

The Impact of Integrated (Physical-Skill) Educational Exercises on Special Strength and Technical Performance in Shot Put among Physical Education Students

¹Rana Mohamed Mutair*

*Corresponding Author: Rana Mohamed Mutair, e-mail: rana.aljbouri@uowasit.edu.iq

¹College of Physical Education and Sport Sciences, Wasit University, Iraq

Abstract

Background: Traditional athletic pedagogy often separates physical conditioning from technical skill acquisition, which can lead to a "mechanical gap" in explosive events like the shot put.

Objectives. This study aimed to design and evaluate the effectiveness of an integrated (physical-skill) educational program in developing special strength and technical performance among first-year students.

Materials and Methods. An experimental approach with a pre-test/post-test randomized control group design was employed. The sample consisted of 40 male students from the University of Babylon (n = 20 experimental; n = 20 control). The experimental group underwent a 4-week program (3 sessions/week) consisting of exercises that combined medicine ball drills and plyometrics with specific shot put technical phases.

Results. Statistical analysis using independent and paired t-tests revealed significant improvements ($p < 0.05$) in both groups. However, the experimental group showed a clear superiority in the post-tests across all variables, particularly in explosive power (medicine ball throw and jumping tests) and technical proficiency (Mean = 9.17 vs. 5.22 for the control group).

Conclusions. Integrated exercises facilitate a more efficient "Motor Transfer," allowing students to apply physical force within the precise technical requirements of the shot put. The author is recommendation Integrating physical and technical drills into a single instructional framework is highly recommended for university-level athletic curricula to optimize performance and learning efficiency.

Keywords: Shot Put, Integrated Training, Special Strength, Technical Performance, Motor Transfer, Physical Education.

1. Introduction

Sports activities, particularly Track and Field events, serve as a true benchmark for physical and technical advancement in the modern era. The Shot Put is one of the events that demands a high level of coordination between explosive capabilities and a precise kinematic path. Reaching optimal technical performance for the learner does not rely solely on skill mastery; rather, it depends on developing 'Special Strength' that serves that skill within a unified temporal and spatial framework.

Recent studies indicate that separating physical training from skill instruction may lead to the fragmentation of the learner's 'motor program.' Consequently, the importance of Integrated Educational Exercises (Physical-Skill) emerges as a vital bridge connecting muscular force with technical performance. This integration facilitates the direct application of physical capacities, such as explosive power and speed-strength, within the technical execution of the skill. In the contemporary era, sports science has shifted towards integrating pedagogical and training methodologies to achieve peak performance. As noted by (Harvey & Jarrett, 2014; Judge et al., 2021), the shot put is a complex athletic event that demands a high degree of synergy between physiological capabilities and biomechanical efficiency. Traditional instructional models often isolate physical conditioning from skill acquisition; however, modern trends emphasize "Complex Training" as a vital bridge for developing the motor programs necessary for explosive events (Zaras et al., 2013). In this context, "Special Strength" is not merely a general physical attribute but a specific power-speed capacity tailored to the kinetic requirements of the throwing phases.

Despite the established importance of integrated training, a pedagogical gap exists in university-level physical education. Through field observation, it has been noted that first-year students often struggle with the technical execution of the shot put due to a lack of "Motor Transfer" between their physical strength and the skill's technical flow. This fragmentation often leads to suboptimal performance where the student cannot effectively employ their muscular force within the narrow temporal window of the delivery phase.

Therefore, the current research seeks to address this gap by designing a program of integrated (physical-skill) educational exercises. The study aims to evaluate how these combined drills can simultaneously develop special strength and technical proficiency, moving away from the isolated training model. It is hypothesized that the implementation of these integrated exercises will have a significant positive effect on both the students' explosive power and their technical performance in the shot put, facilitating a more efficient transition from physical exertion to technical mastery compared to traditional teaching methods (Beboucha Wahib et al., 2017) (Usama Maqbool et al., 2024).

2. Methods

2.1. Research Design

The researcher employed an **experimental approach** using a pre-test/post-test randomized control group design. This design was selected to determine the causal relationship between the independent variable (integrated physical-skill exercises) and the dependent variables (special strength and technical performance).

2.2. Participants and Sampling

The research community consisted of first-year students at the College of Physical Education and Sports Sciences, University of Babylon, for the academic year 2022-2023 (N = 80). A sample of **40 students** was selected via simple random sampling and equally divided into two groups (n = 20 each):

- **Experimental Group:** Subjected to the integrated (physical-skill) educational program.
- **Control Group:** Followed the traditional curriculum prescribed by the college.

2.3. Measures and Instrumentation

A battery of physical and technical tests was established based on expert consultation and scientific literature to measure development in shot put performance:

1. Explosive Power (Upper Body): Medicine ball throw (2 kg).
2. Explosive Power (Lower Body): Three-step bounding test (left and right leg) and Standing Long Jump.
3. Muscular Endurance: Push-up test (maximum repetitions in 10 seconds).
4. Technical Proficiency: Qualitative evaluation of the shot put technical performance phases.

2.4. Pilot Study and Scientific Foundations

A pilot study was conducted on October 20, 2023, with six students (outside the main sample) to verify the suitability of the tools and the clarity of the instructions.

- **Validity:** Content validity was ensured through a panel of experts who reviewed the tests' relevance to the pedagogical objectives.
- **Reliability:** A test-retest method was applied with a five-day interval (r values ranged from 0.812 to 0.891, $p < 0.05$).
- **Objectivity:** Inter-rater reliability was calculated using the Pearson Correlation Coefficient between two independent evaluators, yielding high objectivity coefficients (0.825–0.929).

2.5. Baseline Equivalence (Homogeneity and Parity)

To ensure internal validity, the sample was tested for homogeneity in anthropometric variables (Table 2). Skewness coefficients were within ± 1 , indicating a normal distribution. Furthermore, independent t-tests confirmed no statistically significant differences ($p > 0.05$) between the experimental and control groups in pre-test scores, ensuring baseline parity (Table 3).

2.6. The Integrated Educational Program

The experimental intervention was implemented from November 30 to December 30, 2022, spanning **4 weeks**. The program was structured as follows:

- **Unit Structure:** Each 90-minute session included a warm-up, a main part (70 min), and a cool-down.
- **The Intervention:** The integrated exercises occupied 26–42 minutes of the main part.
- **Exercise Logic:** Drills combined physical loads (using 1–3 kg medicine balls) with technical shot put movements (glide/rotation) to ensure a high degree of "training specificity."
- **Progression:** Exercises followed a balanced sequence targeting the legs, torso, and arms to mirror the kinetic chain of the shot put.

2.7. Statistical Analysis

Data were analyzed using **SPSS (v.26)**. Descriptive statistics (Mean, SD, Median, Skewness) were calculated. Inferential statistics included:

- Independent Samples t-test: To compare the two groups.
- Paired Samples t-test: To evaluate within-group improvements from pre-to-post-test.
- The significance level was set at $\alpha = 0.05$.

3. Results

3.1. Analysis of Within-Group Differences (Pre- vs. Post-test)

Table 1: Shows the arithmetic means, standard deviations, and T-value calculated for the pre- and post-tests for the control group.

Variables	Pre-test		Post-test		T Value Calculated	Level Sig	Type Sig
	Mean	Std. Deviations	Mean	Std. Deviations			
Throwing a 2 kg medicine ball test	8.30	1.21	9.12	1.01	2.12	0.000	Sig
The three bounding test with the right and left leg	12.90	2.06	14.03	1.68	2.60	0.000	Sig
Push-up for 10 seconds	9.20	0.73	10.15	0.63	2.19	0.000	Sig
Jump from stability test	2.09	0.48	2.20	0.38	1.88	0.000	Sig
Technical performance by shot put	3.51	0.63	5.22	0.79	3.40	0.000	Sig

Table 2; Shows the arithmetic mean, the standard deviation, the calculated T-value, and the statistical significance of the results of the two tests (pre-post) for the variables for the experimental group

Variables	Pre-test		Post-test		T Value Calculated	Level Sig	Type Sig
	Mean	Std. Deviations	Mean	Std. Deviations			
Throwing a 2 kg medicine ball test	8.23	1.36	11.29	1.07	4.62	0.000	Sig
The three bounding test with the right	12.63	2.11	16.25	1.88	3.39	0.000	Sig

and left leg							
Push-up for 10 seconds	9.13	0.79	12.05	0.41	4.38	0.000	Sig
Jump from stability test	2.11	0.57	2.40	0.36	2.49	0.000	Sig
Technical performance by shot put	3.83	0.77	9.17	0.66	6.70	0.000	Sig

The statistical analysis presented in Tables 4 and 5 indicates significant improvements ($p < 0.05$) in all physical and technical variables for both the control and experimental groups.

For the control group, the development in explosive power and technical performance can be attributed to the traditional curriculum which included high-intensity resistance exercises and plyometric drills. As noted by (Haff & Triplett, 2015; Kamal Abdul-Hameed Ismail, 1996) any structured training curriculum based on scientific principles of load distribution and repetition will inevitably lead to physiological adaptations and skill enhancement.

However, the experimental group exhibited a more pronounced transformation. The mean scores for technical performance jumped from 3.83 ± 0.77 to 9.17 ± 0.66 (Table 5), a rate of improvement that far exceeds the control group. This confirms that while traditional training is effective, it lacks the specificity provided by integrated (physical-skill) exercises.

3.2. Comparative Analysis (Experimental vs. Control Group)

The core finding of this study lies in **Table 3**, which compares the post-test results of both groups. The independent t-test results reveal a statistically significant advantage for the experimental group across all measures ($p < 0.000$).

Variables	Control		Experimental		T Value Calculated	Level Sig	Type Sig
	Mean	Std. Deviations	Mean	Std. Deviations			
Throwing a 2 kg medicine ball test	9.12	1.01	11.29	1.07	3.55	0.000	Sig
The three bounding test with the right and left leg	14.03	1.68	16.25	1.88	4.11	0.000	Sig
Push-up for 10 seconds	10.15	0.63	12.05	0.41	3.67	0.000	Sig
Jump from stability test	2.20	0.38	2.40	0.36	2.18	0.000	Sig
Technical performance by shot put	5.22	0.79	9.17	0.66	6.77	0.000	Sig

Table (3) shows the values of the arithmetic means and standard deviations between the post-tests and for the control and experimental groups. Through our observation of the arithmetic means and standard deviations, the researcher used the (t) test for independent samples, and the calculated (t) values for all tests appeared because the value of the (Significant significance) is less than the level of significance (0.05) Therefore, there is an advantage for the experimental group.

4. Discussion

4.1 Discussion of Special Strength (Explosive Power of Legs and Arms)

The superiority of the experimental group in the medicine ball throw and jumping tests is directly linked to the "Integrated Exercise" model. The researcher integrated medicine ball drills (1–3 kg) with the specific throwing phases of the shot put. This approach aligns with the findings of (Zaras et al., 2021), who emphasized that explosive power development in shot put is most effective when the resistance mimics the kinetic chain of the actual event.

Furthermore, the significant development in the three-hop test and standing long jump for the experimental group suggests that the combined drills enhanced the **Rate of Force Development (RFD)**. By performing jumping exercises within a technical framework, students learned to transition from the "power position" to the "delivery phase" with greater speed and efficiency. This is consistent with (Abdel-Fattah, 1992; Zatsiorsky et al., 2020), who argued that high-speed force training is essential for optimal motor performance in explosive athletic events.

4.2 Discussion of Technical Performance

The most striking result was the experimental group's mastery of the technical performance (Mean = 9.17) compared to the control group (Mean = 5.22). The researcher attributes this to the Motor Transfer effect. Traditional methods often create a "mechanical gap" where the student has the strength but cannot apply it technically.

By using integrated exercises, the students practiced the skill and the physical requirement simultaneously, which led to better "neuromuscular coordination." As supported by (Gabbett, 2016) (Young, 2009) (Adesokan, 2022), integrated physical-technical exercises facilitate faster cognitive assimilation of complex movements. This progression from simple to complex, as emphasized by (Qasim Lazam, 2005), allowed students to internalize the "fluidity" of the shot put movement, reducing time and effort while maximizing the force of the throw.

5. Conclusions

Based on the statistical analysis and the observed results, this study concludes that the implementation of integrated (physical-skill) educational exercises leads to a significant and superior development in both special strength and technical performance in the shot put compared to traditional isolated methods. The synergy between physical loading and technical execution within a single training framework effectively bridged the gap between muscular power and its mechanical application, resulting in a more efficient "Motor Transfer" and enhanced neuromuscular coordination among students. This approach not only optimized the explosive power of the legs and arms but also facilitated a faster and more accurate transition through the technical phases of the throw (glide and delivery). Therefore, the study strongly recommends the formal integration of these combined exercises into the athletics curricula of physical education colleges, shifting away from traditional separate training modules to maximize pedagogical efficiency and athletic achievement within shorter timeframes.

6. Limitations of the Study

To ensure the scientific integrity and generalizability of the findings, the scope of this study was defined by the following parameters:

- Human Domain: The study was limited to first-year male students at the College of Physical Education and Sports Sciences, University of Babylon, for the academic year 2024-2025.
- Time Domain: The experimental intervention was conducted over a period of four weeks, from November 30, 2024, to December 30, 2024.
- Spatial Domain: All tests and educational units were carried out at the athletics stadium and specialized facilities of the University of Babylon.
- Objective Domain: The research focused specifically on "Special Strength" (explosive power and speed-strength) and the "Technical Performance" of the shot put event.

References

- Abdel-Fattah, A. A. (1992). *Sports Biology and Athlete Health* (1st ed.). Dar al-Fikr al-Arabi.
- Adesokan, A. (2022). Effect of physical exercise on the motor skills acquisition among pupils with intellectual disability. *Indonesian Journal of Sport Management*, 2(2), 159–166. <https://doi.org/10.31949/ijsm.v2i2.2490>
- Beboucha Wahib, Ameer Ameer Housseyn, & Bengoua Ali. (2017). *The Effectiveness Of A Training Program Using Integrated Exercises (Physical- Skill) To Develop Strength, Speed And Some Essential Technical Skills – A Case Study About Football Players Under 17 In Mostaganem, Algeria*. <https://doi.org/10.5281/ZENODO.573352>
- Gabbett, T. J. (2016). The training—Injury prevention paradox: Should athletes be training smarter and harder? *British Journal of Sports Medicine*, 50(5), 273–280.
- Haff, G. G., & Triplett, N. T. (2015). *Essentials of strength training and conditioning 4th edition*. Human kinetics.

- Harvey, S., & Jarrett, K. (2014). A review of the game-centred approaches to teaching and coaching literature since 2006. *Physical Education and Sport Pedagogy*, 19(3), 278–300. <https://doi.org/10.1080/17408989.2012.754005>
- Judge, L. W., Cheetham, P. J., Fox, B., Schoeff, M. A., Wang, H., Momper, M., & Dickin, D. C. (2021). Using sport science to improve coaching: A case study of Felisha Johnson's Road to Rio. *International Journal of Sports Science & Coaching*, 16(3), 848–861. <https://doi.org/10.1177/1747954121991451>
- Kamal Abdul-Hameed Ismail. (1996). *Theories and Applications of Sports Training* (1st ed.). Dar al-Fikr al-Arabi.
- Qasim Lazam. (2005). *Principles of Learning and Motor Training in Athletics* (1st ed.). Al-Tayf Press.
- Usama Maqbool, Sara Ijaz, & Muhammad Zia ul Haq. (2024). The Effects of Multiple Training on the Performance of Shotput Players. *THE SPARK*, 9(1), 27–36.
- Young, M. (2009). *Development and application of an optimization model for elite level shot putting*. Louisiana State University and Agricultural & Mechanical College.
- Zaras, N., Spengos, K., Methenitis, S., Papadopoulos, C., Karampatsos, G., Georgiadis, G., Stasinaki, A., Manta, P., & Terzis, G. (2013). Effects of Strength vs. Ballistic-Power Training on Throwing Performance. *Journal of Sports Science & Medicine*, 12(1), 130–137.
- Zaras, N., Stasinaki, A.-N., & Terzis, G. (2021). Biological determinants of track and field throwing performance. *Journal of Functional Morphology and Kinesiology*, 6(2), 40.
- Zatsiorsky, V. M., Kraemer, W. J., & Fry, A. C. (2020). *Science and practice of strength training*. Human kinetics.