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ADAPTED PHYSICAL EDUCATION

Role of Physical Education in Helping Students with ADHD: A Scoping Review

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Abstract

Attention deficit hyperactivity disorder (ADHD) is one of the common neurodevelopmental disorders among students. This scoping review aimed to map the evidence on the role of Physical Education (PE) in helping ADHD Students. PsycINFO, MEDLINE (PubMed), Google Scholar, ProQuest, and SPORTDiscus databases were searched for evidence. Following the recommended processes for conducting a scoping review, 11 articles were included in this review. The interventions included in this review can be summarized in three clusters: reduction of symptoms, obtaining strategies, and positive impacts on feelings, relationships, performance, engagement/enjoyment. Considering the various study designs, methods, sample sizes, and PE approaches in these 11 investigations, it is challenging to determine the best PE setting to help ADHD children. However, based on the results of this review, PE classes can positively impact ADHD students. Implementing a structured movement program and integrating this program into the PE curriculum would be beneficial for ADHD students.

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Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is one of the most frequent neurodevelopmental disorders (Reeves & Bailey, 2016). It is estimated that the global prevalence of ADHD among children and adolescents is between 5% and 10% (Hall, 2024). Students with ADHD often may have difficulty maintaining focus and may exhibit excessive levels of activity. They may also experience lack of self-control and impulsive behaviors (Salari et al., 2023). This disorder also affects children's emotions, academic performance and social interactions (Zhu et al., 2023). It is important to treat the main symptoms of this disorder in children, since these symptoms might lead to lots of problems such as academic failure (Ogundele & Ayyash, 2023). Therefore, addressing the main symptoms of ADHD through effective interventions could be beneficial (Coghill et al., 2021). Behavioral and medical management are considered as primary interventions for ADHD children (Jerome & Jerome, 2020).

However, the evidence indicates that over a third of children do not respond or experience adverse reactions to the pharmacological interventions (Zhu et al., 2023). Concern has been expressed that pharmaceutical interventions may not be appropriate for managing ADHD symptoms in children and most of the parents are concerned about the short and long-term side effects of medications (Ng et al., 2017). Therefore, there is a strong need to consider alternative and non-pharmacological interventions to help ADHD children (Lelong et al., 2021). Non-pharmacological interventions are effective in reducing the behavioral problems in these students. Behavioral interventions are also considered as an alternative intervention to improve their social skills and academic performance (Ogundele & Ayyash, 2023).

As the pursuit of alternative interventions continues, physical activity is also considered as an effective strategy to help ADHD students (Cornelius et al., 2017). Physical activity (PA) is described as any bodily movement generated by skeletal muscle action, resulting in an increase in the energy expenditure (Caspersen et al., 1985). PA as a potential intervention for ADHD, could reduce the ADHD symptoms by increasing the level of dopamine and norepinephrine neurotransmitters. Furthermore, PA has been linked to increase the

levels of 5-hydroxytryptamine and endogenous opioids and potentially boosting mood and attention (Xie et al., 2021). Although many investigations have described the impact of PA on students with ADHD, few studies have examined the role of physical education (PE) as a treatment for these students (Giesige, 2018). PE defines as a socially constructed curriculum that includes the broader spectrum of physical culture, sport and health-related physical activities (Coulter & Ní Chróinín, 2011). Currently, much of the literature studying the potential impact of PE on ADHD emphasizes its contribution to motor development in ADHD students (Bicalho et al., 2023). Others suggest PE can reduce stress and anxiety in these students. PE also impacts positively on the social interactions and academic performance (Mulrine & Flores-Marti, 2014). While these benefits of PE for ADHD students are known, more research is needed to fully understand the role and mechanism of these benefits. It follows that Bicalho et al. (2023) highlights the need for a better understanding of the role of PE in ADHD treatment.

It is important for PE teachers to utilize their pedagogical skills when teaching students with ADHD (Mulrine & Flores-Marti, 2014). Therefore, some studies have been done in the field of PE and ADHD, but still the knowledge of physical educators and students about PE and ADHD is not enough (Bicalho et al., 2023). To our knowledge, there are no comprehensive reviews about the role of PE in helping students with ADHD. Additionally, there is a limited number of investigations assessing the outcomes regarding this role. By identifying the existing research and emerging evidence, this review aims to recognize gaps in the relevant literature on the role of PE in helping students with ADHD, ultimately facilitating the future research directions and the development of PE settings to help students with ADHD.

Methods

The aim of this scoping review was to assess the role of PE in helping students with ADHD. Therefore, to address this aim, we followed the established framework for scoping studies (Arksey & O'Malley, 2005), which consists of five stages: (1) identifying the research questions; (2) identifying relevant studies; (3) study selection, (4) charting the data; and (5) collating, summarizing, and reporting the results. For this scoping review, we also used the PRISMA-ScR

checklist (Preferred Reporting Items for Systematic Reviews and Meta-analyses Extension for Scoping Reviews (Page et al., 2021). The protocol was also registered in the Open Science Framework (https://osf.io/harwq/).

Identifying the Research Question

To fulfill the aim of this study, the following research question was developed: "What role can physical education play for students with ADHD?"

Identification of Relevant Studies

A comprehensive search was performed using five main databases of PsycINFO, MEDLINE (PubMed), Google Scholar, ProQuest, and SPORTDiscus. Key search terms were determined through the broad review of literature in the field of PE and ADHD. The identified key terms of *ADHD, Physical Education, students, children,* and *youth* were applied within the five relevant databases in the searching process. We also used search terms such as *structured PE* and *academic behaviors* to ensure comprehensive search. Database searches were performed for articles published between January 1, 2014, and April 20, 2024, to ensure the review included the most current knowledge on the topic. We also excluded systematic reviews and articles that lacked sufficient data for a meaningful second analysis. Upon a comprehensive search across the five databases and considering the inclusion and exclusion criteria, we realized that there is limited literature available on the topic of our study.

Selection of Sources of Evidence

Based on the recommendations of Arksey and O'Malley (2005), the criteria for the selection of studies were refined after the initial search. Therefore, the following inclusion criteria were applied for the abstracts: (1) must be related to PE and ADHD; (2) must be related to children and youth; (3) published between January 1, 2014, and April 20, 2024; and (4) published journals, PhD theses. The studies were also excluded based on the following criteria: (1) not related to physical education; (2) not related to ADHD; (3) not related to children and youth; and (4) published before January 1, 2014. After applying these criteria, the authors examined the full-text versions of all eligible abstracts for further review. Any conflicts were identified

and resolved through discussion between the three reviewers. The authors determined that 11 papers met the eligibility criteria for the final review.

Data Items

After determining 11 papers for the final review, the authors extracted and presented the key findings of each paper in a standardized table. This table includes the name of authors, year of findings and outcomes. No supplementary software or calibration were used during this process.

The study designs were diverse, including one experimental study, five quasi-experimental studies, three qualitative studies, and two observational studies. Each study was independently reviewed by three independent researchers, and discrepancies in the assessments were resolved through discussion. The primary objective of this scoping review was not to assess the study designs, although the included study designs will be briefly addressed. Instead, the authors aimed to describe and examine the role of PE in helping children with ADHD. Furthermore, the review aimed to suggest potential strategies for boosting the effectiveness of PE in managing the symptoms of ADHD.

Results

Results of the Search Procedure

Figure 1 presents the screening process. Articles were sourced from five different databases. After removing the duplicates and following the eligibility criteria, three independent researchers assessed the titles and abstracts of the retrieved articles. The articles that met the initial criteria were subsequently included in full review by the same researchers to determine their eligibility for inclusion in this scoping review. The 11 articles subjected to full review are presented in Table 1. The related characteristics of the investigated populations, research methods and objectives are also provided in this table. The outcome section of this table also described how the physical education setting impacted the symptoms of ADHD or how it could assist students with ADHD.

Table 1
Characteristics of Included Studies

Authors	Population	Study Design (research method)	PE intervention	Outcome
(Dana et al., 2018)	n= 40 boys with ADHD. Age: 7-10	Quasi-experimental study with pre- and post-test design	A three-month course of education based on developmental PE (two sessions of one-hour weekly with fundamental movement skills and physical fitness components)	Reduction of conduct problems, social problems, anxiety-shyness, psychosomatic, and overall level of ADHD
(Taylor et al., 2019)	n=12 children Study group: 6 children with ADHD (5 boys and 1 girl) Control group: no diagnosis of	Quasi Experimental design (A repeated-measures design)	40-min sessions of short-duration, mixed activities (warm-up, two different gym-based and outdoor blocks of mixed	A significant reduction in ADHD symptoms, helping children manage ADHD symptoms. Evaluated the exercises as
	ADHD (3 boys and 3 girls) Age: 10-11		activity, cool-down) Bi-weekly sessions for 11 weeks	acceptable and enjoyable for those with and without ADHD.

Table 1 (cont.)

(Taylor, 2019)	n= A single cohort of 4 boys with ADHD. Age: 10-11	Observational study	Moderate to high intensity PA. Ten 40-minute sessions over five weeks (short periods of each activity and a variety of different exercises including warm up, outdoor activities and indoor gym-based activities and cool down)	A general increase in engagement and effort in classroom-based lessons, lower hyperactivity and inattentive symptom scores
(Mok, 2023)	n=4(3 boys and 1 girl) Age:6-9	Experimental Design	30 minutes of structured PA	Decreasing the number of off-task behaviors
(Villa-de Gregorio et al., 2022)	n=13 students with ADHD (9 boys and 4 girls, AND 13 students (9 boys and 4 girls), without attentional problems (Age:15)	Quasi-experimental design	A 12-week curriculum-based PE program	A curriculum-based PE program influenced the social preferences for learning in PE

Table 1 (cont.)

(Vaage, 2017)	n=3 (1 boy and 2 girls) at three different secondary schools Age:13-15	Qualitative phenomenological research	How children with ADHD experience PE.	The structure given by the teacher, the valuing/de-valuing of certain activities and how the students can adjust to the habitus of the field were the main experiences that could be helpful for ADHD students
(Roca, 2018)	n=3 pupils in the 4th, 5th and 6th grades diagnosed with ADHD	Qualitative research	Identify the behavior of pupils with ADHD, distinguishing between desirable and undesirable behaviors.	Outcomes to help the students with ADHD: a) the teachers must create situations in which desirable behaviors occur more frequently b) use techniques to increase or maintain behavior c) use reinforcement techniques or positive techniques (RTB) more than punishment

Table 1 (cont.)

(Bores-García et al., 2024)	n = 8 secondary school ADHD students (5 girls and 3 boys) Age: 11-16	A qualitative descriptive study based on an interpretative framework.	Describe the perspective of ADHD students and PE teachers concerning PA practice in high school	ADHD is not experienced as limiting the practice of PA and PE by students, except in motor activities that require concentration
	And 4 PE teachers (1 woman and 3 men)			such as tactical games. On the contrary, PA and PE help ADHD students feel better. Teachers have not had to make extensive methodological modifications in their teaching styles with students with ADHD
(COSTA et al., 2015)	n=4 students with ADHD (3 girls and 1 boy) Age: 6-10	Observational study	Three thematic types of activities were selected and applied: psychomotor, play activities and strategy games.	Obtaining some strategies to help ADHD students including teacher /student and student /student bond; cooperative work.; mediation; routine; resource selection and environment.

Table 1 (cont.)

(Hemayattalab et al., 2016)	n= 30 boys Age: 9-11	Quasi-experimental study	SPARK physical education program (Effects of sports, play, and active recreation in kids) for 12 sessions of 30 minutes and has two parts: a health-fitness activity (15 min) and a skill-fitness activity (15 min).	Reducing behavioral problems, including externalizing and internalizing behaviors along with eight syndromes (anxiety/depression, withdrawal, somatic/ thought/ social complaints/attention problems, delinquent and aggressive behavior)
(Banikarimi et al., 2018)	n= 38 elementary school boys Experiment (21 subjects) and control (17 subjects)	Quasi-experimental study with a pretest-posttest design.	The experimental group trained for ten sessions in the fundamental motor skills (FMS) program and the control group continued with its daily activities.	FMS training can have a positive effect on children's performance in motor impulsiveness and controlling movement and impulses in children with ADHD symptoms.

Synthesis of Results

Participants

The 11 studies included a total of 149 participants ranging from 7 to 16 years of age. Four PE teachers were included in the population of the study by Bores-Garcia (2024), since this study was qualitative. Therefore, the total number of participants in this scoping review is 153.

Intervention

The interventions included in this review can be summarized in three clusters: reduction of symptoms, obtaining pedagogical strategies, and positive impacts on feelings, relationships, performance, and engagement/enjoyment.

Reduction of Symptoms

Although several studies (Dana et al., 2018; Hemayattalab et al., 2016; Mok, 2023; Taylor, 2019; Taylor et al., 2019) each utilized different methods for PE sessions, they all resulted in reducing the symptoms of ADHD. For example, Dana et al. (2018) found that fundamental movement skills and physical fitness components in the PE sessions led to decreased conduct problems, social problems, anxiety-shyness, psychosomatic, and overall levels of ADHD symptoms in the experimental group of 40 students with ADHD. Taylor et al. (2019) demonstrated that 40-min PE sessions of short duration and mixed activities resulted in a significant reduction in ADHD symptoms, helping children manage their ADHD. In another study (Taylor, 2019), the investigators used moderate to high-intensity PA during PE sessions, and they concluded that this PE intervention led to lower hyperactivity and inattentive symptom scores in kids. Mok (2023) also concluded that structured PA during PE sessions decreased the off-task behaviors in students with ADHD. Although the sample sizes are low in these two investigations (Mok, 2023; Taylor, 2019), their findings are still valuable as they are among the few research studies that have examined the impact of PE setting on students with ADHD in school. Also, the results of a quasi-experimental study by Hemayattalab et al. (2016) suggested that after implementing the SPARK PE program, the level of behavioral problems reduced in students with ADHD.

Obtaining Pedagogical Strategies

Three of the studies included in the review shared outcomes related to pedagogical strategies for most effectively working with ADHD students. The qualitative research implemented by Roca (2018) demonstrated that using strategies such as creating situations in which desirable behaviors occur more or using reinforcement more than punishment can be helpful for students with ADHD. In

another observational study (COSTA et al., 2015), psychomotor and play activities were applied to obtain some strategies to help three students with ADHD, and researchers realized that the following strategies could be implemented to assist these students: teacher/student and student/student bond, cooperative work, mediation, routine, resource selection, and environment. Vaage (2017) in qualitative phenomenological research concluded that the structure given by the teacher, the valuing/de-valuing of certain activities and how the students can adjust to the habitus of the field were the main experiences of students with ADHD during the PE sessions. Although the sample size in all these studies (COSTA et al., 2015; Roca, 2018; Vaage, 2017) were low, the strategies seem effective in helping ADHD students.

Positive Impacts on Feelings, Relationships, Performance, and Engagement/Enjoyment

The quasi-experimental design study implemented by Taylor et al. (2019) in the study group of six children with ADHD demonstrated that 40-min sessions of short duration, mixed activities resulted in a reduction in ADHD symptoms (as previously mentioned). In addition, the students with ADHD evaluated the PE sessions as acceptable and enjoyable. In another observational study on a single cohort of four boys with ADHD, a general increase in engagement and effort in classroom-based lessons was reported.

In a 12-week curriculum-based PE program (Villa-de Gregorio et al., 2022), the researchers concluded that this program could influence the social preferences for learning in PE by promoting the ADHD students' relationships with other classmates. In the most recent study by Bores-García (2024) on secondary school students, it was determined that teachers have not had to make extensive methodological modifications in their teaching styles with ADHD students. Another important finding was that PE sessions could successfully help students' positive affect. A quasi-experimental study (Banikarimi et al., 2018) on 38 boys (21 as experimental and 17 as control subjects) with a pretest-posttest design concluded that ten sessions of fundamental motor skills program in PE setting can have a positive effect on ADHD children's performance in motor

impulsivity and controlling movement. This research examines fundamental motor skills training, which is considered significant.

In another investigation on a low sample size of four participants (Taylor, 2019) with ADHD, moderate to high-intensity PA in PE sessions increased participants' engagement in the class lessons.

Discussion

Eleven articles were included in our final review. These articles examined how PE can help children with ADHD. In the studies included in our review, a diversity of methods was implemented. Two of the studies were observational (COSTA et al., 2015; Taylor, 2019) in which different activities were applied. Three of the investigations were qualitative (Bores-García et al., 2024; Roca, 2018; Vaage, 2017). In these studies, the authors investigated the experience of children with ADHD with PE sessions. All three studies concluded that PE sessions could have several positive impacts on ADHD students, mainly helping them feel better and helping the PE teachers to identify some helpful strategies and techniques.

Five other studies were quasi-experimental design (Banikarimi et al., 2018; Dana et al., 2018; Hemayattalab et al., 2016; Taylor et al., 2019; Villa-de Gregorio et al., 2022), and in two of them the sample sizes were low (Taylor et al., 2019; Villa-de Gregorio et al., 2022). Three of these studies resulted in the reduction of ADHD symptoms in children (Dana et al., 2018; Hemayattalab et al., 2016; Taylor et al., 2019), While studies (Banikarimi et al., 2018; Villa-de Gregorio et al., 2022) concluded positive effects of PE on the student's performance and relationships/social preferences in PE, respectively. In another investigation conducted by Mok (2023), structured PA was implemented during the PE sessions and this approach resulted in the reduction of off-task behaviors. All in all, the findings of these 11 included articles in our review indicated the positive impact of physical education sessions on helping students with ADHD.

One key observation in some of the included articles in this review (COSTA et al., 2015; Mok, 2023; Roca, 2018; Taylor, 2019; Taylor et al., 2019; Vaage, 2017; Villa-de Gregorio et al., 2022) is that the samples sizes are small. Since the findings from studies with small sample sizes may not generalize well to the broader population of students with ADHD, this highlights a potential limitation in existing literature. However, the study samples represent the ratio

of students identified as having ADHD in general education classes. Various sample sizes and different research methodologies undermine any significant relationship between PE and reducing ADHD symptoms. Individual differences, various PE programs, and different study designs make it challenging to determine a direct link between participation in PE and symptom reduction in students with ADHD. Moreover, given the nature of pilot studies and the small sample sizes, the findings should be considered with caution. Given that some of the studies included in this review were conducted in a relatively short time frame, another issue must be considered in interpreting the results. Although findings suggest that both short-term and long-term engagement in PA are beneficial for children with ADHD, long-term training will result in improvement in executive function (Chan et al., 2022). Moreover, it is challenging to determine the precise mechanisms through which PE sessions may reduce symptoms of ADHD. Some studies have demonstrated a positive correlation between PA and the release of dopamine in the brain, which is believed to affect attention and cognitive function (Reeves & Bailey, 2016). Some findings also suggested that PA might stimulate neurohormonal mechanisms and enhance children's attention (Hemayattalab et al., 2016). Increasing the functional connectivity between attention and executive control following acute PA might be another potential mechanism which improves the reaction time in ADHD students (Suarez-Manzano et al., 2018).

While PE settings and sessions may not be utilized as much as PA, in general, in addressing the needs of students with ADHD, the effectiveness of PE as a source of PA for these students requires more investigation. With many students identified as having ADHD having Individualized Education Program in place, PE is a legal requirement for them in schools. However, the effectiveness of diverse activities within the PE sessions in engaging and helping students with ADHD may vary. Studies that prioritize developmental PE, mixed activities, individualized movement, moderate to high intensity PA and fundamental movement skills (Banikarimi et al., 2018; Dana et al., 2018; Taylor, 2019; Taylor et al., 2019) may offer greater benefits for students with ADHD within the PE setting.

In contrast, traditional PE classes may rely more on team sports and competitive activities, which might be challenging for students

with ADHD, since these students struggle with attention and social interactions. In one of the studies included in Table 1 (Bores-García et al., 2024), the authors concluded that ADHD is not considered as a limitation to take part in PE classes, except in situations that require great concentration such as tactical games. Decision-making, following game rules, and adapting as a team member are the cognitive factors that are associated with participating in physical activities and children with ADHD typically display poor performance in these areas (Christiansen et al., 2019). Therefore, the PE setting can provide an environment to improve these psychological issues of children with ADHD.

Self-Determination Theory (SDT) is an important theorical framework that can be considered for this scoping review. This theory is an approach to human motivation and personality and emphasizes the importance of autonomy, competence, and relatedness as basic psychological needs for human development (Ryan & Deci, 2000). These factors are crucial for intrinsic motivation and engagement in PE settings. Therefore, designing the PE sessions with consideration of these three principles (autonomy, competence, and relatedness) can be beneficial for ADHD students. By allowing the ADHD students to make choices in activities (autonomy) in PE sessions, their engagement would be increased. By designing challenging and achievable activities, the PE teachers can help the students feel successful (competence) and more willing to participate in the activities. By providing a cooperative, supportive and inclusive environment (relatedness) for these students, their motor skills, attention and active participation may be improved. This approach aligns well with the results of some of the studies included in this scoping review, where diverse and socially engaging activities within the PE sessions led to positive impacts on ADHD students.

Conclusion and Recommendations

There is a significant need for non-pharmacological interventions for children with ADHD, so the primary aim of this scoping review was to map the existing evidence for the role of PE in helping these students. These children often perform extra physical activities because of their hyperactive tendencies. Therefore, implementing an extra PA program that aligns well with their needs would be benefi-

cial for their development (Simion, 2015). PE activities that promote structured routines, clear instructions, cooperative learning, and opportunities for free movement activities may complement the needs of students with ADHD (Higgins et al., 2018). Moreover, supportive and inclusive PE classes enable educators to create opportunities for ADHD students to improve their physical fitness, motor skills, emotions, and overall well-being. The existing relevant literature provides limited insights into the impact of structured and school-based PE programs on students with ADHD. However, the conclusion of this scoping review shows that PE can be considered as a potential additive approach for the management of this disorder. PE sessions can have positive impacts on the emotions, relationships, performance, and enjoyment of children with ADHD and these children would also experience fewer symptoms. Obviously, the PE teacher plays a significant role in enhancing the social inclusion of children with ADHD, and developing their fundamental skills (Bicalho et al., 2023), so when the PE teachers are equipped with an understanding of the student's challenges, as well as their educational needs, it enables them to support students with ADHD to reach their full potential (Mulrine & Flores-Marti, 2014). As a result, teacher training and ongoing professional development for PE teachers seems necessary in schools to maximize the benefits of PE for ADHD students. Training programs should include pedagogical strategies to address learning challenges experienced by ADHD students in PE settings. Additionally, given the limited amount of research on the impact of PE on students with ADHD, it is necessary to conduct studies in this area with larger sample sizes and long-term approaches to gain more insights in helping these children. Movement interventions within PE sessions at schools are also beneficial for children diagnosed with ADHD. Accordingly, more research should be conducted in diverse PE settings to provide optimized interventions for helping ADHD students. On the other hand, students with ADHD might experience some difficulties in understanding the conceptual details and objectives within PE classes. Consequently, it is highly recommended that behavioral interventions be implemented by PE educators. This approach would be beneficial for inclusion of children with ADHD (Henry, 2016). Educators, healthcare providers, and family members must support these students to enhance their quality of life (Oliveira

et al., 2018). By reviewing the existing literature, addressing the characteristics and needs of ADHD students, and considering inclusive PE sessions, educators can contribute to the overall development and success of students with ADHD.

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