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Karrar Abdulkareem Khudhair
College of Physical Education and Sports Sciences, University of Wasit, Iraq

Corresponding Author:
Karrar Abdulkareem Khudhair
College of Physical Education and Sports Sciences, University of Wasit, Iraq

The effectiveness of using the partial method in developing some kinematic variables and achieving effective triple jump jumpers for beginners

Karrar Abdulkareem Khudhair

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Abstract
The purpose of this paper is to identifying the kinematic variables and their values among members of the research sample from the beginning of the step phase of the approximate sprint until the landing phase, preparing special exercises to develop kinematic variables, and identify the effectiveness of using the partial method in developing kinematic variables and students' effective achievement of the triple jump for members of the research sample. The researcher used the experimental method (one-group design with pre- and post-test) because it suits the nature of the problem to be solved**.** The research community was determined by third-year students at the College of Physical Education and Sports Sciences/Wasit University for the academic year (2023-2024), who numbered (145). The research sample was selected from the original community, represented by third-year students at the College of Physical Education and Sports Sciences / University of Wasit, with a rate of (30) students and a simple random method, as the percentage reached (20.68%). One of the most important results reached by the researcher is that: The partial method in developing some kinematic variables has a positive impact on the development of the kinematic variables investigated in the research sample, and the special exercises in which the researcher based his work on kinetic analysis had an impact on the learning events of the students of the College of Physical Education and Sports Sciences, which led to the development of kinematic variables in the research sample. One of the most important recommendations recommended by the researchers is that: Use the partial method when teaching the effectiveness of the triple jump, especially with students, and necessity of evaluating technical performance because of careful observation using biomechanical analysis via computer to diagnose errors and the extent of their treatment.

Keywords: Long jump, kinematic variables, kinematic analysis, training curriculum, partial method

Introduction
The interaction between the sports sciences is something that works to raise the level of performance, and one of these sciences is biomechanics. The main content of this science is the study of the causes of movement. It provides the most appropriate solutions by using kinetic analysis, which constitutes the initial hypotheses and premises with a scientific relationship to rationalize learning for various sports activities, in particular Athletics events. Education and its various methods played an effective and fundamental role in developing the level of performance for the triple jump, and modern teaching methods appeared in a way that is consistent with each of the activities and in a way that enhances the educational process. The importance of the research lies in choosing the partial method for the following reasons This method depends on dividing the movement into main parts, then he begins to teach each part separately, and after controlling all parts of the movement and the teacher being certain of this, here we wonder which part of the movement should we start with? To answer this question, we will review two methods: This method is based on starting to teach the parts according to the movement sequence. The partial method is not suitable for learning all sports movements from an economic point of view, and thus we are forced to use this method in the following circumstances:

- When the movement or activity is long and difficult to perform.
- When the parts of the movement or activity are complex and require high skill.
- When there is enough time to divide the movement and control those parts.
- When learners are young and inexperienced.
- When there are no means of explanation.

Research problem

The researcher noticed that most beginners face difficulty when learning the triple jump compared to other jumping activities, and its difficulty in the process of linking the approach stage of running (especially in the step stage) with the process of getting up and its impact on the rest of the stages (flying and landing). The researcher attributes the reason for this to the fact that the method followed by the trainer and the exercises he uses in teaching effectiveness still relies on the method of verbal explanation and model presentation, which may sometimes be lacking in order to make the educational situations more effective and lively. Therefore, the possibility of using other methods is the best solution to move away from traditional methods, so the researcher decided to study the effectiveness of using the partial method in developing some kinematic variables and achieving effective triple jump jumpers for beginners.

Research objectives

- Identifying the kinematic variables and their values among members of the research sample from the beginning of the step phase of the approximate sprint until the landing phase.
- Preparing special exercises to develop kinematic variables.
- Identify the effectiveness of using the partial method in developing kinematic variables and students' effective achievement of the triple jump for members of the research sample.

Research hypothesis

- There are significant differences between the pre-test and post-test and the students' achievement in the triple jump.
- There are significant differences in the effectiveness of using the partial method in developing some kinematic variables and achieving the effectiveness of the triple jump and the methods followed by teachers.

Field of research

- **Human field:** Third stage students in the College of Physical Education and Sports Sciences / University of Wasit for the academic year (2024-2023).
- **Time field:** The period from 18/11/2023 to 11/2/2024.
- **Spatial field:** Arena and field at the College of Physical Education and Sports Sciences - University of Wasit.

Research methodology and field procedures

Research methodology

The researcher used the experimental method (one-group design with pre- and post-test) because it suits the nature of the problem to be solved.

Research population and sample

The research community was determined by third-year students at the College of Physical Education and Sports Sciences/ University of Wasit for the academic year (2023-2024), who numbered (145). The research sample was selected from the original community, represented by third-year students at the College of Physical Education and Sports Sciences / University of Wasit, with a rate of (30) students and a simple random method, as the percentage reached (20.68%).

Methods and tools used in the research

Research methods

The researcher used the following research methods

- Arab and foreign sources and references.
- Note.
- Kinetic analysis.
- Information network (Internet).
- Kinetic analysis results form.

Tools and devices used in the research

Field research procedures

The procedures included the following:

Exploratory experience

The exploratory experiment is a mini-experiment of the basic experiment, and it must meet the conditions and conditions in which the basic experiment is conducted as much as possible so that it can be implemented. (Qais Naji, Bastawisi Ahmed, 1987) [1].

The exploratory experiment was conducted on 11/25/2023, and the following was identified:

1. The extent of the sample's readiness to apply the tests.
2. Know the time it takes to conduct the tests.
3. Knowing the suitability of the tests for the research sample.
4. Ensure knowledge of the devices and tools used.
5. The assistant work team.
6. Ensure that the appropriate dimensions for the camera are installed, the range of vision, the clarity of the image, and the possibility of photographing.

Pre-test

The test "is a means of evaluation, measurement, diagnosis and guidance in various curricula, programs and plans for all levels and age stages. It clearly indicates the extent of progress and success in achieving objective goals" (International Federation of Athletics Federations, 2005) [2].

The pre-test was conducted on Monday, December 1, 2023 at nine in the morning on the arena and field court at the College of Physical Education and Sports Sciences - Wasit University. A multi-speed video camera (CASIO-EX-FH20 (30-1000)) was used. One image/second, at a distance of (15.30 m) from the middle of the approach road from the right side and at a height of (1.05 m), and it is perpendicular to the middle of the ascent board in order to photograph the last section of the approximate run (the step phase) up to the last third of the landing area (the pit).

Guiding marks were also placed on the hip joint to be a virtual point representing the center of gravity, as well as reflective points on the knee joint. The marks were used to help calculate kinematic variables after converting the images into numbers directly by computer. The research sample members were photographed and given (3) legal attempts for all learners, according to the law. Even if the number of contestants is more than (8) players (Kamal Abdel Hamid and Muhammad Sobhi Hassanei, 1997) [3].

The researcher used a drawing scale according to the camera used, as every (1) m in nature equals (1.05) cm in the picture, and these measurements were used to extract speeds and distances later, and the pre-test also included the following:

- The digital achievement of each jumper out of three attempts, the best attempt was chosen.

- Evaluating performance by photographing the students' performance. This photograph was presented to the experts and they gave grades for the three stages involved in the research, which are (the step stage, the rising stage, and the flying stage).

Kinematic analysis of movement

"Analysis in general is a means of dividing whole bodies into parts and studying these parts in depth to reveal their subtleties." (Saeb Attia and others, 1991) [4], In order to obtain the results of movement analysis accurately, analyzing movement through video photography is an accurate way to study movement variables, as those conducting the movement study were able to Pointing out the strengths and weaknesses affecting the movement.

Kinematic variables related to the research and how to measure them

Horizontal speed during the step phase

Horizontal speed is of great importance in the effectiveness of the triple jump, and the difference in the step phase depends on several mechanical variables, including the speed of the jumper, the length of the step, and the pre-step. This does not only require high speed, but in addition to that, the approach and rise are well, because when the approach and rise are accomplished well, it constitutes 90% of performing the duty. The speed of approach (for a step) is calculated by both the length and time of the step according to the following law. (Al-Sumaidaie Louay, 1991) [5].

Distance (length of the last three steps)

$$\text{Average speed} = \frac{\text{Distance (length of the last three steps)}}{\text{Time (the time of the last three steps)}}$$

Step stage: (Muhammad Jassim Al-Hilli, 2001) [6]

It is extracted using the special program (Kinovea) designed to measure distances, which is the horizontal distance confined between the point of contact of the back foot (leading leg) with the ground, the beginning of the step, to the last point of contact of the front foot (leading leg) to the ground.

Jumping flight speed: (Saeb Attiya (and others)

It is the resultant of the horizontal and vertical speed of a body during flight, and it is represented by the speed of movement of the center of gravity of that body. This variable is measured after the take-off foot leaves the take-off plate. The first and second photos are taken from the photography during the player's flight phase, and the distance between them is measured using a drawing scale for the distance and its time.

$$\text{Airspeed} = \frac{M2 - M1}{N2 - N1}$$ (Qasim Hassan Hussein and Iman Shaker, 1998)

N2 - N1

Where it represents

M2 = second distance.

M1 = first distance.

N2 = second time.

N1 = first time.

Flight angle

It is considered "the angle between the horizontal line passing through the center of gravity of the body during flight, the center of gravity of the body when the foot leaves the landing pad, and the horizontal line parallel to the ground. It was calculated by determining the two sides of the angle and is measured in degrees" (Kamal Abdel Hamid and Muhammad Sobhi Hassanein, 1997) [9].

The angle of maximum knee flexion at the moment of support

It is "the angle between the thigh and the leg, and it is calculated by determining the two sides of the angle for the support leg".

Height of the body's center of mass (m.kg) at the moment of support

This is done by determining the body's center of mass (m.kg.) at the moment the body reaches the vertical position above the riser foot, and from the integrated shape of the body, the distance between the position of (m.kg.) is measured at the moment the riser foot touches the riser plate in the last step and between the earth (Muhammad Jassim, 2006) [6].

Educational curriculum

For the purpose of knowing the effectiveness of the partial method in developing kinematic variables and students' learning and achievement of the triple jump event, the educational curriculum included ten educational units in addition to three introductory units, with two learning units per week. The time of the educational unit is (90) minutes.

The educational curriculum has been formulated according to the results of the analysis of the kinematic variables identified for the research sample, as the difficulty of performance is related to the absence of a precise section on mechanical principles and foundations.

Post-tests

After completing eight educational units, the post-test was conducted on the research sample on 1/13/2024, corresponding to Monday at eleven in the morning, until 1/17/2024 at the arena and field stadium in the College of Physical Education and Sports Sciences - Wasit University, and the researcher prepared the same conditions. For the test in terms of time and place in the pre- and post-tests.

Statistical methods

Statistical methods were used using (SPSS) program.

Presentation, analysis and discussion of the results

Presenting the results of the pre- and post-test for the two research groups and for the variable horizontal speed rate during the last three steps, analyzing and discussing them

Table 1: Shows the arithmetic means, standard deviations, and (T) value calculated for the pre- and post-test of the horizontal speed rate variable in the last three steps

Variables	Pre		Post		(T) value calculated	Type sig
	Arithmetic means	Standard deviations	Arithmetic means	Standard deviations		
Average horizontal speed of step	5.63	0.58	6.84	0.75	7.24	sig
Angle (maximum knee flexion at the moment of support)	119.5	6.91	156.8	5.42	27.88	sig
Flight angle	19.52	2.45	21.97	3.03	3.86	sig
Airspeed	5.72	0.38	6.73	0.51	8.67	sig
Center of body mass	0.64	0.11	0.65	0.23	3.39	sig
Performance variable	4.43	0.29	6.46	0.74	8.05	sig
Achievement variable	4.36	0.68	4.84	0.57	6.94	sig

The tabular T value is (2.14) at the degree of freedom (14) and below the significance level (0.05).

Through Table (1), the researcher attributes this result to the fact that any exercise can have a positive impact on the level of skill performance, especially if the nature of the education tends to develop performance, and this is what happened with the members of the sample that were exposed to the educational curriculum, as the exercise gave a positive result in Developing the speed characteristic in general and the approach speed in particular (as this characteristic is important in controlling the final speed of the jump or to rise through proportionality to the goal and path of the motor performance of the event). Which made this variable develop among the members of the research sample, especially in the post-test. The reason is due to the effectiveness of the partial method in alerting the student about the presence of a mechanical error in motor performance, as well as the use of some special exercises present in the prepared educational curriculum that help improve speed and achieve the appropriate mechanical goal. For the motor path of the approach stage, especially the speed of the approach during the last step before rising in a smooth manner. This means that the sample members have prepared the paths of their bodies in the correct manner and at the appropriate speed so that the last step is under high mechanical and flowing conditions to perform the process of getting up, i.e. the correct connection of the approach and rise, and this is what Luay Al-Sumaidaie prepared. (The athlete achieves high results thanks to the horizontal speed he obtains through his approximate running) (Luay Al-Sumaidaie, 1987) [14], and as for (For the variable angle of maximum knee flexion at the moment of support), he attributes this result to the use of repetition lessons of many flexibility exercises and the basic preparatory period, as well as strength and speed exercises according to the path and nature of the movement in the triple jump to withstand the force applied to the board by the jumper, which worked to develop muscle resilience. Which works at this stage of performance and then develops the angle of the knee of the rising leg. This helps in ensuring that the torque of the weight is small when the student's body leans backward and thus the radius moves away from the line of gravity to help him move the body forward correctly and in the effectiveness of applying the educational curriculum in the partial method. It is what led, as I mentioned previously, to developing the resilience of the ligaments, muscles and joints of the rising leg, especially the knee joint, "as it bears approximately 33% of the force produced by the foot above the (rising) plate" (Qasim Hassan Hussein and Iman Shaker, 1998). As for the angle of flight, it emphasizes that (the angle of flight must fall between (20-24) degrees, as it is determined by the horizontal line that passes through the center of gravity of the body of the jumper and is parallel to the surface of the ground during the rise before leaving the rise board and between the line drawn by the center of gravity of the body a moment later. Leaving the ground, from the above, the researcher believes that the implementation of the educational curriculum prepared for the sample was positive in influencing and achieving an appropriate starting angle to achieve the required horizontal distance from the sample. Thus, statistically significant differences appeared between the pre- and post-tests, as the researcher indicates that the limits of the starting angle In training and practicing to teach the effectiveness of the triple jump, it is not suitable for learners, and it is one of the factors that the teacher emphasizes when teaching and training this activity. Therefore, the continuation of training and practice has developed the extent of this angle, and the reason is that when the jumper exerts a greater force while getting up, this has led to the highest height while getting up, and this leads to increasing the horizontal distance and achieving better achievement, and the goal of the mechanical skill is to obtain the farthest horizontal distance, and also the variable speed of flight. It was noted that this is due to the exercises that the sample was exposed to during the learning stage, which depends on the speed of approach. It must be applied and in accordance with the correct exercise for the ascension phase, and emphasis must be placed through these exercises on the launch speed (the rapid, explosive force of the leg muscles) upon ascension, as the variable of the launch speed is important in determining the jump distance in accordance with the appropriate increase in the launch angle, and that "results of recent experiments In the field of triple jump, it refers to the level of the jump (the digital level), which is determined in a ratio (2-3) by the speed of the approach and in a ratio (1-3) by the strength and speed of the rise. (Muhammad Othman, 1990).

The researcher found the variable center of mass of the body (M.K.C) to have developed positively, and this is due to the effect of various exercises through the application of the prescribed method, which contributed significantly to the increase in the center of mass of the body, that is, the higher the center of mass of the body, the closer it is to the line of gravity passing through it. Perpendicular to the ground. This is what made the jumper benefit from the momentum during the process of getting up to gain a greater distance, which made the students apply the path of the center mass of the body in the correct mechanical way to support and get up according to mechanical conditions and smoothly, with no significant decrease in the starting speed, provided that the

rate of its influence and relationship is effective. With the total distance achieved (Fathi Milad Qanbour, 1994).

Regarding the performance variable, and through the above, the researcher notes that the development and improvement occurring in all the kinematic variables investigated that are directly related to motor performance, which is evidence of the improvement of technical performance, which was confirmed through the use of exercises and the partial method, and what has been achieved in correcting the errors accompanying the performance has helped. To develop the ability of the sample members to correctly use the parts of the body involved in the performance to achieve its goal, and this is what Khairiya confirmed by saying that "the use of educational methods and methods with a direct effect that are chosen primarily according to the type of weakness and defect occurring in the performance so that the development is specific to the type of defect works to improve the performance "(Khairiya Ibrahim Al-Sukkari, 1996).

From the above, the researcher attributes this development in achievement to the fact that the exercises that were used on the research sample and all the developments that occurred in the stages of performance and the kinematic variables investigated and related to performance and which were revealed by the results of the analysis were helpful in serving the kinetic goal of the jump, which is achieving the farthest horizontal distance for the jump and This indicates that the development of the variables gave an indication of increased work efficiency between the body's joints and working muscles, and thus gave greater speed, which helped in the development of the total distance for the effectiveness of the triple jump (achievement) in the dimensional measurement.

The application of the performance was linked to the partial method that became based on scientific foundations, as the educational curriculum prepared by the researcher and his various exercises and the resulting exercises had an effective role in the work of the muscles related to the triple jump and the focus on their work in the correct path, as it works on the economy of effort and the flow of movement, and it affected the development of the achievement in its form. This helped the sample obtain an advantage in the triple jump event in terms of...

Digital achievement, as "skill is a significant characteristic of the effectiveness of performance, as the learner develops some motor responses in a new motor organization, and every motor skill requires organizing and arranging the work of specific muscle groups and in a specific direction" (Qasim Hassan Hussein, 1995).

Conclusions and recommendations

Conclusions

Through discussing the results, the researcher reached the following conclusions

- The partial method in developing some kinematic variables has a positive impact on the development of the kinematic variables investigated in the research sample.
- The special exercises in which the researcher based his work on kinetic analysis had an impact on the learning events of the students of the College of Physical Education and Sports Sciences, which led to the development of kinematic variables in the research sample.
- The effect of the partial method described according to the results of the kinetic analysis has affected the improvement of the performance and achievement of the research sample.

Recommendations

According to the conclusions reached, the researcher recommends the following

- Use the partial method when teaching the effectiveness of the triple jump, especially with students.
- Necessity of evaluating technical performance because of careful observation using biomechanical analysis via computer to diagnose errors and the extent of their treatment.
- Conduct similar studies for other sporting events and for different age groups.

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