# EFFECT OF VIRTUAL REALITY EXERCISES TO LEARN TRIPLE JUMP PERFORMANCE FOR STUDENTS

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## ABSTRACT

**Background.** The integration of advanced technology in sports education has created new possibilities for improving the teaching and learning process of complex motor skills. The triple jump, as one of the technically demanding track and field events, requires precise coordination, rhythm, and execution, making it challenging for students to master through traditional instruction alone. **Objectives.** This study aimed to design an educational program based on virtual reality (VR) technology and to investigate its effectiveness in enhancing the technical performance of the triple jump among university students. **Method.** The research population consisted of second-year students at the College of Physical Education and Sports Sciences, University of Kirkuk, during the academic year 2024/2025, totaling 80 students. From this population, a random sample of 36 students was selected and divided into two equal groups: an experimental group (n = 18) taught using the VR-based program and a control group (n = 18) taught using conventional methods. Several students were excluded due to prior experience, failure in the course, incomplete participation, or repeated absences to ensure sample homogeneity. Data were collected through pre- and post-tests assessing technical performance using video analysis. **Results.** The results show that the experimental group achieved a higher average score (M = 8.36, SD = 0.54) than the control group (M = 5.59, SD = 0.84). The calculated t-value was -11.783 with a significance level of 0.000 ($p < 0.05$), indicating a statistically significant difference in favor of the experimental group. These findings confirm that the use of virtual reality-based education programs is more effective than traditional methods in improving technical performance in long jump among students. **Conclusion.** The study concludes that VR-based exercises represent an effective approach to teaching the technical components of the triple jump. Accordingly, it is recommended that such technology be adopted in sports education curricula to enhance students' practical skills and learning outcomes.

**Keywords;** virtual reality, regular teaching, triple jump, track and field.

## A. INTRODUCTION

Scientific progress has become a defining feature of the modern era, marked by rapid scientific and technological achievements that affect all aspects of human life. The world is currently experiencing successive changes and a remarkable scientific and technological revolution, which has transformed traditional concepts of teaching (Zulnadila et al., 2025). This shift has encouraged the use of modern technologies in education to provide students with comprehensive knowledge, innovative teaching methods, and diverse learning tools that enhance their opportunities to acquire experiences effectively (Haniyyah et al., 2025; Hussein, 2025). In this context, teachers can maximize the benefits of advanced technological devices in the teaching and training process, thereby raising learners' capabilities to higher levels.

Previous studies highlight the importance of interactive technologies in education. For instance, Ihsan and Mohammed (2025) emphasized that interactive augmented reality contributes significantly to visual perception and activates the learner's role in exploring new knowledge. Similarly, Ali (2023) argued that adopting innovative methods can accelerate the learning process and improve skill acquisition, aligning with the remarkable progress in sports performance and achievements. Virtual reality (VR), in particular, is defined as an interactive, computer-generated environment in which individuals actively engage with the content, navigate, and interact with tasks in ways that extend real-life experiences (Noufal, 2010).

Athletics, as one of the most popular sports worldwide, derives its importance from its close relationship to basic human movements such as walking, running, throwing, and jumping. These fundamental actions are integral not only to athletics but also to physical preparation for competitive, recreational, health, and educational purposes (Rateb, 2000). Within athletics, the triple jump is considered one of the more complex activities due to its technical phases, which require precise coordination and rhythm. Murad et al. (2025) noted that every physical activity is inherently linked to mental and emotional processes, influencing and modifying movement behavior.

Based on classroom observations in teaching athletics to second-year students at the College of Physical Education and Sports Sciences, University of Kirkuk, researchers identified difficulties faced by students in performing the triple jump effectively. This

challenge is attributed to the complexity of the skill and the limited use of modern teaching strategies. Consequently, the researchers proposed the integration of VR technology as a modern teaching tool to improve student performance (Rumpoko et al., 2025). VR provides immersive learning experiences by involving multiple senses—sight, hearing, and movement—thereby increasing learner engagement and responsibility for their own progress.

The novelty of this study lies in its application of VR technology specifically to the triple jump event, which has received limited attention in sports education research. While previous studies have explored VR in general physical education contexts, few have investigated its effectiveness in teaching highly technical athletics skills that require sequential movements, such as the triple jump (Gunawan et al., 2023; Han et al., 2021; Yang, 2018). Moreover, this study contributes to the literature by not only developing a VR-based educational program but also experimentally testing its impact on student performance compared to traditional teaching methods. This approach provides new insights into how immersive technologies can address the challenges of teaching complex motor skills in athletics.

Given these considerations, the present study aims to design exercises and an educational program utilizing VR technology to examine its effect on learning the triple jump among students. Specifically, the study seeks to determine the differences in learning outcomes between students taught using VR-based methods and those taught using traditional approaches. The researchers hypothesize that there will be statistically significant differences between pre- and post-test results in favor of the experimental group, thereby confirming the effectiveness of VR technology in enhancing technical performance in the triple jump.

## B. METHOD

*Participant*

The research community was chosen intentionally, and they are second-year students in College of Physical Education and Sports Sciences, University of Kirkuk, for academic year 2024/2025, consisting of two sections, numbering (80) students, and research sample, which was chosen randomly from sections (A, B), numbering (36) students, was distributed

into two equal experimental and control groups according to their sections, as each experimental group was determined to be (18) students, and a control group (18), and a number of students were excluded for following reasons : (students who had failed stage, numbering (7 ), students who had experience in practicing activity, numbering (10) , absent students who did not attend pre-test (photography of artistic performance), numbering (11), students who did not complete questionnaire, numbering (11), students who were absent for more than two lectures when implementing main experiment, numbering (5). Thus, number of sample members became (36) students, with (18) students for each group (experimental, control), at a rate of (45%) of second-stage students, and Table (1) shows this:

**Table 1.** Shows research sample and reasons for exclusion

| Groups | No. | Reason for exclusion | | | | | | Total excluded | Total sample | Percentage |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Absent from pre-test | Failure year | Experience and practice | Absent from lectures | Uncomplete answer. | Absent from post-test | | | |
| A | 39 | 6 | 3 | 4 | 3 | 5 | _ | 21 | 18 | 34,883% |
| B | 41 | 5 | 4 | 6 | 2 | 6 | _ | 23 | 18 | 36,585% |
| Total | 80 | 11 | 7 | 10 | 5 | 11 | _ | 44 | 36 | 34,615% |

The researchers found homogeneity between individuals of basic and exploratory research sample in tests. Variables as in Table (2):

**Table 2.** shows homogeneity of primary and exploratory research sample in some selected variables (mass - height - age)

| No. | Variables | Measurement Unit | Mean | St.d | Coefficient of skewness |
|---|---|---|---|---|---|
| 1 | Mass | Kg. | 65.3333 | 4.16104 | -341 |
| 2 | Height | cm. | 171.9167 | 6.77548 | .067 |
| 3 | Age | year | 19.6667 | .47809 | -.738 |

*Research Design*

The researchers used experimental method because it is suitable for nature of research. experimental method is distinguished from other educational methods by its ability to control and adjust various factors.

*Exploratory experiment*

Conducting an experiment is to survey researchers on ability and validity of tools, team, and tests that will assist them in experiment. This is an important process recommended by

scientific research specialists. It is an experiment or test that serves as a prelude to a larger experiment and test (Qasim Hassan et al. , 2022) . researchers conducted a pilot experiment on 10/15/2024 at 11:00 AM to determine appropriate placement of cameras, determine height of camera, and determine number of support staff. Although triple jump test was applied to similar groups of participants in other studies, researchers established following scientific basis:

1. *Honesty:* technical performance of triple jump was verified to be true by presenting it to experienced and specialized gentlemen, as previously mentioned, in addition to calculating self-truth, which is $\sqrt{\text{stability}^2}$ , and Table (3) shows that.
2. *Stability:* To ensure stability of technical performance of triple jump, researchers applied test to a sample of (18) players on 10/16/2024 and repeated test on same sample on 10/29/2024, and Table (6) shows that.
3. *Objectivity:* researcher verified objectivity of technical performance of triple jump event by recording test results by two judges who recorded test results in one breath and on exploratory experiment sample consisting of (18) players. Then, simple correlation coefficient (Pearson) was calculated between judges' scores, and it was shown that there was a high correlation coefficient in judges' evaluation, which indicates objectivity of test. Table (3) shows scientific foundations of technical performance of triple jump.

**Table 3.** shows validity, reliability and objectivity coefficients of scoring selection from stability of six divisions and scale of bodily-kinesthetic intelligence

| Variables | First application | | Second application | | Scientific foundations | | |
|---|---|---|---|---|---|---|---|
| | Mean | St.d | Mean | St.d | Stability coefficient | Self-honesty | Objectivity |
| Technical performance of triple jump event | 5,666 | 0.573 | 5,766 | 0.651 | 0.829 | 0.910 | 0.96 |

*Main experiment*

The educational programs were started to be applied to experimental and control groups on Sunday 11/17/2024, two educational units per week for each experimental and control group, as they were implemented by researchers to learn technical performance in triple jump activity for two groups in stadium of College of Physical Education and Sports

Sciences, applying program specific to each group in it, including educational objectives, and that each educational unit contains (virtual reality) and is given after performing exercises for practical part in it in a sequential manner, and that all educational units were applied to educational units distributed according to weekly schedule from Mondays of each week, as follows:

1. first experimental group that applied virtual reality.
2. second control group that applied usual teaching.

The implementation of educational units for experimental and control groups was completed on Thursday, February 20, 2025.

Post-test for learning technical performance in triple jump activity for three experimental groups began on Monday 2/24/2025. (3) attempts were given to each student and performer for each photography attempt, in same manner in which pre-test was conducted.

*Statistical Methods*

The researchers used the Statistical Analysis System (SPSS) for data analysis, except for percentages and standard deviations. Arithmetic means, simple correlation coefficients (Pearson), percentages, and t-tests between two related and unrelated arithmetic means were used.

## C. RESULTS AND DISCUSSION

### Results

Presentation and discussion of results of differences between pre- and post-tests in learning technical performance in triple jump activity For two research groups , after researchers obtained data, they processed it statistically using (T) test for related samples and to find out differences between arithmetic means between pre- and post-tests in learning technical performance in triple jump effectiveness.

The results of the study showed clear differences between the control and experimental groups in learning the technical performance of the triple jump. Table 4 presents the comparison between pre- and post-tests within each group. In the control group, there was

no significant difference between pre-test (M = 5.61, SD = 0.95) and post-test (M = 5.59, SD = 0.84), with a calculated t value of 0.090 and a significance level of 0.930 ($p > 0.05$). This indicates that the traditional teaching method did not lead to measurable improvement in technical performance. Conversely, the experimental group demonstrated significant progress. Their mean score increased from 7.33 (SD = 0.82) in the pre-test to 8.36 (SD = 0.54) in the post-test. The calculated t value was -5.140 with a significance level of 0.000 ($p < 0.05$), confirming that the virtual reality program had a positive effect on learning the triple jump.

**Table 4.** Shows results of differences between pre- and post-tests in learning technical performance

| Group | Pre-test | | Post-test | | calculated T value | Sig. value |
|---|---|---|---|---|---|---|
| | Mean | St.d | Mean | St.d | | |
| Control | 5.6111 | .94799 | 5.5861 | .84258 | .090 | .930 |
| Experimental | 7.3333 | .82248 | 8.3611 | .53703 | -5.140 | .000 |

**Table 5.** Shows results of (T) test for two post-tests between control and experimental groups in learning technical performance of two research groups in triple jump activity

| Variables | Test | Mean | St.d | Mean | St.d | T value | Sig. level | Sig. type |
|---|---|---|---|---|---|---|---|---|
| Virtual reality | Control | 5.5861 | .84258 | -2.77500 | .23551 | -11.783 | .000 | Sig. |
| | Experimental | 8.3611 | .53703 | | | | | |

Significant at error rate (0.05).

Table 5 further highlights the differences between the two groups in the post-test. The experimental group achieved a higher mean score (M = 8.36, SD = 0.54) compared to the control group (M = 5.59, SD = 0.84). The calculated t value was -11.783 with a significance level of 0.000 ($p < 0.05$), indicating a statistically significant difference in favor of the experimental group. These findings confirm that the use of virtual reality-based educational programs is more effective than traditional methods in improving the technical performance of the triple jump among students.

## Discussion

The analysis of the differences between pre- and post-tests in learning the technical performance of the triple jump (Table 4) indicates that the experimental group achieved a significant improvement in favor of the post-test ($p = 0.000 < 0.05$). This suggests that the educational units designed with virtual reality (VR) technology had a clear and measurable effect on enhancing students' performance. In contrast, the control group, which received traditional instruction, showed no significant progress.

The researchers attribute the improvement in the experimental group to the structure and content of the educational units, which incorporated VR-based exercises. These exercises provided students with the opportunity to observe technical skills through immersive visualizations, thereby facilitating better understanding, absorption, and replication of movements. As emphasized by Saher Razzaq (1993), the integration of modern technologies fosters learner motivation by combining visual engagement with cognitive processing, making the learning experience more effective and enjoyable. Similarly, Ihsan and Mohammed (2025) noted that augmented and virtual reality technologies enable smoother interaction and understanding of information during the learning process.

The results of the post-test comparison between groups (Table 5) further confirm the superiority of the experimental group over the control group. The VR-supported learning environment allowed students to connect prior experiences with new knowledge and develop more effective cognitive strategies for skill acquisition. Moreover, the positive and engaging atmosphere created by the teacher through diversified exercises increased students' enthusiasm, interaction, and willingness to participate actively in learning. Qasim Lazam (2005) also emphasized that variety in teaching methods and approaches creates excitement and enjoyment, which accelerates the acquisition of technical skills.

The findings align with Munir (2017), who explained that VR technologies blend reality with imagination, producing a multimedia environment rich in sensory inputs. Such an environment helps learners perceive technical performance as if they were the performers themselves, enabling them to identify mistakes, correct technical errors, and achieve a more accurate execution of complex skills. In the context of the triple jump, VR facilitated learners' ability to mentally visualize each phase of the skill, focus attention on details, and integrate physical and cognitive resources for optimal performance.

These outcomes underscore the importance of VR in creating a stimulating and motivating learning environment. As Sawsan Saad (2020) noted, interactive and engaging instructional approaches enhance student focus, motivation, and preparedness to learn. Furthermore, the findings are consistent with Nagasubramani and Raja (2018), who highlighted that modern technologies not only transform teaching methods but also address limitations inherent in traditional education.

In summary, the superiority of the experimental group demonstrates that VR-based programs provide learners with powerful tools for mastering the complex movements of the triple jump. By engaging multiple senses, enhancing visualization, and fostering learner motivation, VR technology contributes to more effective and sustainable improvements in technical performance.

## D. CONCLUSION

The results of this study confirm that virtual reality (VR)-based educational programs significantly enhance the learning of triple jump technical performance among second-year students at the College of Physical Education and Sports Sciences, University of Kirkuk. The experimental group that utilized VR showed clear superiority in post-test results compared to the control group, indicating the effectiveness of immersive technology in improving skill acquisition. This research contributes to the field of sports education by providing empirical evidence of VR's role in teaching complex athletics skills, offering a replicable instructional model, and bridging the gap between theoretical knowledge and practical execution. In practice, VR can create engaging learning environments, increase student motivation, and enable repeated observation and correction of technical performance, thereby assisting teachers in delivering more effective instruction. Based on these findings, it is recommended that VR-based programs be integrated into teaching the triple jump and other athletic skills, applied across diverse sports activities and larger samples, and combined with modern technologies such as motion capture and wearable devices to further enhance training effectiveness and long-term skill retention.

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## F. AUTHOR CONTRIBUTION STATEMENT

WGS was responsible for the manuscript and provided the main ideas for the research. In addition, he also assisted in research planning and contributed to the process from start to finish. MID contributed to data analysis and research development. Finally, HASS took care of the finalization and assisted with all revisions.

## G. REFERENCE

Al-Haiti, S. A.-D. H. (2004). *Statistical methods in administrative sciences: Applications using SPSS*. Wael Printing and Publishing House.

Ameen, I. Q., & Mohammed, M. Q. (2025). [Open-access article]. Licensed under Creative Commons Attribution 4.0 International (CC BY-NC-ND). https://creativecommons.org/licenses/by/4.0/

Anchunda, H. Y., & Kaewurai, W. (2025). An instructional model development based on inquiry-based and problem-based approaches to enhance prospective teachers' teamwork and collaborative problem-solving competence. *Social Sciences & Humanities Open*, *11*, 101480. https://doi.org/https://doi.org/10.1016/j.ssaho.2025.101480

Awad, M., & Barghouth, M. (2017). The effect of using a virtual learning environment on the achievement of ninth grade female students in the technology curriculum in Palestine. *Jordanian Journal of Applied Sciences,* *18*(2), 16–30. https://jjoas.asu.edu.jo/index.php/jjoas-n/index

Badrakhan, S. S. A.-D., & others. (2020). The degree of impact of using modern educational technologies on the quality of education and its development at Amman Private University from the perspective of academic staff members. *Al-Balqa Journal of Research and Studies, 23*(2), 66–80. https://digitalcommons.aaru.edu.jo/albalqa/vol23/iss2/5

Filippou, D., Buchs, C., Quiamzade, A., & Pulfrey, C. (2022). Understanding motivation for implementing cooperative learning methods: a value-based approach. *Social Psychology of Education : An International Journal*, *25*(1), 169–208. https://doi.org/10.1007/s11218-021-09666-3

Gunawan, A., Wiranto, N., & Wu, D. (2023). Application of virtual reality in diverse fields of study in education sector: a systematic literature review. *Procedia Computer Science*, *227*, 948–957. https://doi.org/https://doi.org/10.1016/j.procs.2023.10.602

Han, S. G., Kim, Y. D., Kong, T. Y., & Cho, J. (2021). Virtual reality-based neurological examination teaching tool(VRNET) versus standardized patient in teaching neurological examinations for the medical students: a randomized, single-blind study. *BMC Medical Education*, *21*(1), 493. https://doi.org/10.1186/s12909-021-02920-4

Haniyyah, N., Suhartini, B., & Salacup, V. L. D. (2025). How does medicine ball pull over pass and resistance band training affect passing and shooting ability? a systematic review on

the sport of handball. *Tanjungpura Journal of Coaching Research*, *3*(1), 67–75. https://doi.org/10.26418/tajor.v3i2.89702

Harianto, E., Gustian, U., Supriatna, E., Shalaby, M. N., & Taiar, R. (2023). Stimulating game performance skills in students: experimental studies using net games. *Tanjungpura Journal of Coaching Research*, *1*(2), 63–70. https://doi.org/10.26418/tajor.v1i2.65009

Huijgen, B. C., Leemhuis, S., Kok, N. M., Verburgh, L., Oosterlaan, J., Elferink-Gemser, M. T., & Visscher, C. (2015). Cognitive functions in elite and sub-elite youth soccer players aged 13 to 17 years. *Plos One*, *10*(12). https://doi.org/10.1371/journal.pone.0144580

Hussein, A. R. A. (2025). The effect of the Ayas model to learning individual fast attack and high-order thinking skills of handball for students. *Tanjungpura Journal of Coaching Research*, *3*(1), 56–66. https://doi.org/10.26418/tajor.v3i1.89153

International Federation of Computer Science Studies. (2025). *Asian Journal of Physical Education and Computer Science in Sports, 32*(1). https://www.ifcss.in/JournalNo.32/Asian%20Journal%2032-1.pdf

Lazam, Q., & others. (2005). *Foundations of learning and teaching football*. Al-Karar Printing and Publishing House.

Mohammed, A. A. (2023). Effect of playing in small spaces according to feedback system on learning some basic football skills for boys of Besiktas Football School in Kirkuk City. *Revista Iberoamericana de Psicología del Ejercicio y el Deporte, 18*(1), 1–8. https://www.riped-online.com/

Noufal, K. M. (2010). *Production of educational virtual reality software*. Manahij Publishing and Distribution House.

Rateb, O. K. (2000). *Sports psychology: Concepts and applications* (1st ed.). Dar Al Fikr Al Arabi.

Raja, R., & Nagasubramani, P. C. (2018). Impact of modern technology in education. *Journal of Applied and Advanced Research, 3*(S1), 33–35. https://doi.org/10.21839/jaar.2018.v3iS1.165

Razzaq, S. (1993). *The effect of a model using audio-visual devices on motor performance in rhythmic gymnastics* (Unpublished master's thesis). College of Physical Education, University of Baghdad.

Rumpoko, S. S., Sistiasih, V. S., Budiyono, K., & Gandasari, M. F. (2025). Evaluating the effectiveness of a virtual reality-based training method for basic scuba diving skills. *Pedagogy of Physical Culture and Sports*, *29*(2 SE-Articles), 105–111. https://doi.org/10.15561/26649837.2025.0204

Sánchez Trujillo, M. D. L. Á., & Rodríguez Flores, E. A. (2022). Cognitive processes and reading skills in nursing students. *Human Review. International Humanities Review / Revista Internacional de Humanidades*, *11*. https://doi.org/10.37467/revhuman.v11.4061

Scager, K., Boonstra, J., Peeters, T., Vulperhorst, J., & Wiegant, F. (2016). Collaborative

Learning in Higher Education: Evoking Positive Interdependence. *CBE Life Sciences Education*, *15*(4). https://doi.org/10.1187/cbe.16-07-0219

Suharsiwi, Rachmawati, N. I., Dehham, S. H., & Darmayanti, R. (2023). "DINO Vs. DINI" educational game to increase children's cognitive abilities—what are its level elements? *Delta-Phi: Jurnal Pendidikan Matematika*, *1*(2), 107–112. https://doi.org/10.61650/dpjpm.v1i2.244

Veldman, S. L. C., Santos, R., Jones, R. A., Sousa-Sá, E., & Okely, A. D. (2019). Associations between gross motor skills and cognitive development in toddlers. *Early Human Development*, *132*, 39–44. https://doi.org/https://doi.org/10.1016/j.earlhumdev.2019.04.005

Yang, Y. (2018). The innovation of college physical training based on computer virtual reality technology. *Journal of Discrete Mathematical Sciences and Cryptography*. https://doi.org/10.1080/09720529.2018.1526400

Yass, M. A., Saber, A. A. M., & Saleh. (2025). Effect of exercises for some motor abilities according to a random practice schedule in learning technical performance of the javelin throw event. *Asian Journal of Physical Education and Computer Science in Sports, 32*(1), 20–29. ISSN 0975–7732.

Zulnadila, Suharjana, Arjuna, F., Sriwahyuniati, C. F., Mappanyukki, A. A., Rahman, A., Agustina, D., & Szczepocki, M. (2025). Traditional games for physical fitness in primary school students: A systematic review in Indonesia. *Tanjungpura Journal of Coaching Research*, *3*(1), 76–86. https://doi.org/10.26418/tajor.v3i2.89690