

RESEARCH ARTICLE

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Effect of Teaching Units on Shot Put Performance Development in Middle School Students

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Abstract

Teaching units represent the fundamental cognitive core in all fields of learning, consisting of homogeneous and interconnected knowledge and behaviors to build specific competencies. Physical education and sports activities are effective means for achieving competencies, values, knowledge, and social participation. Shot put is an official component of the Algerian middle school physical education curriculum, yet empirical evidence on the effectiveness of teaching units remains limited.

This study evaluated the effectiveness of proposed teaching units on shot put

performance in fourth-year middle school students in Biskra, Algeria.

A descriptive pre-post design was implemented with 164 students (74 boys, 90 girls; age range 14-17 years) enrolled in three public middle schools. Shot put performance was assessed before and after a 9-session instructional program using the lateral glide technique, integrated into regular physical education classes. Each session lasted approximately 60 minutes and was delivered once per week. The intervention focused on six technical phases: grip, starting position, glide, power position, release, and balance maintenance. Paired-sample t-tests were used

to assess pre-post changes, with significance set at $p < 0.01$.

For boys ($n = 74$), mean performance increased from 6.84 m ($SD = 1.65$) to 7.31 m ($SD = 1.57$), with a very strong correlation between pre- and post-test scores ($r = 0.884$) and a statistically significant paired t-test ($t = -5.179$, $p < 0.01$). For girls ($n = 90$), mean performance improved from 3.77 m ($SD = 0.84$) to 4.16 m ($SD = 0.93$), with a strong correlation ($r = 0.555$) and a significant t-value ($t = -4.383$, $p < 0.01$).

A structured, curriculum-based shot put teaching program can significantly enhance performance in both sexes at the middle school level. The results support the integration of technically focused and anthropometrically informed content into school physical education curricula, emphasizing the role of body height, biomechanical principles, and technical instruction in improving shot put performance.

Keywords: shot put; teaching units; physical education; middle school; performance improvement; biomechanics; adolescence

1. Introduction

Teaching units represent the fundamental cognitive core in all fields of learning, consisting of homogeneous and interconnected knowledge and behaviors aimed at building

specific competencies. All teaching units related to a particular activity are linked to what is termed foundational competency[1]. Physical education and sports activities are the most effective means for achieving competencies, values, knowledge, social participation, and desired outcomes[2].

The changes occurring in teaching units reflect major curriculum modifications aimed at keeping pace with rapid scientific progress, opening up to the world, and adapting to current times through optimal utilization of learners' abilities. This requires teaching units with quality content and methodology[3].

To construct effective teaching units for shot put, several factors must be considered, including the mechanical principles of release velocity, angle of release, height of release point, and air resistance effects. Shot put differs significantly from other throwing events in terms of motor performance because the implement is pushed rather than thrown[4]. Therefore, both natural and mechanical factors related to projectile laws, which have a significant impact on shot put distance, must be taken into account when teaching this event.

From a biomechanical perspective, shot put performance is determined by several factors: release height, release angle, and release velocity. Release height is determined by the athlete's body height, which can be optimized through focus on cognitive and cross-

curricular competencies of learners[5]. Body height plays an important and essential role in performance by relying on the lever system to produce the greatest amount of force. Anthropometric measurements including height and weight contribute to performance achievement[6].

The shot put teaching unit is always aligned with physics education, demonstrating the integration and interconnection of educational subjects through students' experimental cognitive development. When selecting shot put athletes, it is essential to consider both height and physical strength characteristics, as elite shot putters typically range from 185 cm to 204 cm in height and weigh over 115 kg[7]. This highlights the role of both height and weight in shot put performance through mobilization of all human resources represented in students' physical characteristics for constructing teaching units.

In Algeria, shot put is part of the official physical education curriculum at the middle school level, yet empirical data on the effectiveness of school-based shot put teaching programs remain limited. The present study addresses this gap by examining the impact of a structured, curriculum-aligned shot put program on performance among fourth-year middle school students in Biskra.

1.1 Research Problem

The following questions guide this investigation:

- Is there an effect of fourth-year middle school teaching units on shot put test results for boys?
- Is there an effect of fourth-year middle school teaching units on shot put test results for girls?

1.2 Research Objectives

- To demonstrate the effectiveness of fourth-year middle school teaching units on shot put results for boys
- To demonstrate the effectiveness of fourth-year middle school teaching units on shot put results for girls

1.3 Research Hypotheses

- There is a difference between pre-test and post-test shot put results for boys
- There is a difference between pre-test and post-test shot put results for girls

2. Materials and Methods

2.1 Study Design

A descriptive pre-post design was adopted based on pre- and post-measurements of students under teacher supervision in schools. The intervention consisted of a 9-session instructional program: two sessions allocated for diagnostic and achievement assessment through pre- and post-tests, and seven

instructional sessions. Each physical education session lasted approximately 60 minutes and was delivered once per week according to the official scheduled curriculum.

2.2 Setting and Participants

The study was conducted in three public middle schools in the municipality of Biskra, Algeria. The sample consisted of 164 students: 90 girls and 74 boys (age range 14-17 years), after excluding individuals who did not meet the conditions for achieving the objectives.

2.3 Intervention Program

The instructional program focused on the lateral glide technique for shot put, which consists of six technical phases[8]:

1. Shot grip technique
2. Starting position
3. Lateral glide movement
4. Achieving power position
5. Release movement
6. Balance maintenance after release

The program emphasized improving technical aspects through monitoring and correcting balance and coordination, changing support points after stabilization, perceiving and directing force while respecting rules, and developing comprehensive movement to achieve optimal results. Sessions combined technical drills with body weight exercises and instructional feedback from qualified teachers.

2.4 Variables and Control of Confounders

Independent variable: Teaching units in shot put activity

Dependent variable: Students' results in shot put activity

Confounding variables: Several potential confounders were controlled to reduce bias:

- Students repeating the fourth year were excluded, as they had already been exposed to the same program in their repeated year
- Students who practice sports in sports clubs were excluded to limit external training effects
- Facilities and pedagogical means for implementing the prescribed physical education and sports program for the fourth year were standardized
- Only classes taught by qualified and competent teachers were included to minimize variability in instructional quality and prevent study results from being affected by teacher competence

2.5 Measurement Procedures

Shot put performance was assessed using the lateral glide technique test, which involves six technical steps: shot grip, starting position, glide, reaching power position, release movement, and balance maintenance[8]. After a general warm-up, students performed shot

put following standardized rules and safety guidelines. Distances were recorded in meters for each participant at pre-test and post-test. The best valid attempt was retained for analysis.

2.6 Statistical Analysis

Statistical analyses were conducted using SPSS (Statistical Package for the Social Sciences). Descriptive statistics (mean, standard deviation) were computed separately for boys and girls at pre- and post-test. Pearson correlation coefficients were calculated to examine the relationship between pre- and post-test scores. Paired-sample t-tests were

Variable	Sample Size (n)	Mean (SD)	Pearson Correlation
Pre-test Shot Put	74	6.84 (1.65) m	0.884
Post-test Shot Put	74	7.31 (1.57) m	

Table 1: Descriptive statistics and correlation for shot put performance in boys (age 14-17 years)

The paired-sample t-test revealed a mean difference of -0.470 m between pre- and post-test, with a calculated t-value of -5.179 (df = 73, sig = 0.000), which is below the 0.01 threshold. This indicates a statistically significant improvement in shot put performance following the instructional program for boys.

Variable	Mean Difference	SD Difference	Sample Size	t-value	p-value
Boys (Pre-Post)	-0.470 m	0.781	74	-5.179	0.000

Table 2: Paired-sample t-test results for boys' shot put performance (df = 73, significance level = 0.01)

3.2 Girls

For girls (n = 90), mean shot put performance increased from 3.77 m (SD = 0.84) at pre-test to 4.16 m (SD = 0.93) at post-test. The Pearson correlation coefficient between pre- and post-test scores was r = 0.555, reflecting a strong relationship.

Variable	Sample Size (n)	Mean (SD)	Pearson Correlation
Pre-test Shot Put	90	3.77 (0.84) m	0.555
Post-test Shot Put	90	4.16 (0.93) m	

Table 3: Descriptive statistics and correlation for shot put performance in girls (age 14-17 years)

used to assess the significance of pre-post changes, with the level of significance set at $p < 0.01$.

3. Results

3.1 Boys

For boys (n = 74), mean shot put performance increased from 6.84 m (SD = 1.65) at pre-test to 7.31 m (SD = 1.57) at post-test. The Pearson correlation coefficient between pre- and post-test scores was $r = 0.884$, indicating a very strong association.

The paired-sample t-test showed a mean difference of -0.338 m between pre- and post-test, with a calculated t-value of -4.383 (df = 89, sig = 0.000), also below the 0.01 level. Thus, the program produced a statistically significant improvement in shot put performance for girls as well.

Variable	Mean Difference	SD Difference	Sample Size	t-value	p-value
Girls (Pre-Post)	-0.338 m	0.840	90	-4.383	0.000

Table 4: Paired-sample t-test results for girls' shot put performance (df = 89, significance level = 0.01)

Overall, both hypotheses were supported: boys and girls demonstrated statistically significant gains from pre- to post-test.

4

. Discussion

The main finding of this study is that a relatively short, school-based instructional program in shot put can significantly improve performance in both male and female middle school students. The observed increases in mean throwing distance, combined with strong pre-post correlations ($r = 0.884$ for boys, $r = 0.555$ for girls), suggest that students not only improved but did so in a consistent manner across the sample.

From a biomechanical perspective, performing the release movement requires transferring body weight to the front foot, with the student facing the throwing sector and the right leg reaching maximum extension and resting on its ball, with body weight positioned on the front leg which continues to extend as the throwing arm releases the shot. The release continues with shot follow-through until release is complete. The higher the release point, the farther the landing point, so increasing body height plays an important role in achieving

better results. This is why we emphasize students' physical characteristics in constructing teaching units[9].

The biomechanical characteristics that determine the distance traveled by any thrown object depend on several factors: height, angle, and velocity at release. Release height is determined by the thrower's body height, which can be achieved through focus on cognitive and cross-curricular competencies of learners[5]. Research by Najih Muhammad Al-Dhiyabat and Inaam Muhammad Al-Dhiyabat demonstrated that total height contributes to performance level, indicating that body height plays an important and essential role in performance by relying on the lever system to produce the greatest amount of force. Anthropometric measurements of height and weight contribute significantly to performance achievement[6].

The shot put teaching unit is always aligned with physics education content, demonstrating the integration and interconnection of

educational subjects through students' experimental cognitive development. When selecting shot put athletes, it is essential to consider both height and physical strength characteristics. Elite shot putters typically range from 185 cm to 204 cm in height and weigh over 115 kg[7]. This highlights the role of both height and weight in shot put performance through mobilization of all human resources represented in students' physical characteristics for constructing teaching units.

Teachers focus in constructing teaching units on improving technical aspects through monitoring and correcting balance and coordination, changing support points after stabilization, perceiving and directing force while respecting rules, and developing comprehensive movement to achieve optimal results[8]. Shot put activity does not require extensive resources for performance, as most schools have the facilities that allow for results improvement.

These findings have practical implications for physical education curricula. They suggest that targeted, technically oriented content can be successfully implemented within the time and resource constraints of public middle schools, without requiring expensive equipment. At the same time, they underscore the importance of teacher expertise, anthropometric considerations, and structured progression in skill acquisition[1][2][3].

4.1 Limitations

Several limitations should be noted. First, the study did not include a control group, which limits causal inferences about the intervention. Second, the relatively short intervention period (nine sessions) may not capture long-term retention of performance gains. Third, external factors such as maturation and previous physical activity outside school were not fully controlled. Future studies should consider randomized controlled designs with longer follow-up periods.

5. Conclusion

The proposed shot put teaching units, implemented within regular physical education classes over nine sessions, led to statistically significant improvements in shot put performance among fourth-year middle school boys and girls in Biskra, Algeria. The results support the effectiveness of structured, curriculum-aligned physical education interventions that combine technical training, biomechanical principles, and pedagogical use of students' anthropometric characteristics.

Therefore, it can be concluded that the hypotheses were confirmed:

- There is an effect of fourth-year middle school teaching units on shot put test results for boys

- There is an effect of fourth-year middle school teaching units on shot put test results for girls

Future research could compare different instructional models, explore long-term retention of performance gains, and examine how similar programs impact other track-and-field events or broader physical fitness indicators. The integration of such evidence-based programs into national physical education curricula may enhance both student performance and overall physical literacy during critical developmental periods.

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