

The Effect of an Adapted Motor Education Program on Basic Control Skills in Children with Intellectual Disabilities: An Experimental Study Conducted on Educable Boys Aged 6–8 Years in Oran, Algeria

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Abstract: Objective: This experimental study aimed to evaluate the effectiveness of an Adapted Motor Education Program in developing three basic control skills—grasping, throwing, and hanging—among educable children with intellectual disabilities aged 6–8 years in Oran, Algeria. **Method:** A pilot study involving six (6) children was first conducted to verify the clarity, feasibility, and reliability of the assessment tools and testing procedures. These children were excluded from the main sample. From the initial population, eleven (11) children were excluded due to comorbid disabilities, excessive weight, or the absence of a comparable peer for matched-pair allocation, and four (4) others were excluded due to repeated absences or behavioral irregularities. The final experimental sample thus consisted of twenty (20) educable boys with intellectual disabilities, matched in pairs by age, gender, IQ, height, and weight. Within each matched pair, one child was randomly assigned to the experimental group (n = 10) and the other to the control group (n = 10). The experimental group participated in an 18-session Adapted Motor Education Program (three sessions per week, 45 minutes each) over six weeks, while the control group continued their regular activities. Pre- and post-tests were conducted using Basic Control Skills Tests assessing grasping, throwing, and hanging under standardized conditions. Data were analyzed using paired-sample t-tests and independent-sample t-tests. **Results:** Post-test results showed statistically significant improvements ($p < 0.05$) in the experimental group compared to the control group in all three basic control skills: grasping (+44.4%), throwing (+100%), and hanging (+54.5%). **Conclusions:** The findings confirm the effectiveness of the Adapted Motor Education Program in improving grasping, throwing, and hanging skills among educable children with intellectual disabilities. The study highlights the importance of integrating structured and individualized adapted motor programs into special education frameworks to enhance motor competence and functional autonomy. **Recommendations:** The study recommends expanding adapted motor education programs in special education centers, providing continuous training for instructors, and encouraging future longitudinal studies on the long-term effects of such interventions.

Keywords: Adapted motor education, fundamental control skills, Educable Children with Intellectual Disabilities, Sustainable Development Goals (SDGs), Quality Education (SDG 4), Good Health and Well-being (SDG 3)

تأثير برنامج تربية حركية مكيفة على مهارات التحكم الأساسية لدى الأطفال المعاقين عقليا: دراسة تجريبية أجريت على الأطفال الذكور القابلين للتعلم (6 إلى 8 سنوات) بمدينة وهران - الجزائر

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المخلص: الهدف: هدفت هذه الدراسة التجريبية إلى فحص فعالية برنامج تربية حركية مكيفة في تنمية ثلاث مهارات تحكم أساسية — المسك، والرمي، والتعلق — لدى الأطفال المعاقين عقليا القابلين للتعلم الذين تتراوح أعمارهم بين 6 و 8 سنوات بمدينة وهران - الجزائر. **المنهج:** أجريت دراسة استطلاعية على (6) أطفال للتحقق من ملائمة الأدوات وتم استبعادهم، كما تم استبعاد (11) طفلا لإعاقات مصاحبة أو زيادة الوزن أو غياب نظير، و (4) أطفال للغياب المتكرر، لتتكون العينة 20 طفلا تم اختيارهم قصدياً من مؤسسات متخصصة، وقُسموا بالتساوي إلى مجموعتين: تجريبية وضابطة (10 أطفال في كل مجموعة) باستخدام أسلوب الأزواج المتناظرة المتطابقة في العمر والجنس ونسبة الذكاء والطول والوزن. خضعت المجموعة التجريبية لبرنامج التربية الحركية المكيفة المكون من 18 حصة (3 حصص/أسبوع، 45 دقيقة لكل حصة)، بينما أصقلت المجموعة الضابطة أنشطتها الروتينية. **النتائج:** أظهرت النتائج فروقا ذات دلالة إحصائية ($p < 0.05$) لصالح المجموعة التجريبية في جميع مهارات التحكم الأساسية الثلاث: المسك (+44.4%)، الرمي (+100%)، والتعلق (+54.5%). **الاستنتاجات:** تؤكد النتائج فعالية البرنامج في تحسين مهارات التحكم الأساسية المستهدفة، وتوصي باستخدام برامج التربية الحركية المكيفة في مؤسسات التربية الخاصة مع مراعاة التخطيط الفردي والأنشطة والمتابعة المستمرة للتطور. **التوصيات:** توصي الدراسة بضرورة تعميم برامج التربية الحركية المكيفة في مراكز التربية الخاصة، وتوفير تدريب مستمر للمختصين، بالإضافة إلى إجراء دراسات طولية مستقبلية لقياس الأثر بعيد المدى لهذه البرامج.

الكلمات المفتاحية: التربية الحركية المكيفة، مهارات التحكم الأساسية، المعاقين عقليا القابلين للتعلم، أهداف التنمية المستدامة، التعليم الجيد، الصحة والرفاه

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Background

Recent decades have seen growing scientific interest in adapted and psychomotor education programs for children with mild intellectual disabilities. These programs play a significant role in enhancing motor coordination, postural control, and perceptual–motor integration. These programs are considered key components in promoting the psychomotor and social development of children with special educational needs, contributing to their functional autonomy and participation in everyday activities (Sherrill & Hinson, 2021).

Children with intellectual disabilities often exhibit deficits in sensory–motor processing, timing, and neuromuscular coordination, which hinder their ability to master basic movement patterns and control skills (Ku, 2020). Adapted motor education programs have been shown to improve coordination, postural stability, and social integration through structured and progressive activities designed according to individual needs (Karakaş et al., 2025).

Across Arabic and Algerian scholarship, prior studies have consistently confirmed the positive impact of structured physical and psychomotor interventions on motor and cognitive development. However, they differ in focus some emphasizing gross motor skills or physical fitness attributes, while others address perceptual or psychosocial outcomes leaving a clear empirical gap in the area of basic control skills (grasping, throwing, hanging).

In the Algerian context, (Belkheyr, 2016) examined the effect of a psychomotor education program on perceptual–motor abilities such as balance, posture, and body awareness among educable children with mild intellectual disabilities aged 9–11 years. Using a pre-test/post-test experimental design, the study reported significant improvements in perceptual–motor capacities and recommended integrating psychomotor education within

adapted physical education curricula in special education centers. While this research advanced understanding of perceptual–motor enhancement, it did not address the specific domain of basic control skills, which require precise coordination and are foundational to independent motor performance.

Similarly, (Merniz, 2012) implemented a recreational physical activity program designed to enhance fundamental motor skills in children with intellectual disabilities, yielding significant gains in strength, balance, and coordination. Yet, this line of research primarily focused on gross motor abilities such as running and jumping, rather than the manipulative control mechanisms that underpin grasping, throwing, and hanging.

(Belkheyr & Mohamed, 2022) further demonstrated that adapted physical activities positively affect self-esteem and social adjustment in individuals with disabilities, highlighting the broader psychosocial benefits of structured physical intervention. Nevertheless, these works emphasized psychological outcomes more than performance-based motor measures.

At a regional level, (Naji, 2004) in Egypt investigated the influence of a recreational program on psychosocial and psychomotor development among educable children with mild intellectual disabilities. The results revealed a significant improvement in social adaptation and emotional stability, yet no direct assessment of measurable control-based motor skills was conducted.

Outside the Arab context, (Hamouda & Al-Hayek, 2009) designed a motor education program for typically developing preschool children and demonstrated that structured movement games improved basic locomotor and manipulative abilities. However, since the study did not include children with intellectual disabilities, its findings cannot be directly

generalized to adapted physical education contexts.

Recent international findings (Karakaş et al., 2025) reaffirm the need for empirically grounded interventions focusing on fine and control-based motor skills rather than general fitness or gross movement. Such approaches align with the growing recognition that manipulative skills—particularly grasping, throwing, and hanging—serve as fundamental determinants of neuromotor functionality and cognitive engagement.

Taken together, previous studies collectively validate the value of adapted and psychomotor education in promoting overall motor performance and psychosocial well-being. However, they share notable methodological and conceptual limitations:

A predominant focus on gross motor or fitness-related skills, with limited attention to precision-based control skills.

A lack of experimental studies in Algerian contexts evaluating neuromuscular control through structured adapted motor education interventions.

Limited differentiation between fundamental motor skills (e.g., running, jumping) and control-based manipulative skills (e.g., grasping, throwing, hanging).

Insufficient analytical discussion explaining how and why specific motor improvements occur within skill domains.

Hence, the present study seeks to fill this empirical and conceptual gap by designing and implementing a scientifically structured adapted motor education program tailored to educable children aged 6–8 years with mild intellectual disabilities in Oran, Algeria. The study focuses on improving three basic control skills—grasping, throwing, and hanging—within a controlled experimental design, offering a contextualized contribution to the

field of adapted physical education and motor learning in Algeria

Furthermore, this study aligns with the United Nations Sustainable Development Goals (SDGs), specifically SDG 3 (Good Health and Well-being) by enhancing the physical and motor capabilities of children with intellectual disabilities, and SDG 4 (Quality Education) by promoting inclusive, equitable, and adapted educational programs.

Research Problem

Despite the growing body of research on adapted and psychomotor education in Algeria and the Arab world, most studies focus on gross motor skills and physical fitness. Few address basic control skills requiring fine neuromuscular coordination, such as grasping, throwing, and hanging.

This conceptual gap limits the understanding of how adapted motor education programs can enhance the specific control-based competencies that underpin children's autonomy and functional adaptation in daily life

In Algerian special education settings, particularly among educable children with mild intellectual disabilities, there is a near absence of structured pedagogical programs targeting these control skills. The currently applied physical education curricula remain largely general and non-adapted to their specific developmental profiles.

Therefore, the present study was designed to address this deficiency by developing and testing an adapted motor education program that systematically targets basic control skills. The purpose is to provide empirical evidence on its effectiveness and contribute to improving the quality of adapted physical education practices in Algeria.

Main Research Question:

Does the adapted motor education program significantly improve basic control skills

(grasping, throwing, and hanging) in children with mild intellectual disabilities?

Sub-questions

1. Are there statistically significant differences between the pre-test and post-test results in the experimental group?
2. Are there statistically significant differences between the experimental and control groups in the post-test results?

Objectives of the Study

- **To** design, implement, and evaluate an adapted motor education program specifically tailored for educable children with mild intellectual disabilities aged 6–8 years.
- To examine the effectiveness of the program in improving selected fundamental control skills namely grasping, throwing, and hanging through structured and progressive motor tasks.
- To compare the post-test results between the experimental and control groups in order to determine the statistical significance of the observed differences and the practical impact of the intervention

Research Hypotheses

Main Hypothesis

The adapted motor education program positively affects the development of basic control skills in children with mild intellectual disabilities.

Sub-hypotheses

1. There are statistically significant differences between the pre-test and post-test in the experimental group.
2. There are statistically significant differences in the post-test results between the experimental and control groups.

Definition of Key Terms

Adapted Motor Education

Terminological: A specialized branch of physical education that provides modified motor activities tailored to the abilities and needs of individuals with disabilities, aiming to develop their physical, cognitive, and social skills (Sherrill & Hinson, 2021).

Operational: The 18-session program (3 sessions/week, 45 minutes each) developed in this study, focused on improving control skills.

Basic Control Skills

Terminological: Fundamental motor skills that require precision and coordination, such as grasping, throwing, and hanging (Hulteen et al., 2018).

Operational: The three target skills assessed through standardized quantitative motor tests:

- Grasping: Ability to catch a ball thrown from a 3-meter distance, scored on a 0–2 point scale per attempt (4 attempts; total score range: 0–8)
- Throwing: Accuracy in throwing a ball toward a target from 3 meters, scored on a 0–2 point scale per attempt (3 attempts; total score range: 0–6)
- Hanging: Duration of maintaining grip on a horizontal bar, measured in seconds and converted to decimal units (actual seconds ÷ 10)

Educable Intellectually Disabled (EID)

Terminological: Individuals with mild intellectual disabilities (IQ between 50 and 70) capable of learning academic, motor, and social skills with structured support (Sherrill & Hinson, 2021).

Operational: Children aged 6–8 years from Oran specialized centers, diagnosed with mild intellectual disability, who participated in this study.

Materials and Methods

Research Design

This study employed a quasi-experimental design with pre-test and post-test measures and a control group. This design was chosen for its suitability in evaluating the effects of the adapted motor education program while allowing controlled comparisons between groups.

Participants

The target population consisted of 41 educable children with mild intellectual disabilities, aged 6 to 8 years, attending two specialized centers in Oran, Algeria. Intellectual functioning levels (IQ range: 50–70) were verified based on the psychological records available in each child's institutional file.

A purposive sampling method was employed to select participants who met the following criteria:

Diagnosed with mild intellectual disability (IQ 50–70).

Chronological age between 6 and 8 years.

Absence of any additional sensory or motor impairment.

Regular attendance and medical fitness for physical activity.

Prior to the main experiment, a pilot study with six (6) children was conducted to verify the clarity, feasibility, and reliability of the assessment tools and testing procedures. These children were excluded from the main sample.

From the initial population, eleven (11) children were excluded due to comorbid disabilities, excessive weight, or the absence of a comparable peer for matched-pair allocation.

Additionally, four (4) children were excluded for repeated absences and behavioral irregularities documented in their attendance records.

The final experimental sample thus consisted of twenty (20) children, matched in pairs according to age, gender, IQ, height, and weight. Within each matched pair, one child was randomly assigned to the experimental group ($n = 10$) and the other to the control group ($n = 10$).

This matched-pair randomization ensured baseline equivalence between groups and minimized selection bias.

Research Setting and Duration

The study was conducted between January 5 and May 10, 2023, at the USTO Disability Center and the Challenge Sports Club for People with Disabilities, both located in Oran, Algeria.

Variables

- Independent variable: Adapted motor education program
- Dependent variables: Basic control skills (grasping, throwing, hanging)

Operational Definitions

Terminological: A branch of physical education offering modified activities tailored to the abilities of individuals with disabilities (Sherrill & Hinson, 2021).

Operational: The 18-session adapted program designed for this study, delivered over six weeks (3 sessions per week, 45 minutes each), incorporating structured motor activities aimed at improving basic control skills.

Research Instrument

The research instrument consisted of a set of quantitative motor tests designed to measure the development level of the three basic control skills targeted in this study: grasping, throwing, and hanging.

These tests were selected in accordance with the developmental characteristics of educable children with mild intellectual disabilities (aged 6–8 years) and the objectives of the proposed adapted motor education program.

Table (1): Description of the Tests and Scoring Procedures.

Skill	Test Description	Scoring Procedure	Unit of Measurement
Grasping	The boy stands 3 meters away while a soft ball is thrown toward them. The child attempts to catch the ball using both hands in four consecutive trials.	Each trial is scored on a 0–2 point scale: 0 = complete failure to catch the ball 1 = partial catch (momentary grasp then drop) 2 = successful and controlled catch. Total score: 0–8 points.	Performance points (0–8)
Throwing	The boy stands 3 meters from a circular target (60 cm in diameter) and throws a soft ball toward the center of the target in three consecutive attempts.	Each attempt is scored on a 0–2 point scale: 0 = completely off target 1 = near or edge hit 2 = accurate hit at the center. Total score: 0–6 points.	Performance points (0–6)
Hanging	The boy is asked to hang from a horizontal bar with both hands for as long as possible.	The duration of hanging is measured in seconds using a digital stopwatch, then converted into a decimal unit according to the following formula: (Actual seconds ÷ 10) = recorded score.	Time in decimal units (s/10)

All tests were administered to both the experimental and control groups during the pre-test and post-test phases under identical conditions, ensuring objectivity, consistency, and experimental reliability of the measurements.

Psychometric Properties

Test–retest reliability was established by administering the tests to a pilot sample of six (6) boys from the same population on January 15, 2023, and re-administering them one week later (January 22, 2023) under identical conditions (same location, tools, and timing).

The correlation coefficients between the two administrations were as follows:

Table (2): Psychometric Properties of the Tests.

Skill	Reliability (r)	Validity ($\sqrt{r}$)	Objectivity	Significance Level (p)	Degrees of Freedom
Grasping	0.81	0.90	High	0.05	5
Throwing	0.85	0.92	High	0.05	5
Hanging	0.94	0.96	High	0.05	5

Reliability was confirmed through test-retest using Pearson's correlation coefficient, which yielded values between 0.81 and 0.94. Content validity was assessed through expert evaluation and yielded CVI scores between 0.90 and 0.96. The scale also demonstrated high objectivity due to clear scoring criteria.

Validity of the Instrument

To verify content validity, the tests were reviewed by (5) academic experts specializing in:

- ✓ Adapted physical activity (1)

- ✓ Motor education (1)
- ✓ Sport psychology (1)
- ✓ Measurement and evaluation (1)
- ✓ Special education (1)

All experts were senior university professors from the Universities of Mostaganem and Oran (Algeria). Their agreement rates on the adequacy of each test were as follows:

Table (3): Experts' Agreement Rates on Test Validity.

Skill	Agreement Rate
Grasping	100%
Throwing	80%
Hanging	100%

Program Design

The program was developed based on expert consultations and prior literature. It included exercises and games structured to progress from simple to complex tasks. Sessions focused on motor development through repetition, interaction, and gradual increase in difficulty. Each session lasted 45 minutes, with three sessions per week over six weeks (total of 18 sessions).

The intervention consisted of a six-week adapted motor education program designed to

Table (4): Structure of the Training Session.

Phase	Duration	Typical Activities	Educational Objective
Warm-up	5 min	Slow walking, arm movements, light jumps, playful tasks	Prepare the body and mind for activity
Main part	35 min	Structured motor games and targeted exercises developing grasping, throwing, and hanging skills	Improve neuromuscular coordination and motor control
Cool-down	5 min	Stretching, breathing exercises, reflection on activities	Relaxation and gradual recovery

Program Content and Progression

Phase 1: Foundation and Adaptation (Weeks 1–2, Sessions 1–6)

Objective: Build confidence, establish familiarity with the three target skills, and adapt children to structured motor play.

- **Grasping:** Catching large foam balls, transferring soft objects between boxes.
- **Throwing:** Tossing soft balls toward a large target placed nearby.
- **Hanging:** Supported hanging from a low horizontal bar for 3–5 seconds.
- **Complementary activities:** Walking in straight lines, finger touches, rhythmic breathing.

Phase 2: Development and Refinement (Weeks 3–4, Sessions 7–12)

Objective: Improve precision, strength, and eye–hand coordination through gradually intensified activities.

- **Grasping:** Catching while moving or jumping lightly.

enhance basic control skills (grasping, throwing, and hanging) in educable children with mild intellectual disabilities aged 6–8 years.

The program was conducted at the Specialized Educational Center for Children with Intellectual Disabilities in Oran, Algeria, over 18 sessions distributed across six weeks, with three sessions per week (Sunday, Tuesday, Thursday), each lasting 45 minutes, from 10:00 to 10:45 a.m.

- **Throwing:** Throwing to a partner or toward a moving target.
- **Hanging:** Maintaining hanging while swinging the legs forward and backward.

Complementary activities: “Follow the leader” games, rhythmic music-based exercises.

Phase 3: Mastery and Evaluation (Weeks 5–6, Sessions 13–18)

Objective: Integrate the three motor skills into combined play situations and evaluate progress.

Grasping: Catching fast-thrown balls or while bouncing on a trampoline.

Throwing: Aiming at higher or smaller targets (mini-goal).

Hanging: Maintaining grip for longer durations (up to 10 seconds) with minimal assistance.

Complementary activities: Cooperative mini-games, playful competitions, closing recognition event.

Ethical Considerations

This study was conducted in accordance with the ethical standards of the University of Mostaganem Research Ethics Committee (Approval No. IEPS-MOSTA/12/12/2022).

Official authorization was also obtained from both specialized centers for children with intellectual disabilities in Oran, confirming institutional approval for data collection and intervention implementation.

Written informed consent was secured from the parents or legal guardians of all participating children after providing a full explanation of the study's objectives, procedures, and potential benefits.

Results

Table (5): Pre-test Group Equivalence (Independent t-test)

Skill	Experimental Group (Mean ± SD)	Control Group (Mean ± SD)	t-value	p-value	Significance
Grasping	4.5 ± 1.6	4.6 ± 1.55	0.20	0.84	NS
Throwing	0.8 ± 0.50	0.9 ± 0.50	0.80	0.43	NS
Hanging	1.1 ± 0.20	1.2 ± 0.25	0.85	0.41	NS

Table 5 indicates that there were no statistically significant differences in motor control skills between the experimental and control groups prior to the intervention ($p > 0.05$ for all skills). This confirms the initial homogeneity of the two groups, validating the

Table (6): Experimental Group: Pre-test vs Post-test Comparison (Paired t-test)

Skill	Pre-test (Mean ± SD)	Post-test (Mean ± SD)	t-value	p-value	Interpretation
Grasping	4.5 ± 1.6	6.5 ± 1.1	7.65	<0.001	Significant
Throwing	0.8 ± 0.5	1.6 ± 0.4	3.25	0.003	Significant
Hanging	1.1 ± 0.2	1.7 ± 0.25	3.65	0.002	Significant

Table 6 reveals statistically significant improvements in all measured skills following the adapted motor education program. Grasping skill increased by 44.4% ($t=7.65$, $p<0.001$), throwing skill by 100% ($t=3.25$, $p=0.003$), and hanging skill by 54.5% ($t=3.65$, $p=0.002$). These results align with theories of motor learning, particularly the role of

Confidentiality and anonymity were strictly maintained: all personal data were coded, securely stored, and used solely for scientific purposes.

Participants were free to withdraw from the study at any time without any consequences.

The research strictly adhered to the principles of the Declaration of Helsinki (2013) concerning human research ethics.

Statistical Analysis

Descriptive statistics (means, standard deviations) and inferential statistics (paired and independent t-tests) were used to analyze the data. The significance level was set at $p < 0.05$.

matched-pairs method and allowing a reliable comparison of program impact. Establishing such equivalence is a key aspect of experimental integrity in developmental intervention studies.

repetition, feedback, and task-specific practice (Schmidt & Lee, 2019). Similar improvements were reported by (Lee et al., 2016) and (Ku, 2020), reinforcing the effectiveness of adapted physical activity programs in enhancing neuromotor function in children with intellectual disabilities.

Table (7): Post-test Comparison Between Experimental and Control Groups.

Skill	Experimental Group (Mean $\pm$ SD)	Control Group (Mean $\pm$ SD)	t-value	p-value	Interpretation
Grasping	6.5 $\pm$ 1.1	4.7 $\pm$ 1.6	3.95	0.001	Significant
Throwing	1.6 $\pm$ 0.4	1.0 $\pm$ 0.5	6.60	<0.001	Significant
Hanging	1.7 $\pm$ 0.25	1.3 $\pm$ 0.2	5.60	<0.001	Significant

Table 7 illustrates that the experimental group significantly outperformed the control group in all post-test assessments: grasping ($p = 0.001$), throwing ($p < 0.001$), and hanging ($p < 0.001$). These differences reflect the program's successful design and delivery. According to Bandura's social cognitive theory (Bandura, 1986), learning through modeling and reinforcement contributes significantly to motor behavior development. Moreover, the use of structured play and progressive task difficulty likely contributed to the improved performance. These findings support the use of individualized and engaging interventions in inclusive education contexts.

Discussion

The results of this study confirmed the effectiveness of the adapted motor education program in improving the three targeted basic control skills (grasping, throwing, and hanging) among educable children with mild intellectual disabilities. The significant post-test differences in favor of the experimental group support the premise that structured, progressive, and individually tailored motor activities facilitate measurable neuromotor development.

While the descriptive results align with previous findings (Shen et al., 2024), the present study contributes deeper empirical insight by examining control-based manipulative skills, which have received far less attention than gross motor competencies in the Algerian and Arab contexts. This distinction is essential because control skills require fine neuromuscular coordination, sensory-motor integration, and stability all

areas often impaired among children with mild intellectual disabilities.

Mechanisms Underlying Improvement The observed improvements can be explained through several theoretically grounded mechanisms:

Repetition and Progressive Loading: According to motor learning theory (Schmidt & Lee, 2019), repeated exposure to structured and progressively complex tasks strengthens motor schemas, enhances sensorimotor prediction, and reduces execution variability. This was evident in grasping and throwing, where repetition improved anticipatory timing and hand-eye coordination.

Feedback-Driven Adjustment: The program emphasized verbal, visual, and tactile feedback. Such multisensory cues facilitate error detection and correction, enabling children to refine movement trajectories and stabilizing muscle activation patterns.

Improved Postural and Proximal Stability: The significant gains in hanging suggest enhanced upper-limb strength and trunk stability. These proximal improvements are foundational for distal control skills such as grasping and throwing.

Motivation and Emotional Engagement: Adapted games and playful scenarios promoted engagement and reduced anxiety, which, according to Bandura's social cognitive theory (1986), enhances self-efficacy a factor strongly correlated with motor performance in children with disabilities.

Comparison With Previous Arabic and Algerian Studies Although previous Algerian studies (Belkheyr, 2016; Belkheyr &

Mohamed, 2022; Merniz, 2012) reported improvements in gross motor skills, balance, and perceptual-motor abilities, they did not directly assess basic control skills using a structured manipulative framework. The present study therefore fills a methodological gap by:

1. Isolating three specific control skills as independent measurable variables.
2. Applying a standardized testing method adapted to local educational constraints.
3. Demonstrating substantial improvements across skills central to functional independence.

Unlike recreational or general psychomotor programs, the current intervention was explicitly oriented toward neuromuscular control mechanisms, offering a novel contribution to Algerian adapted physical education research.

Conceptual Contribution Beyond empirical results, this study advances current knowledge in three ways:

- It situates control-based motor skills as a distinct developmental domain not merely a subset of fundamental motor skills.
- It provides evidence from a North African educational context, where adapted motor education is still emerging and lacks standardized programming.
- It highlights the relevance of structured motor learning principles progression, individualization, repetition, and feedback for children with mild intellectual disabilities in real educational settings.

Conclusions and Recommendations

This study demonstrated that a carefully structured adapted motor education program can substantially enhance basic control skills (grasping, throwing, and hanging) among educable children with mild intellectual disabilities aged 6–8 years. The significant

improvements observed in the experimental group confirm the program's effectiveness and highlight the developmental potential that can be unlocked when motor learning principles are applied systematically and within an inclusive pedagogical framework.

Broader Implications The findings carry important implications for special education policy and practice in Algeria:

- **Curriculum Development:** Adapted motor education should be formally integrated into special education curricula, with clearly defined learning objectives for control-based motor skills.
- **Teacher Preparation:** Training programs for adapted physical education teachers must include modules on motor learning, neuromuscular control, and evidence-based intervention design.
- **Institutional Support:** Special education centers require improved facilities and equipment to implement such programs effectively.

Future Research to build on the present findings, future studies should consider:

- Conducting longitudinal research to assess retention and long-term transfer of motor gains.
- Testing the program in multiple regions to establish broader generalizability.
- Integrating biomechanical or neurophysiological measures (e.g., EMG, motion tracking) to better understand the mechanisms of motor improvement.
- Examining complementary psychosocial outcomes such as self-regulation, autonomy, and social participation.

Overall, the study provides a foundation for advancing adapted motor education in Algeria and serves as a model for developing context-appropriate, evidence-based interventions for children with mild intellectual disabilities.

Disclosure Statement

- **Ethical approval and consent to participate:** The study protocol was approved by the Research Ethics Committee of the University of Mostaganem (Approval No. IEPS-MOSTA/12/12/2022). written informed consent was obtained from the parents or legal guardians of all participating children in accordance with the Declaration of Helsinki.
- **Availability of data and materials:** The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.
- **Author contribution:** Belkheyr Kaddour bey is the sole author. He conceived the study, conducted the experiments, analyzed the data, and wrote the manuscript.
- **Conflict of interest:** The author declares that there is no conflict of interest regarding the publication of this article.
- **Source of the Research:** The author declares that this research is an original work and is NOT derived from a Master's thesis or a Doctoral dissertation. Furthermore, it has not been previously published or submitted for publication elsewhere.
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