Academia and Society: International Journal of Education and Society

HOLY CROSS

Print ISSN : 2393-9419
Online ISSN : 2393-8919

AAS 2025: 12 (1-2)

Effects of a Play-Based Physical Activity Programme on Enjoyment Among Children with Cerebral Palsy: A Randomised Wait-List Controlled Trial

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ABSTRACT

Background: Children with cerebral palsy (CP) encounter substantial barriers to participation in enjoyable physical activity, despite strong evidence that enjoyment enhances motivation, engagement, and sustained participation. Although play-based approaches are increasingly advocated in paediatric rehabilitation, enjoyment is rarely examined as a primary outcome.

Objective: To evaluate the immediate effects of a structured play-based physical activity programme on enjoyment among children with CP using the Physical Activity Enjoyment Scale (PACES).

Methods:A randomized wait-list controlled trial was conducted with 84 children aged 5–17 years with CP (GMFCS levels I–V). Participants were randomly allocated to an Immediate Play group (n = 42) or a Wait-List Control group (n = 42), with stratification based on GMFCS level. The Immediate Play group received a 12-week structured play-based physical activity programme comprising 36 sessions. Enjoyment was assessed before and after the intervention using PACES. Within- and between-group differences were analysed using paired and independent t-tests, and effect sizes were calculated.

Results:The Immediate Play group demonstrated a substantial increase in enjoyment (mean change = +9.48 ± 3.11; $p < 0.001$), whereas the Wait-List Control group showed minimal improvement (+0.90 ± 0.91; $p < 0.001$). Between-group comparison revealed a large and statistically significant difference in change scores (mean difference = 8.58; $p < 0.001$), with an extremely large effect size (Cohen's $d = 3.74$).

Conclusion: A structured play-based physical activity programme significantly enhances enjoyment in children with cerebral palsy. Incorporating enjoyable, child-centred play into rehabilitation may strengthen motivation and support sustained participation in physical activity.

Keywords: Cerebral Palsy, Play-based Intervention, Physical Activity, Enjoyment, PACES, GMFCS, Participation

Received: 18 October 2025, Revised 19 December 2025, Accepted 23 December 2025

DOI: https://doi.org/10.6025/aas/2025/12/2/31-43

1. Introduction

Cerebral palsy (CP) is the most common cause of lifelong physical disability in childhood and is defined as a group of permanent, non-progressive disorders of movement and posture resulting from disturbances in the developing brain[1]. Children with CP commonly experience motor impairments that restrict activity performance and limit participation in age-appropriate life situations [2, 21]. These restrictions often persist across development and may intensify as environmental and social demands increase [25] .

Play and physical activity are central to childhood development, contributing to physical health, emotional regulation, social competence, and cognitive development [3, 4]. Participation in enjoyable physical activities enables children to explore their environment, develop peer relationships, and build self-confidence. However, children with CP frequently encounter substantial barriers to meaningful participation, including motor limitations, fatigue, inaccessible environments, limited opportunities, and psychosocial constraints[3, 9, 15].Reduced participation has been associated with lower physical fitness, diminished motivation, social isolation, and poorer health-related quality of lifeu [5, 12].

Enjoyment is a key determinant of participation in physical activity and plays a central role in motivation and sustained engagementv [6, 14] . Activities perceived as enjoyable are more likely to be initiated voluntarily, repeated frequently, and maintained over time. In paediatric rehabilitation, enjoyment is particularly important because long-term functional and participation outcomes depend on consistent, self-motivated engagement rather than short-term exposure alone[10, 19] Despite its importance, enjoyment has rarely been examined as a primary outcome in rehabilitation research involving children with CP, where emphasis has traditionally been placed on impairment-level or performance-based measures[10, 20].

Contemporary paediatric rehabilitation frameworks increasingly emphasise participation-focused, child-centred approaches. The International Classification

of Functioning, Disability and Health (ICF) highlight participation as a key outcome of health interventions [3, 16]. Complementing this model, the "F-words for child development" framework places fun at the centre of meaningful functioning, alongside function, fitness, friends, family, and futuret . Within these frameworks, play-based interventions are particularly relevant because they naturally promote autonomy, competence, and social interaction—core drivers of intrinsic motivationv [6, 14].

Play-based physical activity interventions have demonstrated positive effects on motivation, engagement, and participation in children with disabilities[13, 19], [22]. Motor play encourages repetition, exploration, and creativity, while social play fosters peer interaction and cooperative behaviourx [8, 17]. However, there is limited randomized evidence specifically examining the effect of structured play-based programmes on enjoyment in children with CP across functional levels.

The Physical Activity Enjoyment Scale (PACES) is a validated measure widely used to assess enjoyment of physical activity in children and adolescents [7] . PACES has demonstrated strong psychometric properties and sensitivity to change, yet its application in cerebral palsy research remains limited [7, 12]. Assessing enjoyment using a validated tool may provide important insight into affective mechanisms that support participation and long-term engagement in physical activity.

Therefore, the present randomized wait-list controlled trial aimed to evaluate the immediate effects of a structured play-based physical activity programme on enjoyment among children with cerebral palsy across GMFCS levels I–V[2]. It was hypothesised that children receiving the play-based intervention would demonstrate significantly greater improvements in enjoyment than those in the wait-list control group, with a large effect size.

2. Methods

2.1 Study Design

A randomized wait-list controlled trial design was employed to examine the immediate effects of a structured play-based physical activity programme on enjoyment in children with cerebral palsy. This design allowed for ethical delivery of the intervention to all participants while enabling a valid comparison between intervention and control conditions during the initial study phase. The trial was conducted in accordance with established methodological standards for paediatric rehabilitation research and participation-focused intervention studies [10, 20] .

2.2 Participants and Setting

Participants were recruited from a special school for children with cerebral palsy in Tiruchirapalli, India. Eligibility criteria were defined to ensure inclusion of a broad functional spectrum while maintaining safety during participation in physical activity. Children were eligible if they had a confirmed diagnosis of cerebral palsy [1], were aged between 5 and 17 years, classified at Gross Motor

Function Classification System (GMFCS) levels I–V², and were able to follow simple instructions. Medical stability to participate in moderate physical activity was required. Children were excluded if they had undergone orthopaedic or neurosurgical procedures within the previous six months, experienced uncontrolled seizures, presented with severe behavioural or cognitive impairments that prevented participation, or were enrolled in other structured physical activity or play-based programmes within the preceding monthy [9, 19].

2.3 Sample Size Estimation

Sample size estimation was performed a priori based on detecting a medium-to-large effect size (Cohen's d = 0.70), which is consistent with previous play-based and activity-focused interventions in children with disabilities [13, 22]. With a power of 80% and a significance level of a = 0.05, a minimum sample of 80 participants was required. To account for potential attrition, 84 children were recruited and randomized.

2.4 Randomization and Allocation

Participants were randomly allocated in a 1:1 ratio to either the Immediate Play group or the Wait-List Control group. Randomization was computer-generated using permuted blocks to ensure balance between groups. Stratification was applied exclusively based on GMFCS levels I–V² to ensure comparable distribution of functional severity across groups. Age and sex were not included as stratification variables, as functional level is the primary determinant of activity participation in children with CP [21, 25].

2.5 Blinding

Due to the nature of the intervention, blinding of participants and treating therapists was not feasible. However, outcome assessors were blinded to group allocation to reduce assessment bias, and data analysts were blinded to group identity during statistical analysis. These procedures are consistent with recommended practices for behavioural and rehabilitation trials [10, 20].

2.6 Intervention: Structured Play-Based Physical Activity Programme

The intervention consisted of a structured, play-based physical activity progrramme delivered over 12 weeks, comprising 36 sessions conducted three times per week. Each session lasted approximately 45–60 minutes and was delivered by qualified physiotherapists trained in paediatric rehabilitation and play-based therapy approaches [13, 19].

The programme was designed to align with participation oriented rehabilitation principles and the "F-words" framework, with an emphasis on fun, autonomy, and social engagement [4]. Activities were adapted according to each child's GMFCS level to ensure accessibility, safety, and meaningful participation [2, 21]. Sessions were conducted either individually or in small groups, depending on functional ability and social participation goals.

Each session followed a consistent structure comprising a warm-up, a main play segment, and a cool-down. The warm-up phase included light rhythmic movements, musi assisted activities, and dynamic stretching to prepare the child for

active engagement. The main play segment incorporated a range of motor and social play activities, including obstacle courses, ball games, modified sports, pretend-play movements, cooperative games, and playground-based activities. Children were encouraged to choose activities and play partners to promote autonomy and intrinsic motivationv [6, 14]. The cool-down phase involved gentle relaxation, breathing exercises, or quiet play to facilitate recovery and emotional regulation.

2.7 Intervention Fidelity

To ensure consistency and reproducibility, a standardized intervention protocol was used across all sessions. Therapists followed a written programme manual detailing session structure, activity categories, progression strategies, and adaptation guidelines based on GMFCS level [2, 13]. After each session, therapists completed session logs documenting activities performed, duration, engagement levels, and any modifications required.

Adherence checklists were used to verify implementation of essential programme components, including use of play-based activities, provision of child choice, positive reinforcement, and appropriate task grading. Periodic oversight was provided by a senior physiotherapist who was not involved in routine delivery, who reviewed documentation to ensure adherence to the intervention protocol. No major deviations were identified during the intervention period.

2.8 Wait-List Control Condition

Participants allocated to the Wait-List Control group continued with their usual daily routines and standard care during the initial 12-week study period. They did not receive any structured play-based physical activity intervention during this phase. Following completion of post-test assessments, children in the wait-list group were offered the same intervention programme, consistent with ethical recommendations for wait-list designs [10, 20].

2.9 Outcome Measure

The primary outcome was enjoyment of physical activity, measured using the Physical Activity Enjoyment Scale (PACES). PACES is a validated self-report instrument consisting of 16 items rated on a 5-point Likert scale, with total scores ranging from 16 to 80. Higher scores indicate greater enjoyment of physical activityw. PACES has demonstrated strong reliability, construct validity, and sensitivity to change in paediatric populationsw [7, 12] and is appropriate for evaluating affective responses to physical activity interventions.

2.10 Ethical Considerations

Ethical approval for the study was obtained from the institutional ethics committee. Written informed consent was obtained from parents or legal guardians prior to participation, and assent was obtained from children where developmentally appropriate. All procedures were conducted in accordance with ethical principles for research involving children with disabilities [1p, 2p].

3. Results

3.1 Participant Flow

A total of 84 children with cerebral palsy were enrolled and randomized into the Immediate Play group (n = 42) or the Wait-List Control group (n = 42). All participants completed baseline and post-intervention assessments. There were no dropouts, protocol deviations, or adverse events during the study period. Complete data were available for all participants, allowing full intention-to-treat analysis, consistent with recommended standards for paediatric rehabilitation trials [10, 20].

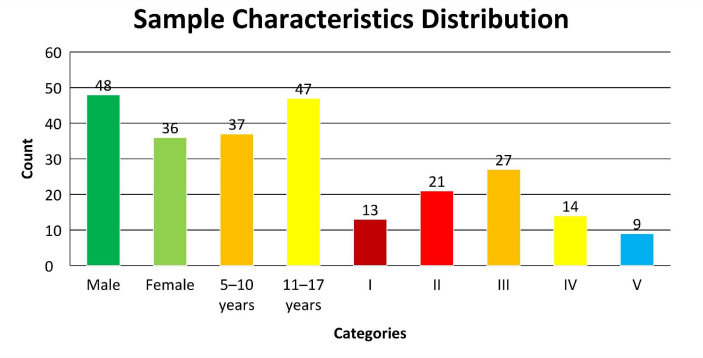
3.2 Baseline Characteristics

The overall sample comprised children aged 5–17 years (mean age 11.2 ± 3.4 years), with 48 males (57.1%) and 36 females (42.9%). Participants represented the full range of functional severity, with GMFCS levels I–V distributed across both groups. Baseline demographic and clinical characteristics, including age, sex, GMFCS level, and pre-intervention PACES scores, were comparable between the Immediate Play and Wait-List Control groups, indicating successful randomization and group equivalence [2, 21, 25].

Baseline enjoyment levels, as measured by PACES, were similar between groups, suggesting that any post-intervention differences could be attributed to the intervention rather than pre-existing disparities in affective response to physical activityw [7, 12].

Variable Age (years)	**Immediate (n=42)**	**Wait-List (n=42)**	**Total Sample (N=84)**
5–10 years	18	19	37
11–17 years	24	23	47
Sex			
Male	24	24	48
Female	18	18	36
GMFCS Level			
I	6	7	13
II	11	10	21
III	14	13	27
IV	7	7	14
V	4	5	9

Table 1. Baseline Characteristics of Participants (N = 84)



3.3 Within-Group Changes in Enjoyment

Children in the Immediate Play group demonstrated a substantial increase in enjoyment following the 12-week structured play-based physical activity programme. Mean PACES scores increased from 59.93 ± 6.33 at baseline to 69.40 ± 5.63 post-intervention, resulting in a mean change of +9.48 ± 3.11. This improvement was statistically significant ($t = 19.75$, $p < 0.001$) and reflects a large enhancement in positive affect and engagement associated with physical activity [6, 14].

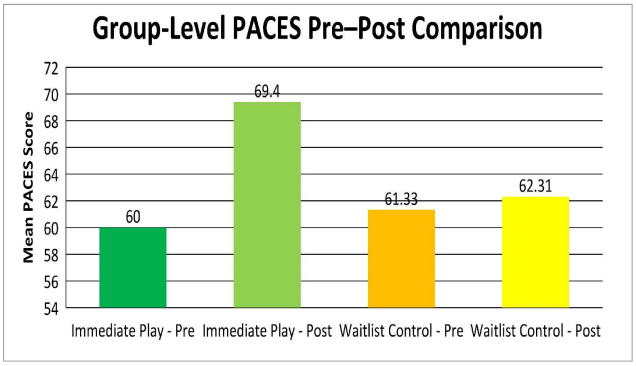
In contrast, the Wait-List Control group showed only a minimal increase in enjoyment over the same period. Mean PACES scores increased from 61.36 ± 8.50 to 62.26 ± 8.37, corresponding to a mean change of +0.90 ± 0.91. Although this change reached statistical significance ($t = 6.48$, $p < 0.001$), the magnitude of improvement was small and likely reflects measurement sensitivity or routine exposure rather than meaningful experiential changew [7, 12].

3.4 Between-Group Comparison

Comparison of change scores between groups revealed a marked and statistically significant difference in favour of the Immediate Play group. The mean difference in PACES change scores was 8.58 points ($t = 17.15$, $p < 0.001$). The corresponding effect size was extremely large (Cohen's $d = 3.74$), indicating a robust intervention effect that substantially exceeded thresholds typically observed in behavioural and rehabilitation interventions [13, 19, 22].

Group	Pre (Mean ± SD)	Post (Mean ± SD)	Mean Change ± SD	t-value	p-value
Immediate Play (n=42)	59.93 ± 6.33	69.40 ± 5.63	+9.48 ± 3.11	19.75	1.47×10^{-22}
Wait-List (n=42)	61.36 ± 8.50	62.26 ± 8.37	+0.90 ± 0.91	6.48	9.12×10^{-8}

Between-group comparison: Mean Difference = 8.58 | t= 17.15 |$p=4.39\times10^{-22}$|d=3.74



The consistency of improvement across participants and the magnitude of effect suggest that the structured play-based programme had a strong and uniform impact on enjoyment, independent of baseline functional level [2, 21].

3.5 Summary of Key Findings

Overall, the results demonstrate that participation in a structured play-based physical activity programme led to a pronounced and clinically meaningful increase in enjoyment among children with cerebral palsy. The minimal change observed in the Wait-List Control group underscores that enjoyment does not increase spontaneously over time but is responsive to intentional, child-centred intervention design focused on play, choice, and engagement [4, 6, 14].

4. Discussion

The present randomized wait-list controlled trial demonstrated that a structured play-based physical activity programme produced a large and clinically meaningful improvement in enjoyment among children with cerebral palsy. Children who participated in the Immediate Play group showed a substantial increase in PACES scores compared with minimal change in the Wait-List Control group, with an exceptionally large effect size. These findings confirm that enjoyment is highly responsive to structured, child-centred play interventions and should be considered a core therapeutic outcome in paediatric rehabilitation.

4.1 Interpretation of Findings

The observed improvement in enjoyment reflects enhanced positive affect, engagement, and emotional involvement during physical activity. According to intrinsic motivation theory, enjoyment plays a central role in sustaining behaviour by supporting autonomy, competence, and relatednessv [6, 14]. The play-based design of the intervention deliberately incorporated these motivational elements by allowing children to choose activities, interact socially, and experience success at an individually appropriate level. This approach likely contributed to the magnitude and consistency of the observed improvements.

In contrast, the minimal improvement observed in the Wait-List Control group suggests that enjoyment does not increase automatically through routine exposure or unstructured activity. Without intentional incorporation of playfulness,

choice, and novelty, physical activity may fail to elicit meaningful emotional engagement in children with CP. This finding reinforces the view that enjoyment should be treated as an active therapeutic target rather than asecondary by-product of interventiont [3, 19, 15].

Relevance to Participation and Rehabilitation Frameworks

Within the International Classification of Functioning, Disability and Health (ICF), enjoyment is closely linked to participation, influencing how frequently and meaningfully children engage in activities [3, 1v]. Children with cerebral palsy often experience participation restrictions that extend beyond physical impairments and are shaped by environmental and psychosocial factors [3, 19, 15]. By enhancing enjoyment, play-based interventions may help reduce these barriers to participation and support more sustained involvement in physical activity.

The findings also align strongly with the "F-words for child development" framework, which places fun at the centre of meaningful functioningt. By prioritising enjoyment, the intervention addressed not only physical engagement but also social interaction and emotional well-being. This alignment highlights the applicability of participation-focused frameworks in guiding effective rehabilitation strategies for children with CP.

4.2 Implications for Motor Learning, Social Interaction, and Quality of Life

Although motor performance and participation frequency were not directly measured in this study, enjoyment is recognised as a key mechanism through which broader functional outcomes may be influenced. Motor learning depends on repeated, self-initiated practice, which is more likely to occur when activities are perceived as enjoyable [19, 22]. Play-based activities that are engaging and meaningful encourage repetition, persistence, and exploration, thereby creating favourable conditions for motor skill development.

Similarly, social play activities incorporated into the intervention may have facilitated peer interaction, cooperation, and communication. Social participation has been shown to contribute significantly to emotional well-being and perceived quality of life in children with disabilitiesu [5, 12, 17]. From this perspective, the large improvement in enjoyment observed in the present study represents an important therapeutic mechanism through which long-term participation and psychosocial benefits may emerge.

4.3 Comparison with Existing Evidence

While relatively few studies have examined enjoyment as a primary outcome in cerebral palsy rehabilitation, previous research has shown that play-based and activity-focused interventions can enhance motivation, engagement, and participation in children with disabilities [13, 19, 22]. The present study extends this literature by providing robust randomized evidence that structured play-based physical activity can substantially enhance enjoyment across GMFCS levels I–V. These findings support a shift away from impairment-focused models toward participation-oriented, child-centred rehabilitation approaches [10, 20, 23].

5. Clinical Implications, Strengths, and Limitations

5.1 Clinical Implications

The findings of this study have important implications for paediatric rehabilitation practice. The substantial improvement in enjoyment observed following the structured play-based physical activity programme indicates that enjoyment should be considered a primary therapeutic target rather than a secondary outcome. Enjoyment is closely linked to intrinsic motivation, which influences a child's willingness to initiate, sustain, and repeat physical activity over time [6, 14]. By designing interventions that are enjoyable, therapists may enhance engagement and reduce resistance to therapy, thereby improving the likelihood of sustained participation beyond the clinical setting.

The effectiveness of the intervention across children classified at GMFCS levels I–V suggests that play-based approaches can be successfully adapted to a wide range of functional abilities [2, 21]. Individualised activity grading and flexible task modification allowed children with varying levels of motor impairment to participate meaningfully, supporting inclusive practice in rehabilitation. This finding reinforces the importance of tailoring play activities to functional capacity rather than excluding children based on severity of impairment [25].

Play-based physical activity also has the potential to influence broader participation outcomes. Enjoyment facilitates repeated engagement, which is essential for motor learning, physical conditioning, and skill acquisition [19, 22] Additionally, play that involves shared goals and peer interaction can promote social participation, communication, and cooperative behaviour, which are often limited in children with cerebral palsy [3, 17]. From a participation perspective, integrating enjoyable play into therapy aligns closely with the ICF framework and contemporary participation-focused models of care [3, 16].

Beyond the clinical environment, the results support the inclusion of play-based physical activity in home and school settings. Encouraging caregivers and educators to create accessible, enjoyable play opportunities may help reinforce therapeutic gains and promote consistent participation in activities. Such strategies may contribute to improved emotional well-being and health-related quality of life over timeu [3, 12, 15].

5.2 Strengths

This study has several methodological strengths that enhance confidence in the findings. The randomized wait-list controlled design allowed for robust comparison while ensuring ethical access to the intervention for all participants [10, 20]. Inclusion of children across the full GMFCS spectrum improved the generalisability of results to a broad cerebral palsy population [2, 21]. The use of a validated and sensitive measure of enjoyment (PACES) strengthened the assessment of affective response to physical activityw [7, 12]. High intervention adherence, absence of attrition, and blinded outcome assessment further support the study's internal validity.

5.3 Limitations

Despite these strengths, certain limitations should be considered when interpreting the findings. The study focused on immediate post-intervention outcomes; long-term maintenance of enjoyment and sustained participation were not evaluated. Longitudinal follow-up is needed to determine whether improvements in enjoyment translate into enduring behavioural change and increased participation in physical activity over time [15, 16].

The study was conducted at a single centre, which may limit generalisability to other settings or service delivery models. Additionally, functional motor outcomes, participation frequency, and quality of life were not directly measured. Although enjoyment is theoretically linked to these domains, future studies should include combined outcome measures to more comprehensively evaluate the impact of play-based interventions [19, 22, 23].

Blinding of participants and therapists was not feasible due to the nature of the intervention, which may introduce performance bias. However, this limitation is common in behavioural and rehabilitation trials and was partially mitigated by blinded outcome assessment and standardised intervention protocols [10, 20].

6. Conclusion

This randomized wait-list controlled trial demonstrated that a structured play-based physical activity programme leads to a large and clinically meaningful improvement in enjoyment among children with cerebral palsy across GMFCS levels [I–V², 21]. Enjoyment is a central determinant of motivation and sustained engagement in physical activity, and enhancing it represents an important therapeutic mechanism for promoting meaningful participationv [6, 14].

Children with cerebral palsy frequently experience participation restrictions that extend beyond motor impairments and are influenced by environmental, social, and motivational factors [3, 9, 15]. By intentionally embedding play, choice, and social interaction within physical activity, the intervention addressed these factors and produced substantial gains in positive affect and engagement. These findings align with contemporary participation-focused rehabilitation frameworks, including the International Classification of Functioning, Disability and Health and the “F-words for child development,” which emphasise enjoyment as a core component of meaningful functioning [3, 4, 16].

Although functional motor performance and participation frequency were not directly assessed, enjoyment is strongly associated with repeated practice, persistence, and voluntary engagement in activity [19, 22]. From this perspective, the observed increase in enjoyment may facilitate downstream benefits in motor learning, social participation, and health related quality of life over timeu [5, 12, 17] Future research should examine these pathways using combined outcome measures and long-term follow-up designs.

In conclusion, incorporating enjoyable, child-centred play into rehabilitation should be considered a key strategy in paediatric cerebral palsy care. Interventions that prioritise enjoyment have the potential to enhance motivation,

support sustained participation, and contribute to more meaningful and sustainable rehabilitation outcomes for children with cerebral palsy [10, 20, 23].

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