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A Modified Physical Education Program for Developing Motor Coordination in Learners Aged 7–8 Years

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Abstract
This study aimed to investigate the effect of a modified sports program on developing motor coordination among learners aged 7–8 years at Ben Doubia Elementary School in Oran. The experimental approach with a two-group pretest-posttest design (experimental and control) was utilized. The sample consisted of 30 pupils divided equally into an experimental group (n = 15) subjected to the 8-week modified sports program (24 units) and a control group (n = 15) following the traditional curriculum. Validated motor coordination tests (eye-hand, eye-foot, and general coordination) were applied. Statistical analysis using t-tests revealed statistically significant differences (p \le 0.05) between pre- and post-measurements of the experimental group favoring the post-test, as well as significant differences between both groups in the post-test favoring the experimental group. The study recommends integrating modified sports programs and adapted equipment into physical education curricula for lower primary grades.
Keywords: Modified Sports Program; Motor Coordination; Learners (7–8 Years

1. Introduction

Middle childhood (7–8 years) is one of the most critical stages in a child's developmental trajectory, during which motor skills transition from simple, random fundamental patterns into organized, skilled motor responses characterized by precision, balance, and mastery. Physical education classes in schools serve as a fertile educational environment where motor skills form the foundational base for integrated physical and healthy development

(Gallahue et al., 2019). This development requires neuromuscular coordination capable of directing the child's skilled behavior across various situations.

Motor coordination is the cornerstone of motor fitness; it reflects the efficiency of the central nervous system in directing different muscle groups to work simultaneously in a harmonious, fluid manner with minimal energy expenditure (Rudd et al., 2020). Recent research indicates that motor coordination acquired during childhood extends beyond physical performance to enhance complex neural executive functions (Molina-García et al., 2022), while contributing directly to behavioral regulation and the development of cognitive and academic skills among pupils (Kitsantas et al., 2023).

Despite this critical importance, field studies (Barnett et al., 2021; Zaghloul & Al-Kack, 2023) indicate that traditional physical education curricula implemented in schools often rely on standard equipment, fields, and rules designed for older age groups. This creates a developmental gap between motor performance requirements and the physiological and morphological capabilities of 7–8-year-old children. Hence, the modern concept of Modified Sports Programs has emerged, which is based on adapting games, scaling down equipment dimensions, and establishing flexible rules that ensure maximum physical activity and successful interaction for children (Pizzuto et al., 2024), thereby directly stimulating neuromuscular response and building comprehensive physical and motor fitness within the school environment (Seabra et al., 2023).

2. Problem Statement

Through continuous field observation in primary schools—specifically in the courtyard of Ben Doubia Elementary School in Oran—a noticeable weakness and decline in certain components of motor coordination were observed among first- and second-grade pupils (aged 7–8 years). This decline is evident in motor confusion when handling equipment, difficulty in coordinating eye-hand movements during catching and targeting, and an inability to maintain coordinated control between eye and foot when kicking a ball or alternating movement between small hurdles.

The root causes of this problem stem mainly from traditional instructional practices relying on repetitive exercises and heavy or disproportionate equipment relative to the child's muscular strength and processing capacity. Because deficits in motor coordination can lead to frustration, motor withdrawal, and reduced self-confidence among learners (Abu To'eimah, 2022), the vital impact of designing an innovative educational intervention is reinforced. Accordingly, the research problem is defined by the following main question: What is the effect of implementing a modified sports program on developing motor coordination among learners aged 7–8 years at Ben Doubia Elementary School in Oran?

3. Study Objectives

- Design a modified sports program whose components and equipment align with the developmental and motor characteristics of learners aged 7–8 years.

- Identify statistical differences between the pre- and post-measurements of the experimental group across motor coordination dimensions (eye-hand, eye-foot, and general body coordination).
- Compare the impact of the modified sports program against the traditional program applied to the control group in the post-measurement at Ben Doubia Elementary School in Oran.

4. Study Significance

- **Theoretical Significance:** Enriches educational and sports literature with modern theoretical and practical frameworks that address the functional concept of modified sports programs and their impact on motor development during middle childhood.
- **Practical Significance:** Provides a validated, practical model of a modified sports program that physical education teachers, instructors, and educational advisors can utilize when formulating teaching strategies in primary education schools.

5. Research Hypotheses

- **First Hypothesis:** There are statistically significant differences at alpha \le 0.05 between the mean scores of the pre- and post-measurements for the experimental group across motor coordination dimensions (eye-hand, eye-foot, general body coordination) in favor of the post-measurement.
- **Second Hypothesis:** There are statistically significant differences at \alpha \le 0.05 between the mean scores of the experimental and control groups in the post-measurement across all motor coordination dimensions in favor of the experimental group.

6. Terminologies and Operational Definitions

- **Modified Sports Program:** Operationally defined as a planned, standardized motor system spanning 8 weeks. It includes games and exercises using modified equipment (lightweight balls, reduced-height hurdles, short rackets), scaled-down playing areas, and simplified rules tailored to pupils aged 7–8 years.
- **Motor Coordination:** Operationally defined as the pupil's ability to coordinate between the nervous and muscular systems to perform complex movements accurately and fluidly. It is operationally measured by the scores obtained on motor coordination tests (throwing and catching balls, foot dribbling, and shuttle run coordination).

7. Theoretical Framework

7.1 Motor Development and Coordination

The age period between 7 and 8 years represents a fundamental transition phase in Gallahue's motor maturation theory (Gallahue et al., 2019), where children transition from fundamental locomotor and non-locomotor skills to specialized, complex motor skills. At this age, the nervous system undergoes rapid development in neuromuscular pathways responsible for transmitting signals between the brain and limbs. Motor coordination is

defined as the neuromuscular synchronization that allows body parts to work together to complete a specific motor task (Al-Khouli & Shafiq, 2021). The main forms of coordination include:

- **Eye-Hand Coordination:** Visuomotor control directed at the arms and fingers, demonstrated in throwing, catching, passing, and targeting skills.
- **Eye-Foot Coordination:** Visuomotor control directed at the lower extremities, as seen in kicking, foot dribbling, and directional jumping.
- **General Body Coordination:** The participation of major muscle groups and joints in performing synchronized movements requiring balance, agility, and rapid changes of direction (Al-Saeed, 2020).

7.2 Philosophy and Applications of Modified Sports Programs

The philosophy of sports modification rests on the field-based premise that "children are not miniature adults"; thus, imposing standard athletic practices limits their conceptual and skill-based success (Rudd et al., 2020). The modified program relies on four main modification axes (Barnett et al., 2021):

1. **Equipment Modification:** Downsizing balls (tennis, foam, light rubber balls), using smaller rackets, and adjusting target dimensions.
2. **Environment and Space Modification:** Dividing the yard into small-sided areas to increase touch frequency and prevent physical overexertion.
3. **Rules and Organization Modification:** Eliminating complex rules and allowing repeated attempts to support neuromuscular adaptation.
4. **Progression in Motor Complexity:** Ensuring smooth transitions from isolated movements to combined skills.

8. Literature Review

8.1 Arabic Studies

- **Zaghloul & Al-Kack (2023):** Evaluated the effect of a modified small-sided games program on developing motor coordination and balance among pupils aged 6–8 years using an experimental design with 24 pupils. Results revealed that modifying equipment and pitch sizes led to statistically significant differences favoring the experimental group.
- **Abu To'eimah (2022):** Examined the effectiveness of modified games and scaled-down equipment in developing fundamental motor skills among primary school children (N = 35) over 6 weeks. Results confirmed higher motor discipline and coordination control in the experimental sample.
- **Al-Saeed (2020):** Demonstrated a strong positive correlation between motor diversification and neuromuscular coordination capacities in lower primary grade children.

- **Boushahit & Al-Omari (2019):** Conducted in the Algerian environment, concluding that modified activities contribute directly to enhancing motor coordination and physical agility.

8.2 Foreign Studies

- **Barnett et al. (2021):** A meta-analysis of 35 experimental studies showed that modified programs (modified equipment and small-sided games) yielded a large effect size in developing visuomotor coordination and general body coordination.
- **Rudd et al. (2020):** Confirmed that modified movement activities accelerate neuromuscular coordination compared to traditional practices in primary school children.
- **Lopes et al. (2020):** Proved that developing motor coordination through targeted physical programs improves neuromuscular control and enhances motor confidence alongside academic achievement.
- **Crotti et al. (2021):** Demonstrated significant improvements in motor accuracy and coordination among experimental group participants when exposed to modified movement environments.

8.3 Commentary on Previous Studies

Scientific consensus across literature highlights the vital role of modified physical activities in elevating children's motor coordination and performance levels. The present study is distinguished by its field implementation at Ben Doubia Elementary School in Oran, Algeria—tailored to local school environment parameters—while providing a complete modified sports program featuring standardized training units and comprehensive motor tests.

9. Methodology and Field Procedures

9.1 Research Design

The researcher adopted the experimental approach using a two-equivalent-group design (experimental and control) with pre- and post-measurements, given its suitability for measuring the effect of the independent variable (modified sports program) on the dependent variable (motor coordination).

9.2 Population, Sample, and Field Setting

- **Target Population:** All primary first- and second-grade pupils enrolled at Ben Doubia Elementary School in the municipality and district of Oran during the field academic season.
- **Study Sample:** Selected via purposive random sampling, comprising 30 pupils (aged 7–8 years) divided equally into:
  - **Experimental Group (n = 15):** Participated in the modified sports program in the school yard.
  - **Control Group (n = 15):** Followed the traditional physical education curriculum.

9.3 Measurement Tools and Tests

Standardized motor tests adapted for school settings were utilized to evaluate motor coordination dimensions:

1. **Eye-Hand Coordination Test (Foam Ball Throw and Catch):** The pupil throws a light foam ball against a wall 1.5 m away and catches it with one hand over 30 seconds (number of successful catches recorded).
2. **Eye-Foot Coordination Test (Foot Dribbling inside a Circle):** The pupil alternates foot-dribbling a lightweight ball inside a 1.5 m diameter circle (number of valid touches before the ball leaves the circle recorded).
3. **General Body Coordination Test (Agility Shuttle Run between Cones):** The pupil navigates a course involving sprinting, directional changes, and jumping over 15 cm foam hurdles (time recorded in seconds).

9.4 Program Design and Implementation Steps

- **Duration:** 8 consecutive weeks.
- **Sessions/Units:** 24 instructional units (3 sessions per week, 45 minutes per session).
- **Session Structure:**

1. **Introduction & Warm-up (10 min):** Adapted mini-games and dynamic warming activities.
2. **Main Section (25 min):** Workstations featuring modified eye-hand, eye-foot, and targeting exercises with scaled-down equipment.
3. **Cool-down & Conclusion (10 min):** Light relaxation games and positive feedback.

10. Results, Analysis, and Discussion

10.1 Equivalence between Groups (Pre-measurement)

To verify baseline equivalence between both groups before program execution, an independent-samples t-test was conducted on pre-test scores (Table 1).

Table 1:
Independent Samples t-test Results for Baseline Equivalence (Pre-test, n_1 = 15, n_2 = 15)

Coordination Dimension	Experimental Group (n=15) Mean ± SD	Control Group (n=15) Mean ± SD	Calculated t-value	Significance (p)	Decision
Eye-Hand Coordination	11.53±1.19	11.33±0.90	0.52	0.607	Non-significant (Equivalent)

Eye-Foot Coordination	9.40±0.99	9.20±0.94	0.57	0.574	Non-significant (Equivalent)
General Body Coordination	14.40±0.99	14.20±0.94	0.57	0.574	Non-significant (Equivalent)
Total Coordination Score	35.33±3.04	34.73±2.55	0.59	0.563	Non-significant (Equivalent)

Data in Table 1 indicate that all calculated t-values were non-statistically significant ($p > 0.05$), confirming complete baseline equivalence between the experimental and control groups prior to intervention.

10.2 Testing and Discussion of the First Hypothesis

The first hypothesis states: "There are statistically significant differences at \alpha \le 0.05 between the mean scores of pre- and post-measurements for the experimental group across motor coordination dimensions in favor of the post-measurement." A paired-samples t-test was used to test this hypothesis (Table 2).

Table 2
Paired Samples t-test Results for Experimental Group (Pre- vs. Post-test, n = 15)

Coordination Dimension	Pre-test Mean ± SD	Post-test Mean ± SD	Calculated t-value	Significance (p)	Statistical Significance
Eye-Hand Coordination	11.53±1.19	16.80±1.15	28.99	0.000	Significant at $\alpha \le 0.01$
Eye-Foot Coordination	9.40±0.99	14.07±1.03	29.28	0.000	Significant at $\alpha \le 0.01$
General Body Coordination	14.40±0.99	20.07±1.16	35.56	0.000	Significant at $\alpha \le 0.01$
Total Coordination Score	35.33±3.04	50.93±3.01	48.64	0.000	Significant at $\alpha \le 0.01$

Discussion of Hypothesis 1:

Results in Table 2 demonstrate statistically significant differences ($p < 0.01$) between pre- and post-measurements for the experimental group across all motor coordination tests, favoring the post-measurement. This development is attributed to the nature of the modified program applied at Ben Doubia Elementary School. Modified activities provided frequent opportunities for successful skill execution without inducing excessive physiological strain. Lightweight balls and scaled-down zones accelerated neuromuscular adaptation and improved visuomotor control, aligning with findings from Zaghloul & Al-Kack (2023), Rudd et al. (2020), and Seabra et al. (2023).

10.3 Testing and Discussion of the Second Hypothesis

The second hypothesis states: *"There are statistically significant differences at \alpha \le 0.05 between the post-measurement mean scores of the experimental and control groups across all motor coordination dimensions in favor of the experimental group."* An independent-samples t-test was conducted (Table 3).

Table 3

Independent Samples t-test Results Between Groups Post-test, n_1 = 15, n_2 =15

Coordination Dimension	Experimental Group Mean ± SD	Control Group Mean ± SD	Calculated t-value	Significance (p)	Superiority
Eye-Hand Coordination	16.80±1.15	12.13±1.36	10.18	0.000	Favoring Experimental
Eye-Foot Coordination	14.07±1.03	9.87±1.06	10.99	0.000	Favoring Experimental
General Body Coordination	20.07±1.16	15.00±1.07	12.42	0.000	Favoring Experimental
Total Coordination Score	50.93±3.01	37.00±2.88	12.95	0.000	Favoring Experimental

Discussion of Hypothesis 2:

Table 3 shows significant superiority of the experimental group over the control group in the post-test across all dimensions ($t = 12.95$, $p = 0.000$). While the control group practiced routine physical education with standardized equipment and rigid rules that ignored the physical characteristics of 7–8-year-old pupils, the experimental group engaged in tailored drills that captured their interest and increased Active Learning Time. These findings

corroborate studies by Barnett et al. (2021), Lopes et al. (2020), Abu To'eimah (2022), Molina-García et al. (2022), and Pizzuto et al. (2024).

11. Conclusion

In light of the experimental methodology applied at Ben Doubia Elementary School in Oran, the modified sports program proved highly effective in developing comprehensive motor coordination (eye-hand, eye-foot, and general coordination) in learners aged 7–8 years. Modifying equipment, reducing play space, and simplifying rules represent crucial educational and physiological adaptations to promote neuromuscular capacity and motor confidence in early primary education.

12. Recommendations

- Officially integrate modified sports programs and adapted games into physical education guidebooks and curricula for primary schools.
- Equip primary schools (such as Ben Doubia Elementary and neighboring institutions in Oran) with safe, adapted, scaled-down equipment (foam tools, light balls, adjustable goals).
- Organize field workshops and training days in coordination with physical education institutes and regional education directorates to train instructors on sports modification strategies.
- Conduct further field studies exploring the effect of modified programs on other developmental variables, such as motor intelligence, attentional focus, and social skills among learners.

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