persisted. However, the study's reliance on observational data without controlling for external variables (e.g., student temperament, classroom environment) limits its generalizability. Additionally, while BMT was effective in reinforcing positive behaviors, its limited efficacy in reducing negative behaviors raises concerns about the sustainability of such interventions in real-world classroom settings.

In contrast, Chu et al. (2022) investigated the effectiveness of a non-pharmaceutical intervention, Group Executive Functioning and Online Parent Training (GEF-OPT), in reducing ADHD symptoms among children in China. Conducted as a randomized controlled trial with 145 children (aged 6–8), the study compared an intervention group (n = 73) with a waitlist control group (n = 72) the eight-session program integrated hospital-based Executive Function (EF) training with an online parent-training component. Post-intervention, children in the treatment group exhibited significant improvements in inattentive symptoms. Nonetheless, hyperactivity-impulsivity remained essentially unchanged. Notably, symptoms of ODD were significantly reduced, along with improvements in the Behavioral Regulation Index (inhibition and emotional control) and the Metacognition Index (working memory, planning, and monitoring). Functional impairments related to learning and parental distress also decreased, as corroborated by go/no-go task results, which indicated enhanced response accuracy and reaction time. While the study provides compelling evidence for the benefits of GEF-OPT, its limited intervention duration raises questions about the long-term efficacy of this approach. Furthermore, improvements in parental distress suggest a potential confounding factor—whether behavioral improvements stemmed from child-focused interventions or changes in parental management strategies. A more extended follow-up period would be crucial to assess the sustainability of these outcomes.

Sluiter et al. (2020) investigated a self-monitoring intervention as a means of reducing off-task behavior and enhancing cognitive function in children with ADHD. Seven male students (aged 9–12) in special education

settings used an interval timer during math lessons as a reminder to self-assess their attentiveness. Observational data revealed a significant reduction in off-task behavior from 46.8% to 27.3% ($\eta^2p = .83$), corroborated by teacher ratings ($\eta^2p = .69$). Improvements in inhibition (Cohen's d = 2.62, 1.24) were also noted. While these findings align with prior research on self-regulation, the small sample size and lack of a control group limit the study's broader applicability. Additionally, the study does not account for potential novelty effects, in which improvements may stem from temporary motivation rather than lasting behavioral change. Future studies with larger, randomized samples and blinded assessments are needed to determine the true efficacy of self-monitoring interventions.

Collectively, these studies highlight the multifaceted nature of ADHD interventions, underscoring both the potential and the limitations of educational and non-pharmaceutical strategies. While BMT appears effective in reinforcing positive behaviors, its inconsistent impact on negative behaviors suggests the need for complementary approaches to address these behaviors effectively. Meanwhile, structured EF training, combined with parental involvement, shows promise, but its long-term effectiveness remains uncertain. Self-monitoring techniques demonstrate clear benefits for attentional control. However, their scalability and sustained impact require further investigation. Moving forward, ADHD intervention research must integrate longitudinal assessments, control for confounding variables, and explore multimodal approaches to maximize educational and behavioral outcomes for students affected by ADHD.

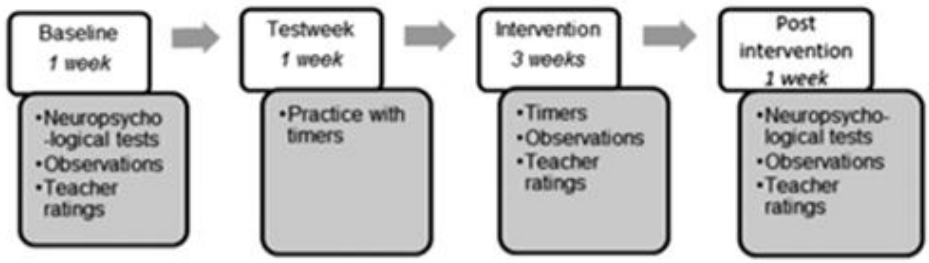

Fig. 2 Procedure for every week during the study

Studies on the neuropsychological effects of self-monitoring interventions for ADHD in schools typically follow a structured, multi-week approach. A baseline phase establishes initial measures through neuropsychological tests, observations, and teacher ratings. This is followed by a familiarization phase, during which participants practice using timers. The core intervention spans three weeks, integrating self-monitoring with continuous behavioral assessments. A post-intervention phase then evaluates its effectiveness through follow-up testing and observations. This systematic approach highlights the potential of self-monitoring in managing ADHD symptoms within educational settings.

Table 3 Matrix of Literature for Theme 1

Title	Objective	Methodology	Key Findings	Conclusions
The effects of educational intervention on the behaviour of students with ADHD (Labrador-Roca et al., 2020)	To analyze the effect of educational interventions by teachers on the behaviour of students with ADHD in a Physical Education (PE) setting.	Observed six PE teachers and six students with ADHD for 42 classes; analyzed 681 behavioural conducts and 397 interventions.	Desirable behaviours increased (e.g., social skills, emotional control). Teachers used BMT, such as praise, to increase positive behaviours. Desirable behaviours were modified in 68% of cases, while undesirable behaviours (hyperactivity, impulsivity) persisted or were reduced.	The use of BMT can effectively improve desirable behaviours in ADHD students. However, it may be less effective for reducing undesirable behaviours. Future research should refine intervention strategies.

Title	Objective	Methodology	Key Findings	Conclusions
Effects of Combining Group Executive Functioning and Online Parent Training on School-Aged Children With ADHD: A Randomized Controlled Trial (Chu et al., 2022)	To evaluate the clinical benefits of a non-pharmaceutical intervention combining group executive function training and online parent training for ADHD children.	Randomized controlled trial with 145 children aged 6-8; intervention group received eight sessions of EF training and parent training.	Significant improvement in inattentive symptoms and executive function (e.g., inhibition, working memory) in the intervention group. Reduction in comorbid ODD and improvements in learning and parental distress.	GEF-OPT is a promising non-pharmaceutical intervention that shows improvements in ADHD symptoms and executive functions.
Exploring neuropsychological effects of a self-monitoring intervention for ADHD-symptoms in school (Sluiter et al., 2020)	To explore whether a self-monitoring intervention (using an interval timer) can reduce off-task behaviour and improve cognitive performance in children with ADHD symptoms.	Seven boys (9-12 years old) in special needs education used an interval timer to monitor on-task behaviour during math classes. Observations, teacher ratings, and neuropsychological tests were used for assessment.	Off-task behaviour was significantly reduced (from 46.8% to 27.3%)— improvements in cognitive functions, particularly inhibition, were observed (with large effect sizes). Teachers and students positively evaluated the intervention.	Self-monitoring interventions can be effective in reducing off-task behaviour and improving cognitive skills, particularly inhibition, in children with ADHD.

Theme 2: Teacher Support and Implementation of Behavioral Classroom Interventions

Teacher-delivered behavioral interventions effectively support students with or at risk for ADHD, yet practical constraints and inconsistent adherence hinder implementation (Lawson et al., 2023). To address this, a pilot RCT evaluated the PBMIR in enhancing teacher fidelity. Over eight weeks, teachers receiving PBMIR demonstrated improved implementation and perceived feasibility compared to controls. Despite promising results, the study's small scale and reliance on self-reports limit generalizability, highlighting the need for objective measures and sustained professional development to ensure long-term intervention success.

Owens et al. (2020) examined best-practices consultation in enhancing teacher responses to student rule violations and classroom management. Among 48 teachers and their ADHD-diagnosed or at-risk students, higher adherence to appropriate disciplinary responses was correlated with fewer class-wide ($r = -.32$ to $-.53$) and individual rule violations ($r = -.22$ to $-.51$). Notably, teachers who exceeded a 51% response benchmark showed greater behavioral improvements. While the findings underscore the role of behavioral consistency, limitations include unaccounted confounders (e.g., teacher experience and school climate), as well as the short-term nature of the consultation, highlighting the need for sustained professional development.

A more scalable and technology-driven approach to ADHD intervention was examined by Haack et al. (2024), who investigated CLS-R-FUERTE, a digital intervention integrating school clinician training, parent and student group sessions, and teacher classroom management support. Conducted as a school-clustered RCT across eight public schools in Mexico ($N = 163$), the study assessed intervention feasibility, fidelity, and effectiveness compared to standard school services. Results indicated high implementation fidelity and participant adherence, with significant improvements in parent- and teacher-rated ADHD symptoms, as well as parent-rated ODD symptoms and functional impairment. The digital format enhanced accessibility and feasibility, aligning with broader efforts in global digital mental health. However, key limitations remain unaddressed, including potential variability in clinician competence, cultural adaptability across diverse educational settings, and the sustainability of intervention effects after the trial. Moreover, outcome measures predominantly relied on parent and teacher ratings, lacking objective neurocognitive or classroom performance

assessments. Future research should explore hybrid models that integrate digital interventions with real-time behavioral monitoring and long-term follow-up to assess the retention and effectiveness of interventions.

Collectively, these studies underscore the crucial role of teacher implementation fidelity, structured consultation support, and digital innovations in enhancing interventions for individuals with ADHD. While PBMIR and consultation models emphasize the need for teacher-focused implementation support, CLS-R-FUERTE demonstrates the potential of technology-driven solutions in addressing ADHD and ODD symptoms at a systemic level. Nevertheless, challenges persist, including issues of scalability, long-term sustainability, and objective outcome measurement. Future research should prioritize multi-tiered intervention models that integrate teacher training, digital intervention tools, and longitudinal assessments to ensure comprehensive, evidence-based support for students with ADHD across diverse educational settings.

Program	CLS	CLS-Spanish	CLS-FUERTE	CLS-Remote	CLS-R-FUERTE
Component	Pfiffner et al., 2016	Haack et al., 2019	Haack et al., 2020	Pfiffner et al., 2023	Current Study
School Clinician Training: Initial 6 to 8-hour workshop, weekly consultation, in-vivo observation and fidelity monitoring of each group and meeting supported by intervention manual and materials	• Trainers and school clinicians travel between school sites for in-person group training/ consultation; trainers travel to school sites to observe and monitor sessions in-person • Real time coaching during session and post-session feedback provided in-person • Training strategies include didactic instruction and role plays • Manuals/materials kept in large paper binders and include paper scripts and handouts of intervention strategies			• Training/consultations and sessions observed and monitored *remotely via videoconferencing* • Real time coaching during sessions and post-session feedback provided *remotely via video-conferencing* • Training strategies adapted for *video-conferencing* target school clinician engagement during remote consultation, *skill demonstration video* review and discussion added to didactic instruction and role play training strategies • *Digital* manuals/materials allow 24-hour access from any location and include *electronic scripts and handouts with infographics and video demonstration* of intervention strategies	
Parent Skill Groups: Weekly sessions on relationship building, setting expectations, and providing consistent positive and negative consequences	• Parents travel to schools for in-person group session delivery				• Parents encouraged to attend groups *remotely via video-conferencing* but those unable to connect may attend groups in-person for hybrid group session delivery when needed
Student Skill Groups: Weekly sessions on social, emotional, and organizational skills, including good sportsmanship, self-control and cool-down tools, and daily routines	• Students must be present at school to attend in-person group sessions • Session strategies include discussion and practice of child skills				• Students typically attend groups in-person during the school day but those absent from school may attend groups *remotely* for hybrid group session delivery when needed • Session strategies include *video demonstration* of child skills
Teacher Consultation: Initial 1-hour orientation, initial 20-30 minute meeting to set up a Daily Report Card (DRC), and daily use of the DRC and reporting to parents	• Parents travel to schools for in-person DRC meeting delivery • Paper-and-pencil DRC travels between school and home each day in the child's backpack so points can be communicated				• Parents can attend DRC meeting *remotely via video-conferencing* • Paper-and-pencil DRC is used in the classroom and points are communicated between school and home *electronically*

Fig. 3 Variations in Training and Intervention Components Across Collaborative Life Skills (CLS) Program Versions

This figure outlines the evolution and adaptations of the CLS program across different iterations, focusing on enhancements made in the CLS-R-FUERTE program, a digitally enhanced school clinician training and ADHD/ODD intervention program implemented in Mexico. The program components include training for school clinicians, sessions for parents and students, and meetings for teachers. Initial versions, such as CLS and CLS-Spanish, required in-person training sessions, with materials kept in binders and direct observation or consultations. The CLS-FUERTE and CLS-Remote versions integrated more digital tools, enabling video conferencing and remote observations to accommodate various delivery settings. In CLS-R-FUERTE, interventions are further adapted to a fully remote and hybrid model, utilizing video conferencing, digital manuals with infographics, video scripts, and real-time engagement techniques. Parents and students participate remotely when needed, facilitating flexibility in attendance. Meanwhile, teachers and clinicians receive digital materials and online support, allowing for wider accessibility and consistency in delivering intervention strategies remotely. This progression reflects a shift toward flexible, accessible, and technology-driven methods in supporting ADHD/ODD interventions in educational settings across multiple sites.

Table 4 Matrix of Literature for Theme 2

Title	Objective	Methodology	Key Findings	Conclusions
Implementation resources to support teachers' use of behavioural classroom interventions: protocol of a randomized pilot trial (Lawson et al., 2023)	To pilot test a resource package, PBMIR, to support teachers in implementing behavioural classroom management interventions for students with ADHD.	RCT with two groups: one receives PBMIR and the other does not. The study measures teacher implementation outcomes (e.g., fidelity) and student outcomes (e.g., ADHD symptoms, academic performance).	Teachers receiving PBMIR showed higher fidelity in implementing behavioural interventions. Students in the PBMIR group showed improvements in ADHD-related impairment, ADHD symptoms, and academic performance. Teachers reported high acceptability and feasibility of PBMIR.	PBMIR is a promising support package for improving teacher implementation of behavioural interventions in ADHD students. Further research is needed to assess its larger-scale effectiveness.
Consultation for Classroom Management and Targeted Interventions: Examining Benchmarks for Teacher Practices That Produce Desired Change in Student Behaviour (Owens et al., 2020)	To explore the effectiveness of teacher consultation on classroom management and the use of a DRC in reducing student misbehaviour and improving teacher practices.	Forty-eight teachers participated in up to eight consultation sessions, focusing on classroom management and the use of DRC. The teacher's response to student misbehaviour was measured, and its relationship to student behaviour and classroom violations was analyzed.	Teachers who responded to a higher percentage of rule violations had fewer class-wide and student-specific rule violations. Teachers who achieved a minimum benchmark (51% appropriate responses) showed greater improvements in student behaviour.	Teacher consultation and training on classroom management, specifically on responding to student rule violations, can significantly improve classroom behaviour and reduce misbehaviour.
Implementation of a Multi-Site Digitally-Enhanced School Clinician Training and ADHD/ODD Intervention Program in Mexico: Randomized Controlled Trial of CLS-R-FUERTE (Haack et al., 2024)	To evaluate the feasibility and effectiveness of a digital program (CLS-R-FUERTE) for training school clinicians and supporting ADHD/ODD interventions, including teacher classroom management and parent-student skills groups.	Randomized controlled trial across eight schools in Sinaloa, Mexico, with students (ages 6-12), their parents, teachers, and school clinicians. The program used digital materials and videoconferencing for clinician training and intervention delivery.	Students in the CLS-R-FUERTE group showed greater improvement in ADHD and ODD symptoms, as well as reduced impairment, compared to the control group. The program demonstrated high feasibility and acceptability.	Digital training programs for school clinicians (like CLS-R-FUERTE) can effectively improve ADHD/ODD outcomes in schools and increase global access to evidence-based interventions.

Theme 3: Psychosocial and Multimodal Approaches to ADHD Treatment

Community Despite extensive research on ADHD interventions, limitations in study design continue to hinder the identification of key mediators within psychosocial treatments. Understanding these mediators is crucial

for refining interventions in community-based and Usual Care (UC) settings. However, most studies fail to adequately assess mechanisms of change, thus limiting their translational impact. Integrative Data Analysis (IDA) presents a promising methodological advancement, enabling researchers to pool and harmonize raw data from multiple RCTs, enhancing the generalizability and robustness of the findings.

Through IDA, researchers integrated data from four RCTs (N = 854) to assess the long-term effects of psychosocial ADHD treatments, emphasizing mediators such as executive functioning and parent-teen communication. Using linear growth curve modeling, the findings indicated that Supporting Teen's Autonomy Daily (STAND) intervention and community-based UC achieved the most significant reductions in ADHD symptoms (d = 0.43–0.99), followed by STP-A and BPT/OST (d = 0.26–0.31) (Sibley et al., 2022). Notably, improvements in organization and time management skills played a crucial mediating role across all interventions. In contrast, BPT/OST and STP-A were particularly effective in preventing social skill decline. In contrast, parent contingency management and disruptive classroom behavior showed no significant mediation effects, prompting a re-evaluation of their influence on ADHD symptom trajectories.

These findings underscore the necessity of refining psychosocial ADHD interventions to emphasize skill-building approaches over traditional behavior management techniques. The differential effects observed across treatments underscore the importance of precision in intervention design, particularly for adolescent populations where executive functioning deficits are prevalent. Future research should prioritize mechanistic analyses in ADHD intervention trials to enhance the efficiency and scalability of treatments in real-world settings.

Category	Details
Key Findings	- One-on-one therapies (individual sessions with adolescents and parents) show more potent effects on ADHD symptom outcomes than group-based treatments. - Group-based treatments may prevent deterioration of social skills.
Primary Mediators of Treatment	- Organization, Time management, and Planning (OTP) Skills: Most robust mediator of ADHD symptom outcomes. - Parent-Teen Communication Skills: Essential for Optimising Treatment Outcomes.
Recommended Treatment Components	- OTP Skills Training: Should be a standard element in ADHD treatment. - Parent-Teen Hybrid Model: Training should target both adolescents and parents to improve parent-teen communication.
Comparison of Treatment Types	- Group-based Treatments (BPT/OST, STP-A): Smaller effects on ADHD symptom outcomes but better at preventing social skills decompensation. - Individually Delivered Treatments (STAND, UC): Stronger impact on ADHD symptoms.
Common Elements of Effective Treatments	- OTP Skills Training with skill application assignments - Clinician Progress Monitoring - Operant Reinforcement of Progress by parents
Recommendations	- Include OTP and parent-teen communication training as standard components for adolescent ADHD treatment. - Use group-based treatments when social problems are a primary concern.

Fig. 4 Primary mediator of treatment

Table 5 Matrix of Literature for Theme 3

Title	Objective	Methodology	Key Findings	Conclusions
Mediators of Psychosocial Treatment for Adolescent ADHD	To identify mediators of psychosocial interventions for adolescent ADHD and	Data pooled from four randomized controlled trials (N = 854) of ADHD psychosocial treatment. Linear growth curve analyses	Key mediators of treatment effectiveness included improvements in organizational skills, time management, and planning. Parent-teen communication	Psychosocial treatments for ADHD in adolescents improve outcomes primarily through the development of

(Sibley et al., 2022)	understand how treatment components influence ADHD symptom outcomes.	were employed to investigate the effects of treatment on ADHD symptoms and five potential mediators.	skills also mediated the outcome for specific treatments. Social skills improved in some interventions, mitigating ADHD symptom escalation.	organizational and time management skills, as well as enhanced communication between parents and teens.

DISCUSSION AND CONCLUSION

The studies in this theme highlight the effectiveness of various interventions for children with ADHD, focusing on both school-based and HB strategies aimed at improving behavior, executive functioning, and overall academic performance. Behavioral classroom interventions, such as those involving teacher-delivered strategies like BMT, show promise in modifying student behavior, with positive outcomes that include increasing desirable behaviors and reducing disruptive ones. Additionally, non-pharmaceutical approaches, such as the GEF-OPT program, demonstrate significant improvements in inattentive symptoms, executive function, and reductions in comorbid ODD, suggesting that these interventions can be effective alternatives to medication. Furthermore, interventions that incorporate self-monitoring techniques, such as the use of an interval timer, have proven successful in reducing off-task behavior and improving cognitive inhibition, providing a cost-effective and practical solution for managing ADHD symptoms in educational settings. Overall, these findings support the idea that a combination of behavioral and executive function-based approaches is effective. Self-regulation interventions can significantly enhance outcomes for children with ADHD, particularly when tailored to the needs of the individual student and supported by teachers and parents.

Studies on this theme underscore the critical importance of supporting teachers in effectively implementing behavioral classroom interventions for students with ADHD. Teacher-delivered interventions can significantly improve ADHD-related symptoms and classroom behavior. However, their successful execution often requires proper training, resources, and ongoing support. The research demonstrates that programs such as PBMIR and consultation models that focus on classroom management and targeted interventions can enhance teachers' abilities to apply evidence-based strategies consistently. For instance, teachers who receive targeted support, such as consultation sessions or access to structured training resources, demonstrate improved fidelity to behavioral interventions and better outcomes in reducing student misbehavior.

Additionally, the use of digital tools in the CLS-R-FUERTE program demonstrates the potential of technology to provide scalable and practical training for school clinicians and teachers, particularly in regions with limited access to traditional in-person programs. The success of these programs in improving teacher practices and student outcomes further highlights the value of comprehensive, teacher-centered interventions that combine direct support, structured training, and ongoing monitoring. These findings suggest that strengthening teacher preparation and offering continuous professional development, particularly in the use of behavioral classroom management strategies, can significantly improve the educational experience for students with ADHD.

The study in this theme highlights the effectiveness of psychosocial and multimodal approaches to ADHD treatment, emphasizing the importance of integrating family, peer interactions, and cognitive-behavioral techniques to address ADHD symptoms. The research demonstrates that family-based interventions, particularly those focusing on parent-teen engagement, as well as community-based care, lead to significant reductions in ADHD symptoms, particularly in areas such as organization, time management, and planning. Notably, improvements in communication between parents and teens, as well as the prevention of social skill deterioration, were identified as key mediators in achieving these outcomes.

Limitations of this review include the small number of studies, potential publication bias, and language restriction to English-only articles. Moreover, the short duration of some interventions and reliance on self-report measures in the original studies may affect the reliability of outcomes. These limitations highlight the need for more longitudinal, large-scale trials examining diverse, context-specific interventions.

These findings underscore the need for tailored, multimodal interventions that address the unique needs of children with ADHD and involve collaboration between educators, parents, and clinicians to optimize

outcomes. The limited number of studies included restricts the generalizability of findings. However, this also reflects a research gap in recent empirical investigations of school-based, non-pharmaceutical interventions targeting disruptive behavior in ADHD populations. Continued research is needed to develop scalable, evidence-based solutions for diverse educational settings. The identification of specific mediators, such as executive functioning skills and parent-teen communication, offers valuable insights into how psychosocial treatments work and can guide future intervention strategies. By focusing on these critical areas, treatment programs can be more tailored and effective in addressing the multifaceted challenges faced by adolescents with ADHD, ultimately improving their long-term outcomes.

In summary, this SLR highlights the effectiveness of various interventions for managing ADHD symptoms, emphasizing the importance of behavioral, executive function-based, and psychosocial approaches. School-based interventions, particularly those delivered by teachers, are enhanced by proper training and support. In contrast, family-centered and community-based approaches have demonstrated significant benefits in improving communication, executive functioning, and social skills. The integration of non-pharmaceutical strategies, including self-monitoring techniques and digital tools, provides scalable and practical solutions for managing ADHD. These findings underscore the need for tailored, multimodal interventions that address the unique needs of children with ADHD and involve collaboration between educators, parents, and clinicians to optimize outcomes.

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