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Worood Shafı Abdullah
University of Baghdad, College of Physical Education and Sports Sciences for Women,
Wurud.Shafi2304m@copew.uobaghdad.edu.iq

Aseel Jaleel Kat'aa
University of Baghdad, College of Physical Education and Sports Sciences for Women,
aseel@copew.uobaghdad.edu.iq

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RESEARCH ARTICLE

The Effect of Instructional Exercises Using Auxiliary Aids on Learning the Technical Execution of the Triple Jump for Female Students

Worood Shafi Abdullah, Aseel Jaleel Kat'aa

University of Baghdad, College of Physical Education and Sports Sciences for Women

Abstract

The importance of this research lies in utilizing assistive tools to develop an integrated approach that enhances learning efficiency and adaptation, in alignment with the lesson, to achieve its objectives in teaching the technical execution of the triple jump event for female students. The researchers believe that the educational assistive tools used in developing the technical execution of the triple jump event are insufficient to achieve comprehensive improvement in performance levels. Therefore, the researchers aimed to explore the possibility of improving performance levels by using certain educational tools, including elastic bands, jumping on boxes of varying heights, foam indicators, and jumping exercises. The application of elastic bands and various exercises for hopping and jumping on boxes was intended to facilitate the learning process of the technical execution of the triple jump event for female students and to optimize performance levels. The experimental method, using a two-group equivalent design, was adopted in the research procedures. The research sample consisted of second-year students from Section (B), with a total of 24 students. Participants were divided into two groups: an experimental group and a control group, with 12 students in each. Training sessions were conducted once a week for six weeks. The main conclusion was that instructional exercises using assistive tools significantly improved the learning process of the technical execution of the triple jump event for female students. The researchers recommended the widespread implementation of these methods, as they align with one of the goals of sustainable development in quality education. and this achieves one of the sustainable development goals of the United Nations in Iraq which is (Quality Education)

Keywords: Instructional exercises, Training aids, Triple jump

1. Introduction

Learning, as a general concept, encompasses the processes by which knowledge is conveyed from the teacher to the learner. Learning and teaching are interconnected components of a unified process, with the objective of enhancing and advancing education. Learning pertains to the concepts and principles that shape the learner's cognitive and practical development, whereas teaching involves instructional strategies and resources employed by the teacher to facilitate learning.

The selection of an instructional integration approach should be based on the requirements and objectives of the lesson. Furthermore, instructional aids play a significant role in the learning process through the implementation and continuous introduction of innovative aids, thereby enhancing ease of execution, optimizing effort, and maximizing time efficiency by increasing the frequency and variety of practice attempts. Additionally, it facilitates the provision of feedback to the learner.

Since track and field events constitute a fundamental component of the practical curriculum in physical education programs, one of the primary aspects of improving performance in the triple jump event is mastering the sequential phases of movement and assessing the extent of the learner's proficiency in essential biomechanics. This research highlights

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E-mail addresses: Wurud.Shafi2304m@copew.uobaghdad.edu.iq (W. S. Abdullah), aseel@copew.uobaghdad.edu.iq (A. J. Kat'aa).

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the significance of employing instructional aids to develop a cohesive framework that aligns with lesson objectives to enhance the acquisition of technical execution in the triple jump for female students. Unlike previous studies, this research focuses on developing tailored instructional aids for each phase of the event, rather than relying on previously established tools.

The research problem is rooted in the established educational principles that emphasize the importance of using teaching aids. The researchers believe that the currently utilized educational aids for developing technical performance in the triple jump event are inadequate for achieving a holistic improvement in performance efficiency. Therefore, this study aims to explore the potential of employing specific instructional aids to reinforce comprehension of these phases and their interdependence in achieving optimal performance outcomes.

1.1. Research objectives

- To develop instructional exercises using instructional tools to facilitate learning the technical execution of the triple jump for female students.
- To examine the impact of instructional exercises utilizing instructional tools on learning the technical execution of the triple jump for female students.

1.2. Research hypothesis

Instructional exercises positively influence learning through the use of instructional tools in acquiring the technical execution of the triple jump for female students.

1.3. Research scope

- **Population Scope:** Second-year female students in the academic year 2024–2025.
- **Temporal Scope:** From 24/10/2024 to 18/12/2024.
- **Location Scope:** Al-Kashafa Field.

2. Methodology and procedures

The researchers employed the experimental design for both the experimental and control groups, as it aligns with the nature of the research.

2.1. The research population and sample

The research sample was selected using a simple random sampling technique (lottery method) from the research population, which comprised second-year female students in the academic year 2024–2025.

The selected sample consisted of 24 second-year students from Section (B). They were randomly assigned into two groups: an experimental group and a control group, each comprising 12 students.

2.2. Homogeneity of the sample

The skewness coefficient values fall within the range of ±1, indicating that the population distribution is approximately normal.

Table 1. It illustrates the homogeneity of the research sample.

Variables	Unit of Measurement	Arithmetic mean	Median	Standard Deviation	Skewness Coefficient
Length	cm	156.000	156.000	4.512	0.901
Mass	Kg	58.000	58.000	2.265	0.580
Age	Year	20.316	20.000	6.343	0.732

Table 1 illustrates the homogeneity of the research sample in terms of the variables of height, with a mean value of 156.00; weight, with a mean value of 58.000; and age, with a mean value of 20.316.

Table 2. It illustrates the equivalence of the research sample in the research variables.

Variables	Unit of Measurement	Experimental group		Control group		Calculated t-value	Error Level	Statistical significance
		Arithmetic Mean	Standard Deviation	Arithmetic Mean	Standard Deviation			
Approach Run	Degree	4.721	0.74	4.556	0.892	0.729	0.065	Non-significant
Hop	Degree	2.278	2.912	2.132	1.453	1.865	0.334	Non-significant
Step	Degree	2.054	3.498	1.823	0.126	0.193	0.169	Non-significant
Leap	Degree	1.779	0.922	1.590	0.865	0.539	0.455	Non-significant
Landing	Degree	2.565	1.678	2.432	1.703	0.954	0.543	Non-significant
Performance Achievement	Meter	8.945	0.865	8.901	1.990	0.211	0.293	Non-significant

Significant at a significance level of ≤0.05 with 22 degrees of freedom.

Table 2 illustrates the equivalence of the research sample in the variables of the hop, the step, and the jump in the triple jump, indicating the absence of a statistically significant difference.

2.3. Data collection methods

Observation, Tests and Measurements, Arabic and Foreign Sources, and the International Information Network (Internet).

2.4. Tools and equipment used in the research

The research utilized the following tools and equipment: an athletics track, 80 markers, 80 boxes of varying heights, 12 stopwatches, a whistle, a 30-meter measuring tape, a whiteboard, a Sony video camera with a frequency of 60 frames per second, a Dell laptop, one electronic medical scale, and two flags (one red and one white).

2.5. Tests used

– Triple Jump Approach Test [1, p. 58]

Purpose of the Test: To measure the level of technical performance.

3. Measurement unit: Meters/centimeters (m/cm)

The necessary equipment for performing the triple jump includes a designated jumping area with a sandpit, a runway, a measuring tape, a whiteboard, and a high-speed video camera with a frame rate of 65 frames per second.

3.1. Performance description

The test begins with a full-speed approach run, leading into the hop, which is the first phase of the jump, executed with the lead leg. This is followed by the step, the second phase, and finally the jump, concluding with the athlete landing on both feet in the designated pit. Each athlete is allowed three attempts.

3.2. Recording method

The measurement is taken from the takeoff board to the nearest mark left by the athlete's body along this line. The best attempt is recorded.

3.3. Pilot study

The researchers conducted an exploratory trial on October 24, 2024, at 10:00 AM at Al-Kashafa Stadium to assess the effectiveness of the triple jump test. The trial was carried out on six female students who were not part of the research sample.

The study involved performing the triple jump, determining the appropriate camera angles, specifying the distances required for optimal recording, and assessing the height of the camera lenses from the ground to ensure image clarity and the suitability of the recording equipment. The research team assisted in evaluating the execution of the tests, refining the testing procedures, and estimating the time required for each test.

3.4. Pre-Tests

The tests were conducted with the assistance of the support team after preparing the results registration form. This took place on 29/10/2024 at 10:00 AM at the Scout Stadium. The researchers filmed the participants in the study using a video camera with a frame rate of 60 frames per second to evaluate the students' performance. The camera was positioned vertically at a point located in the middle of the triple jump performance, 9.50 meters away from the takeoff board. The camera's distance from the center of the performance area and the height of the camera lens from the ground was 1.30 meters. The researchers provided each student with two attempts after completing the general and specific warm-up for preparation. The best attempt for each student was recorded. An evaluation form was also prepared, as shown in Appendix 2.

– The score was calculated out of 10 for each phase of the technical performance (approach run, hop, step, landing) by two experts, as shown in Appendix 1.

4. Educational exercises

The researchers conducted an introductory unit for the activity, which included a full video of the triple jump performance, shown at a slow pace to help the students understand and clearly view the event. The curriculum was designed for a duration of 6 weeks, with one educational unit per week, making the total number of units 6. The units began on 3/11/2024 and continued until 15/12/2024, every Tuesday.

– Each educational training unit lasted 90 minutes.

4.1. Post-tests

The post-tests were conducted on December 18, 2024, at Al-Kashafa Stadium, under the same conditions as the pre-tests to ensure consistency and reliability in the results.

4.2. Statistical analysis

The statistical methods were applied using the SPSS software package for data processing and analysis.

5. Results

Presentation and analysis of the results of the differences between the pre-test and post-test for the control group

Presentation and analysis of the results of the differences between the pre-test and post-test for the experimental group

Presentation and analysis of the results of the differences between the experimental group and the control group in the post-test.

6. Discussion

Table 5 clearly indicates that there are statistically significant differences between the experimental group and the control group in the post-tests, favoring the experimental group across the research variables. The superior performance observed in the experimental group can be attributed to the implementation of educational exercises using auxiliary tools, including rubber bands, jumping on boxes of varying heights, markers, cones, and jumping drills. These tools played a crucial role in facilitating the learning of the technical performance of the triple jump for female students. The use of rubber bands and box-jumping exercises provided an effective learning environment by introducing

Table 3. It illustrates the differences between the pre-test and post-test results for the control group.

Variables	Pre-test		Post-test		Deviation of differences	Calculated t-value	Error Level	Statistical significance
	Arithmetic Mean	Standard Deviation	Arithmetic Mean	Standard Deviation				
Approach run	4.553	0.553	6.383	0.772	0.664	4.997	0.001	Significant
Hop	2.112	0.895	4.669	0.734	1.134	3.984	0.002	Significant
Step	1.878	4.476	4.034	3.175	1.525	6.503	0.002	Significant
Leap	1.546	0.871	4.012	1.191	1.056	2.822	0.003	Significant
Landing	2.423	1.839	4.277	1.707	1.156	7.361	0.004	Significant

Significant at a significance level of ≤0.05 with 11 degrees of freedom.

Table 3 indicates a statistically significant difference between the pre-test and post-test results of the control group in the variables related to the technical performance of the triple jump. However, the level of significance does not reach the degree achieved by the experimental group.

Table 4. It presents the differences between the pre-test and post-test results for the experimental group.

Variables	Pre-test		Post-test		Deviation of differences	Calculated t-value	Error Level	Statistical significance
	Arithmetic Mean	Standard Deviation	Arithmetic Mean	Standard Deviation				
Approach run	4.723	2.861	7.775	1.932	1.233	3.988	0.001	Significant
Hop	2.276	3.826	6.052	1.172	3.578	2.657	0.001	Significant
Step	2.054	1.722	5.448	1.735	4.431	4.453	0.000	Significant
Leap	1.773	1.544	4.661	1.854	6.291	3.871	0.004	Significant
Landing	2.512	1.868	5.633	1.747	5.497	2.653	0.002	Significant

Significant at a significance level of ≤0.05 with 11 degrees of freedom.

Table 4 reveals a statistically significant difference between the pre-test and post-test results in the technical performance variables of the triple jump across all phases of execution. This improvement, which distinguished the experimental group from the control group, is attributed to the use of instructional exercises.

Table 5. It presents the differences between the experimental and control groups in the post-test results.

Variables	Experimental group		Control group		Calculated t-value	Error Level	Significance level
	Arithmetic Mean	Standard Deviation	Arithmetic Mean	Standard Deviation			
Approach run	7.775	1.932	6.383	0.772	1.569	0.000	Significant
Hop	6.052	1.172	4.669	0.734	3.010	0.002	Significant
Step	5.448	1.735	4.034	3.175	3.621	0.004	Significant
Leap	4.661	1.854	4.012	1.191	2.933	0.001	Significant
Landing	5.633	1.747	4.277	1.707	3.787	0.003	Significant

Significant at a significance level of ≤0.05 with 22 degrees of freedom.

external resistance to the active muscle groups involved in executing the movement [1, p. 211].

This aligns with the study conducted by Dapena, J, which highlights that the use of marked circles to indicate the positions of the hop and step phases contributed positively to the development of specific speed required for the approach run [2, p. 51]. Additionally, specific speed is considered one of the fundamental components of performance level [3, p. 433]. This is consistent with the findings of Schmidt, A. Richard, and Timothy, D. Lee, who emphasize that the educational exercises implemented in practical lessons reinforce this principle, which plays a crucial and effective role in acquiring the correct motor execution of the triple jump phases [4, p. 59].

Furthermore, the hop phase performance in the experimental group showed significant improvement, attributed to the activation of leg muscles through the application of specific strength exercises. The study highlights the importance of focusing on the motor performance phases specific to the hop, ensuring coordinated jumping movements in an alternating pattern, and maintaining continuous movement within the motor performance sequence [5, p. 43].

Additionally, the study by Arnold indicates that performance level is directly linked to the development of leg muscle strength and its integration, which is essential for achieving accurate motor transfer [6, p. 122].

Furthermore, the step and jump phases showed notable improvements in the experimental group. These phases, representing the final execution of the triple jump, demand explosive power to achieve optimal horizontal distance. This conclusion is consistent with Magill who emphasized that the primary objective of educational exercises is to acquire, refine, and master new skills, as learning is the process through which motor skills and knowledge are developed through experience and practice [7, p. 166].

This finding also aligns with the research of Diana and Aseel, who argue that movement fluidity depends on a high level of synchronization between force application during the support and push phases. Their study suggests that movement absorption and force application at key moments of contact play a crucial role in determining performance efficiency [8, p. 115]. The overall improvement observed in student performance is further attributed to the progressive skill-building approach, transitioning from simpler to more complex skills, in addition to structured lesson planning, effective use of available resources, instructional demonstrations, and increased practice repetition.

Moreover, optimizing time and effort, along with the integration of feedback, played a pivotal role in enhancing movement coordination and accelerating skill acquisition by focusing on sequential motor learning. This outcome is reinforced by the findings of McArdle [10], who highlighted the significance of performance assessment scores, movement analysis, and instructor feedback in increasing student motivation toward mastering the triple jump technique. These findings also align with research indicating that educational exercises utilizing auxiliary tools contribute significantly to achieving high-level performance in the triple jump event among students [9, p. 114].

7. Conclusions

- The use of auxiliary tools has a positive impact on the technical performance of the triple jump event.
- The type of instructional exercises implemented significantly influenced the performance of the students in the experimental group.

8. Recommendations

- It is essential to incorporate auxiliary tools to enhance learning efficiency and reinforce the technical execution of the triple jump.
- Further studies should be conducted using auxiliary tools in different athletic events and with varied research samples.

The researchers concluded that variations in training volume led to statistically significant differences in the research variables between the pre-test and post-test measurements, favoring the post-test results.

Author's declaration

Conflicts of interest: None.

We confirm that all tables and figures in this article are ours and written by the researchers themselves.

Ethical-clearance: This manuscript approved by local ethical committee of physical education and sport sciences college for women on (October/2024).

Author's contributions

All contributions of this study were done by the researchers (W.S and A.J) who get the main idea and work on writing and concluding also with number of experts, woror shafi in Statistics, Prof. Haifaa Ahmed Jawad in revision, Ayman Sabah in translating, Dr. Batoul Ahmed Salim in proofreading.

Facilitate the task: This study was supported by Second-year female students in the academic.

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Appendix 1

Experts

No.	Name and Title	Specialization	Workplace
1	Prof. Dr. Haider Faiq Al-Shammaa	Athletics	University of Baghdad
2	Lect. Dr. Fahem Abdul Wahid Issa	Athletics	University of Baghdad

Appendix 2

Technical Performance Evaluation Form for the Triple Jump

Student's Name			Group:	
Stage	Movements	Attempt 1	Attempt 2	Score
Approach run	Arm movement			
	Leg movement			
	Trunk movement			
Hop	Arm movement			
	Leg movement			
	Trunk movement			
Step	Arm movement			
	Leg movement			
	Trunk movement			
Leap	Arm movement			
	Leg movement			
	Trunk movement			
Landing	Arm movement			
	Leg movement			
	Trunk movement			
Expert:			Score:	
			Signature	

Educational Plan Model

Week 1 Second-year Students
Time: 90 minutes
Educational Goal:
Learn the approach run and all its stages Days: Tuesday
Educational Objective: Striving to achieve the goal

Unit Sections	Time	Details	Formations	Notes
Preparatory Section	**15 minutes**	• General Warm-up • Specific Warm-up	× × × × × × × ×☺	
Main Section Educational Phase	**70 min** **20 min**	Explanation of the skill by the teacher + Model Performance The approach distance depends on the student acquiring the appropriate speed that enables her to perform the take-off with strength and effectiveness. Each student has her own specific distance that matches her ability to gain the appropriate speed. The accuracy of the approach distance and reaching the take-off foot on the take-off board depends on: • The accuracy of measuring the approach distance. • The consistency of the step length, especially the initial steps. • The consistency of step frequency, particularly the last steps.		• Using one of the foam triangle devices • Using hoops to control the steps of the triple jump • Using a springboard to control the take-off
Practical Application Phase	**50 min** **15–20 min** **30–35 min**	Performing exercises from approach run - hop - step - then jump into the pit Performing exercises from approach run - two hops - two steps - and jump into the pit		