# Effectiveness of Play-Based Therapy on Gross Motor Development in Developmental Coordination Disorder

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## *Abstract*

*Developmental Coordination Disorder (DCD) is a neurodevelopmental condition affecting motor coordination, daily activities, academics, and physical activity in children. Traditional therapy often relies on repetitive exercises, which can reduce engagement. Play-based therapy (PBT) incorporates motor skill training into enjoyable play, enhancing motivation and functional outcomes. Research on PBT in Pakistan is limited. This study evaluated a 12-week PBT program for 60 children aged 6–10 years with DCD in Islamabad and Rawalpindi. Participants were divided into an intervention group (n = 30) receiving twice-weekly 60-minute PBT sessions and a control group (n = 30) receiving standard care. Gross motor function (GMFM-88) and motor coordination/balance (MABC-2) were measured at baseline, post-intervention, and three-month follow-up. Results showed significant improvements in the intervention group. GMFM-88 scores rose from 56.7 ± 8.1 to 68.4 ± 7.3 post-intervention, remaining stable at 67.9 ± 7.6 at follow-up, while controls showed minimal change. MABC-2 scores improved from 61.4 ± 6.5 to 72.8 ± 5.9 (follow-up 71.9 ± 6.1). Repeated measures ANOVA indicated significant group × time effects (GMFM: $F(2,116)=11.42$, $p<.001$, $\eta^2=.16$; MABC-2: $F(2,116)=9.87$, $p=.002$, $\eta^2=.14$). PBT proved effective, engaging, and culturally adaptable, leading to high adherence and meaningful motor gains. Limitations include small sample size, short follow-up, and non-randomized design. Future research should explore long-term outcomes, larger randomized samples, and psychosocial benefits. These findings support integrating enjoyable, culturally relevant play-based strategies in pediatric rehabilitation.*

**Keywords:** Developmental Coordination Disorder, Gross Motor Development, Play-Based Therapy, Pediatric Rehabilitation, Motor Coordination, GMFM-88, MABC-2, Pakistan.

## Introduction

Developmental Coordination Disorder (DCD) is a neurodevelopmental condition characterized by marked difficulties in acquiring and performing motor skills, significantly impacting academic performance and daily functioning (American Psychiatric Association, 2013). Globally, prevalence estimates range from 5–6%, with similar rates reported in South Asian populations (Lingam et al., 2009; Huque et al., 2016). Children with DCD often exhibit poor balance, impaired

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coordination, and delayed motor milestones, which can lead to psychosocial challenges and reduced participation in physical activities (Missiuna et al., 2014).

Traditional therapeutic approaches for DCD have emphasized task-specific training, cognitive strategies, and principles of motor learning (Blank et al., 2019). More recently, play-based therapy (PBT) has emerged as a promising intervention. PBT integrates therapeutic motor goals within structured, child-initiated play activities, harnessing children's natural motivation and engagement to support motor skill development and generalization (Bundy et al., 2008; Case-Smith & O'Brien, 2014).

Despite a growing international evidence base for PBT, research from low- and middle-income countries, including Pakistan, remains limited. Contextual factors such as resource constraints, cultural practices, and restricted access to specialized services may influence rehabilitation outcomes (Mahmood et al., 2021). Addressing this gap, the present study evaluates the effectiveness of a culturally adapted play-based therapy program on gross motor development in Pakistani children with DCD.

Children with DCD typically demonstrate motor performance substantially below expectations for their age and opportunities for skill acquisition, manifesting as gait abnormalities, balance deficits, and poor ball skills (DSM-5; APA, 2013; Wilson et al., 2013). These motor impairments are frequently associated with low self-esteem, psychosocial difficulties, and reduced engagement in sports and recreational activities (Cairney et al., 2013).

Play is a primary context for skill acquisition during childhood. Grounded in motor learning theory, play-based therapy leverages age-appropriate play tasks to promote practice of targeted motor skills (Therapeutic Play Framework; Bundy et al., 2008). Evidence supports its effectiveness across various pediatric populations, including cerebral palsy, autism spectrum disorders, and sensory-motor delays (Morrison et al., 2015; Perlmutter & Goodgold, 2020). In children with DCD, play-based interventions have demonstrated moderate improvements in balance, coordination, and overall motor competence (Smits-Engelsman & Wilson, 2013; Kluzik et al., 2016).

In Pakistan, rehabilitation research remains underrepresented. Socio-cultural factors, limited pediatric therapeutic services, and low caregiver awareness can hinder intervention uptake (Afzal et al., 2020). Culturally adapted play-based interventions offer a promising approach by aligning therapy with natural child engagement and leveraging available community resources.

The primary aim of this study was to evaluate the effectiveness of a culturally adapted play-based therapy program in improving gross motor development among children diagnosed with DCD in Pakistan.

## Methodology

This study utilized a quasi-experimental pretest–posttest control group design to assess the effectiveness of play-based therapy on gross motor development in children diagnosed with Developmental Coordination Disorder (DCD) in Pakistan. A quasi-experimental approach was adopted due to ethical and institutional limitations that made random assignment unfeasible within clinical rehabilitation settings. Participants were allocated to either an intervention group, which received play-based therapy, or a control group, which continued with standard rehabilitation care. Both groups underwent assessments at three distinct time points: baseline (pre-intervention), immediately post-intervention (after 12 weeks), and at a follow-up session conducted three months after the intervention. This design enabled the evaluation of changes in gross motor development over time and the comparison of outcomes between the two groups.

**Participants**

Participants were selected for this study based on specific inclusion and exclusion criteria. Children eligible for participation were aged between 6 and 10 years and had a clinical diagnosis of Developmental Coordination Disorder (DCD) according to DSM-5 criteria. Additionally, participants were required to score at or below the 5th percentile on the Movement Assessment Battery for Children-2 (MABC-2) and demonstrate the ability to follow simple verbal instructions. Children with severe intellectual disabilities were not included. Exclusion criteria were applied to ensure the specificity of the sample; children were excluded if they had other neurological disorders such as cerebral palsy, muscular dystrophy, or epilepsy, or if they had severe visual or hearing impairments. Furthermore, children currently enrolled in another intensive motor intervention program were not considered for participation. This careful selection ensured that the study focused on children with DCD without confounding conditions.

**Sample Size**

The study included a total of 60 children, equally divided into two groups: 30 children in the Play-Based Therapy (PBT) group and 30 children in the Control group. The sample size was determined through a priori power analysis using G*Power software, with a moderate effect size of 0.30, an alpha level of 0.05, and a desired statistical power of 0.80. The analysis indicated that a minimum of 54 participants was required to detect significant effects; therefore, 60 children were recruited to accommodate potential attrition and ensure adequate statistical power.

**Sampling Technique**

A non-probability purposive sampling technique was employed to recruit participants from selected rehabilitation centers. Eligible children were identified through therapist referrals and review of clinical records. Following a screening process based on predefined inclusion criteria, participants were allocated into intervention and control groups using a matched assignment strategy that considered age, gender, and baseline GMFM scores. This method ensured comparability between the groups while adhering to ethical standards in clinical practice.

**Interventions**: **Play-Based Therapy Program**

The intervention was conducted over a duration of 12 weeks, with participants attending two sessions per week, each lasting 60 minutes, for a total of 24 sessions. Each session was structured into three components: a 10-minute warm-up, 40 minutes of core play activities, and a 10-minute cool-down. The warm-up included light stretching and simple locomotor movements to prepare children for activity. The core play segment consisted of obstacle courses, ball throwing and catching games, hopscotch and balance beam tasks, relay races, and various jumping and hopping activities. The cool-down involved relaxation exercises and feedback discussions to consolidate learning and encourage reflection. The intervention was grounded in key therapeutic principles, including motor learning theory, task-specific training, repetition with variation, progressive difficulty levels, and positive reinforcement. All activities were culturally adapted to align with common play patterns of Pakistani children.

The control group received standard occupational and physical therapy services as routinely provided at the rehabilitation centers, focusing on traditional motor exercises without structured play-based components. To assess outcomes, the Gross Motor Function Measure (GMFM-88) was used to evaluate motor skills across five domains: lying and rolling, sitting, crawling and kneeling, standing, and walking, running, and jumping. The GMFM-88 has high reliability (ICC > .95) and

strong validity in pediatric populations. Additionally, the Movement Assessment Battery for Children-2 (MABC-2) assessed motor coordination through manual dexterity, aiming and catching, and balance, providing percentile rankings to determine motor impairment severity, with demonstrated reliability ($\alpha > .80$).

The study procedure began with obtaining permission from the rehabilitation centers, followed by screening eligible children using the MABC-2. Informed consent was obtained from parents, and baseline assessments were conducted using GMFM-88 and MABC-2 by evaluators blinded to group allocation. Participants then completed the 12-week intervention, followed by post-intervention and three-month follow-up assessments. All data were coded and analyzed using SPSS Version 26. To minimize bias, assessments were conducted by trained therapists who were not involved in delivering the intervention.

**Analysis**

Data analysis was conducted using the Statistical Package for Social Sciences (SPSS) Version 27. The preliminary analysis involved descriptive statistics, including means, standard deviations, frequencies, and percentages, to summarize the characteristics of the study variables. Normality of the data was assessed using the Shapiro-Wilk test, while homogeneity of variance was evaluated with Levene's test. For inferential analysis, an independent samples t-test was performed to compare baseline differences between groups. Repeated measures ANOVA was used to assess within-group changes over time and to examine group × time interaction effects. Effect sizes were calculated using Partial Eta Squared ($\eta^2$) for ANOVA and Cohen's d for t-test comparisons to determine the magnitude of observed effects. The significance level was set at an alpha of 0.05. Any missing data were addressed using the last observation carried forward (LOCF) method to maintain the integrity of the dataset.

## Results

Before conducting inferential statistics, assumptions of normality, homogeneity of variance, and sphericity were tested. Data met all assumptions for parametric analyses.

**Table 1: Normality and Homogeneity of Variance**

| Variable | Shapiro-Wilk (p) | Levene's F | Levene's p |
|---|---|---|---|
| GMFM_Baseline | .18 | — | — |
| GMFM_Post | .12 | 0.34 | .56 |
| MABC_Baseline | .22 | — | — |
| MABC_Post | .16 | 0.41 | .52 |

*Note:* All p-values > .05 indicate normality and homogeneity of variance assumptions were satisfied.

**Table 2: Baseline Comparisons Between Groups**

| Variable | Group | N | Mean | SD | t | df | p |
|---|---|---|---|---|---|---|---|
| GMFM_Baseline | PBT | 30 | 56.70 | 8.10 | -0.71 | 58 | .48 |
| | Control | 30 | 58.10 | 7.90 | | | |
| MABC_Baseline | PBT | 30 | 61.40 | 6.50 | -0.48 | 58 | .63 |
| | Control | 30 | 62.20 | 6.10 | | | |

*Note:* No significant baseline differences; groups were comparable before intervention.

**Table 3: GMFM-88 Scores Across Time**

| Group | Time | Mean | SD |
|---|---|---|---|
| PBT | Baseline | 56.70 | 8.10 |
| | Post | 68.40 | 7.30 |
| | FollowUp | 67.90 | 7.60 |
| Control | Baseline | 58.10 | 7.90 |
| | Post | 61.20 | 8.00 |
| | FollowUp | 60.80 | 7.80 |

**Table 4: Repeated Measures ANOVA – GMFM-88**

| Effect | F | p | Partial $\eta^2$ |
|---|---|---|---|
| Time | 28.34 | <.001 | .33 |
| Time × Group | 11.42 | <.001 | .16 |
| Between Groups | 14.62 | <.001 | .20 |

*Note:* Large effect sizes indicate strong clinical impact of play-based therapy.

**Table 5: MABC-2 Scores Across Time**

| Group | Time | Mean | SD |
|---|---|---|---|
| PBT | Baseline | 61.40 | 6.50 |
| | Post | 72.80 | 5.90 |
| | FollowUp | 71.90 | 6.10 |
| Control | Baseline | 62.20 | 6.10 |
| | Post | 65.40 | 6.40 |
| | FollowUp | 65.10 | 6.60 |

**Table 6: Repeated Measures ANOVA – MABC-2**

| Effect | F | p | Partial $\eta^2$ |
|---|---|---|---|
| Time | 22.71 | <.001 | .28 |
| Time × Group | 9.87 | .002 | .14 |
| Between Groups | 10.93 | .002 | .16 |

*Note:* Partial $\eta^2 > .14$ indicates large effects for both GMFM and MABC outcomes.

There were no significant baseline differences between PBT and control groups on GMFM-88 or MABC-2 scores ($p > .05$). Repeated measures ANOVA revealed significant main effects of time and significant time × group interactions for both GMFM-88 and MABC-2 ($p < .001$ for GMFM, $p = .002$ for MABC). Between-group comparisons indicated that the PBT group achieved significantly higher post-intervention and follow-up scores than controls. Effect sizes (partial $\eta^2$) were large for both outcomes (GMFM $\eta^2 = .16$; MABC $\eta^2 = .14$), demonstrating a strong clinical impact of play-based therapy on gross motor function and coordination.

## Discussion

The findings of this study align with the growing body of research indicating that play-based, task-oriented interventions are effective in improving gross motor development and coordination in children with developmental coordination disorder (Smits-Engelsman et al., 2018). The significant improvements in GMFM-88 and MABC-2 scores observed in the intervention group are consistent with the results of Cairney et al. (2013), who reported that structured, enjoyable motor activities enhanced balance and coordination in children with DCD more effectively than conventional exercises. Similarly, Wilson et al. (2017) demonstrated that interventions emphasizing repetitive, goal-directed motor tasks embedded in play contexts led to significant gains in gross motor function, supporting the notion that play can facilitate motor learning through motivation and active engagement.

However, while the magnitude of improvement in the present study is comparable to that reported by Polatajko et al. (2019), the duration of follow-up differs. Whereas Polatajko and colleagues observed improvements maintained over six months, the current study only assessed outcomes at three months post-intervention, limiting long-term generalizability. Despite this, the sustained gains at follow-up suggest that even short-term play-based programs can produce meaningful and lasting changes in motor ability. Additionally, Sugden and Chambers (2011) emphasized that interventions focusing solely on isolated skill training may yield short-lived improvements, whereas the play-based, functional approach employed in this study promotes transfer of motor skills to daily activities, which may explain the observed retention of gains.

In contrast to some previous studies that utilized larger samples or randomized controlled designs (Smits-Engelsman et al., 2013), this study used a quasi-experimental design with purposive sampling due to practical constraints within clinical settings in Pakistan. While this may limit external validity, it reflects the real-world feasibility of implementing such interventions in resource-limited contexts. Furthermore, the study addressed both gross motor function and motor coordination comprehensively, whereas several earlier studies focused predominantly on either balance or upper limb coordination alone (Cairney et al., 2012). This holistic assessment strengthens the argument for play-based therapy as a multidimensional intervention capable of producing improvements across various motor domains.

Critically, the study adds to existing literature by providing evidence from a South Asian context, where research on pediatric rehabilitation for DCD is limited. Most prior studies have been conducted in Western populations (Wilson et al., 2017; Polatajko et al., 2019), and cultural differences in children's play and therapy engagement may influence outcomes. By adapting play-based activities to culturally relevant games and routines, this study demonstrates that contextualized interventions can be both effective and feasible, an aspect not extensively examined in previous literature. This highlights the importance of cultural adaptation in pediatric motor interventions, supporting the notion proposed by Sugden and Chambers (2011) that context-specific strategies may enhance adherence and functional gains.

Finally, while the study supports the efficacy of play-based therapy, the critical comparison with prior research indicates areas for further investigation. Long-term follow-up, larger randomized samples, and examination of psychosocial outcomes such as motivation, self-efficacy, and participation in daily activities would provide a more comprehensive understanding of the intervention's impact (Smits-Engelsman et al., 2018; Cairney et al., 2013). Overall, the findings corroborate the existing evidence base while extending knowledge to a Pakistani pediatric population and highlighting the importance of culturally adapted, engaging, and multidimensional interventions for children with DCD.

## Conclusion

In conclusion, the study provides empirical evidence that play-based therapy is an effective intervention for enhancing gross motor development and motor coordination in children with DCD in Pakistan (Polatajko et al., 2019). Significant improvements were observed in GMFM-88 and MABC-2 scores, which were maintained at follow-up, demonstrating the potential for long-term benefits. While limitations related to sample size, study design, and follow-up duration exist, the findings underscore the clinical relevance of engaging, task-specific, and child-centered play interventions in pediatric rehabilitation. The study contributes to the growing body of literature supporting play-based approaches as a feasible and effective therapeutic strategy, emphasizing their importance for improving functional outcomes and participation in everyday activities for children with developmental motor disorders (Smits-Engelsman et al., 2013; Wilson et al., 2017).

### Implications

Findings highlight the value of play-based therapy in improving gross motor skills, balance, and coordination in children with DCD in Pakistan. Child-centered, engaging activities may enhance motivation and therapy adherence. Educators and therapists are encouraged to integrate structured play into school and community motor programs, while rehabilitation professionals should receive training in culturally adapted play-based techniques. Policymakers could support specialized motor skill programs to benefit children with developmental coordination challenges.

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