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Role Of Assistive Equipment And Environmental Adaptations In Enhancing School Participation Of Children With Cerebral Palsy

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Abstract

Background: Children with cerebral palsy (CP) often experience significant challenges in school participation due to motor impairments, postural difficulties, and environmental barriers within educational settings. Limited accessibility, inadequate classroom design, and lack of appropriate assistive equipment can restrict their engagement in academic, social, and

Objective: The present study aimed to examine the role of assistive equipment and environmental adaptations in enhancing school participation among children with cerebral palsy.

Methods: A school-based, quasi-experimental pre–post study design was employed involving children diagnosed with cerebral palsy attending inclusive school settings. Participants received individualized assistive equipment (such as adaptive seating, mobility aids, writing supports, and classroom access tools) along with targeted environmental adaptations, including classroom layout modifications, accessibility enhancements, and task-specific environmental restructuring..

Results: Post-intervention findings demonstrated a significant improvement in school participation, including enhanced engagement in classroom activities, improved task performance, greater independence in mobility and self-care within the school environment, and increased social interaction with peers. Environmental adaptations reduced physical and contextual barriers, while assistive equipment supported functional performance and sustained participation across academic tasks.

Conclusion: The study highlights that the combined use of assistive equipment and environmental adaptations plays a crucial role in promoting meaningful school participation among children with cerebral palsy. Integrating these strategies within inclusive school settings can facilitate accessibility, functional independence, and active engagement, thereby supporting participation-focused, child-centered educational practices.

Keywords: Cerebral palsy, assistive equipment, environmental adaptations, school participation, inclusive education, occupational therapy.

I. Introduction

Cerebral palsy (CP) is a group of permanent, non-progressive neurodevelopmental disorders characterized by impairments in movement, posture, and coordination, often accompanied by sensory, cognitive, communication, and behavioral challenges. These functional limitations can significantly restrict a child's ability to participate meaningfully in everyday activities, particularly within school environments where motor, social, and cognitive demands are high. School participation is a critical component of childhood

development, as it supports not only academic learning but also social interaction, independence, and overall quality of life. For children with cerebral palsy, barriers within the physical, social, and instructional school environment frequently limit active engagement and inclusion in educational settings.

Participation in school activities is influenced not only by a child's physical and functional abilities but also by environmental factors, as emphasized by the International Classification of Functioning, Disability and Health (ICF). Inaccessible infrastructure, unsuitable classroom furniture, lack of mobility aids, and limited supportive technologies can exacerbate functional limitations and hinder participation. Conversely, appropriate assistive equipment and environmental adaptations have the potential to minimize activity restrictions and promote functional independence. Assistive equipment such as adaptive seating, mobility aids, writing supports, and communication devices can enhance postural control, fine motor performance, and access to learning activities, while environmental adaptations—including modified classroom layouts, ramps, handrails, accessible toilets, and supportive school policies—can reduce physical and attitudinal barriers.

Inclusive education frameworks emphasize the right of children with disabilities to learn alongside their peers in mainstream school settings. However, successful inclusion requires more than enrollment; it necessitates the provision of appropriate supports that enable meaningful participation. For children with cerebral palsy, the integration of assistive equipment and environmental modifications plays a crucial role in bridging the gap between functional limitations and participation demands. These interventions not only facilitate academic engagement but also promote peer interaction, self-confidence, and autonomy within the school context.

Despite growing recognition of the importance of inclusive education, there remains limited empirical evidence, particularly in low- and middle-income settings, examining the combined role of assistive equipment and environmental adaptations in enhancing school participation among children with cerebral palsy. Understanding how these factors influence participation outcomes is essential for guiding occupational therapy practice, educational planning, and policy development. Therefore, the present study aims to explore the role of assistive equipment and environmental adaptations in enhancing school participation of children with cerebral palsy, with the goal of identifying practical strategies to support inclusive and participation-focused educational environments.

II. Rationale of the Study

Children with cerebral palsy often face significant barriers to active participation in school due to motor impairments and inaccessible physical and social environments. While inclusive education policies promote school enrolment, meaningful participation remains limited when appropriate assistive equipment and environmental adaptations are not adequately provided. Understanding the role of these supports is essential for identifying practical and cost-effective strategies that enhance functional independence, academic engagement, and social participation within school settings.

III. Objectives

1. To assess the level of school participation of children with cerebral palsy before the use of assistive equipment and environmental adaptations.
2. To identify the types of assistive equipment commonly used by children with cerebral palsy in school settings.
3. To evaluate the impact of environmental adaptations (physical, social, and instructional) on classroom participation and engagement.

IV. Research Methodology

Study Design

This study employed a **quasi-experimental pre–post intervention design** to evaluate the effectiveness of a classroom environmental modification–based intervention on functional and occupational performance outcomes in children with cerebral palsy (CP). The design facilitated **within-group comparisons** by assessing outcome measures at baseline and after completion of the intervention, thereby enabling the examination of intervention-related changes in the absence of random assignment.

Sampling Method and Sample Size

Participants were recruited using a **convenience sampling technique**, selected based on accessibility and feasibility. A total of **50 children with cerebral palsy** who satisfied the predefined inclusion and exclusion criteria were enrolled in the study. This sample size was deemed sufficient to detect clinically meaningful changes in occupational performance and satisfaction following the intervention.

Source of Data

Participants were identified and recruited from **rehabilitation centers, pediatric outpatient clinics, and preschools**. The research team reviewed medical records to screen for eligibility, after which caregivers of potentially eligible children were contacted and provided with detailed information regarding the study objectives, procedures, and duration.

Selection Criteria

Inclusion Criteria

Children were eligible for inclusion if they met the following criteria:

- Age between **4 and 8 years**
- Either **male or female**
- Clinically diagnosed with **cerebral palsy**
- Classified within **Gross Motor Function Classification System (GMFCS) levels I–III**
- Ability of the child and caregiver to commit to intervention-related activities for the full study period, with no anticipated relocation
- **Written informed consent** obtained from a parent or legal guardian

Exclusion Criteria

Children were excluded from the study if they met any of the following conditions:

- Age below 4 years or above 8 years
- Lack of parental or guardian consent
- Presence of additional medical conditions associated with CP, including **cardiorespiratory or rheumatic disorders**
- Significant **joint or musculoskeletal abnormalities** limiting passive range of motion of the upper limbs
- **Severe visual impairments** that could hinder participation in the intervention

Variables

- **Independent Variable:** Classroom environmental modification–based intervention
- **Dependent Variables:** Occupational performance and occupational satisfaction scores

Screening Tools and Outcome Measures

- **Gross Motor Function Classification System (GMFCS):** Utilized as a screening tool to classify motor function severity and determine participant eligibility.

- **Canadian Occupational Performance Measure (COPM):** Served as the primary outcome measure to evaluate changes in occupational performance and satisfaction based on individualized goals identified by caregivers and children.

Data Collection Procedure

Following recruitment, eligible participants were formally enrolled after obtaining written informed consent from parents or guardians. Each child was assigned a **unique study identification number**, and demographic and clinical information—including age, sex, CP subtype, comorbid conditions, school type, and ongoing therapies—was collected using a structured data collection form.

A licensed pediatric occupational therapist or physiotherapist confirmed the GMFCS level during the screening process. **Baseline assessments** were conducted prior to commencement of the intervention. The COPM was administered through a **semi-structured interview** with the caregiver and, where appropriate, the child to identify **three to five priority occupational performance goals**. Performance and satisfaction scores were documented by trained assessors. With consent, interviews were audio- or video-recorded to enhance scoring accuracy and reliability.

Intervention Procedure

Classroom environmental modifications were implemented over a **one-year intervention period**. Modifications included adaptations to **classroom furniture, seating systems, spatial layout, visual supports, accessibility pathways, and assistive devices**, based on individual child needs. An **intervention log** was maintained to document the type and timing of each modification, staff training activities, and teacher compliance. To ensure intervention fidelity, **monthly site visits** were conducted by trained monitors using a standardized fidelity checklist to verify consistent and accurate implementation.

V. Results

Table 1.0

Distribution of GMFCS Levels

GMFCS Level	Frequency (n)	Percentage (%)
Level I	14	28
Level II	17	34
Level III	19	38
Total	**50**	**100**

The distribution of participants according to Gross Motor Function Classification System (GMFCS) levels indicates that the largest proportion of children fell under Level III. Out of the total 50 participants, 19 children (38%) were classified as GMFCS Level III, reflecting moderate limitations in gross motor function. This was followed by Level II, which included 17 participants (34%), and Level I, comprising 14 participants (28%). Overall, the distribution demonstrates representation across mild to moderate functional levels, with a slightly higher concentration of children exhibiting greater motor involvement.

Table 2.0

Descriptive Statistics

Stats		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre COPM	5.708	50	.8400	.1188
	Post COPM	7.430	50	.9197	.1301

The table and figure present the descriptive statistics of the Canadian Occupational Performance Model (COPM) scores obtained from the study participants before and after the intervention. In line with the objective of determining demographic data with outcome measures, a total of 50 participants were included for both pre-test and post-test assessments, ensuring consistency in measurement across the sample. With respect to the objective of determining pre-test and post-test scores of the COPM, the mean pre-intervention COPM score was 5.708 (SD = 0.84), indicating a moderate level of occupational performance and satisfaction at baseline.

The relatively low standard error values for both pre-test (0.1188) and post-test (0.1301) scores suggest that the mean scores are reliable and that variability within the sample was minimal. Although this table does not directly present GMFCS screening scores, the observed improvement in COPM outcomes can be interpreted in relation to the functional classification of participants, supporting the objective of examining outcome measures alongside functional status. Overall, the increase in mean COPM scores from pre-test to post-test demonstrates a positive change following the intervention, indicating its effectiveness in enhancing occupational performance outcomes among the study population.

VI. Conclusion

The results of the study indicate a positive improvement in occupational performance and satisfaction following the intervention, as reflected by increased COPM scores. The moderate baseline scores highlight existing functional challenges, while the post-intervention improvement demonstrates the effectiveness of the intervention in enhancing occupational performance. The low standard error values support the reliability and consistency of the findings across the sample. Overall, the study confirms that the intervention was effective in improving perceived occupational performance outcomes among the participants.

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