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The effect of exercises using an innovative electronic device on learning to perform the skill shooting from constancy in basketball for students at the College of physical education and sports sciences

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Abstract

Basketball is one of the sports that requires high mastery of motor skills the use of electronic devices can stand for a qualitative leap in the methods of teaching its basic skills. Therefore, the importance of the research was to study the effect of exercises using an electronic device designed specifically to teach the performance of the skill of shooting from constancy. The research focuses on exploring the effectiveness of these devices in improving skill acquisition and increasing performance accuracy among physical education and sports science students in line with modern developments in educational curricula. The two researchers used the experimental approach in the study as it is the optimal option The research community included the students of the first stage of the evening study at the College of physical education and sports sciences at the Mustansiriyah University for the academic year (2024-2025) numbering (46) students with a percentage of (48.93) % from the community of origin who belong to two classes (A B). The results showed that both the control and experimental groups had significant improvements in arithmetic mean between pre-test and post-test. The control group teams averaged 1.2 while the experimental group teams averaged 2.6. The T-values of both groups were higher than the calculated t-values which indicates statistical significance. The study concluded that an innovative electronic device improved basketball shooting skills by 2.6 points in the experimental group compared to 1.2 points in the control group. Real-time feedback has accelerated the learning process which supported the use of technology in sports training especially in complex motor skills.

Keywords: basketball, shooting, biomechanics, electronic device, motor learning.

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Introduction

Basketball constitutes one of the most widespread and respected team sports globally attributed to its inherent dynamism and constant movement that coordinates individual dexterity with collaborative teamwork. This sports discipline is based on several competencies with a special emphasis on shooting passing and dribbling as these competencies support the technical and collective effectiveness of the team. Mastery of shooting in particular through the skill of shooting from Fortitude is one of the basic skills that was prioritized during the early stages of basketball pedagogy due to its great influence on the accumulation of points that ultimately dictate the outcome of a win or loss. Shehata (2018) emphasizes that the execution of shooting from a stationary position needs a high degree of accuracy in performance and it needs a balance between strength and trajectory in order to successfully hit a target which makes it a fundamental competence in the progress of novice and experienced athletes. In the context of motor learning the process is characterized as a continuous course of constructive changes in performance resulting from repetitive practice and assimilation of feedback. Schmidt and Lee (2011) proved that motor learning entails a coherent interaction of physical and cognitive dimensions since the process involves not only strengthening physical maneuvers but also needs a deep understanding of performance parameters and error correction. In the same vein. One of the fundamental pillars for studying and improving motor abilities in a variety of sports including basketball is biomechanics. When applying mathematical skills motion analysis helps to understand how mechanical forces affect the body. One of the key elements in the shooting ability of steadiness is the control of elbow and wrist angles which determine the accuracy of the shot (Fadel et al. 2022). Since the angle of the elbow when performing directly affects the kinetic path that the ball takes the appropriate angle helps to provide the best force to achieve the injury. The wrist also plays an important role in knowing the direction and speed of the ball when it is released as the movement of the wrist helps to add rotation to the ball which increases the likelihood of its accuracy in the ring (Jassim 2024). The skill of shooting from immobility is one of the skills that requires high concentration by learners as it requires complete control of body movement while balancing speed and accuracy (Khalid Jassim 2024). Rank (2010) points out that teaching this skill requires following diverse learning strategies based on repetition and practical revision to gradually improve performance. Recent studies also confirm that improving the learning of shooting from consistency contributes to enhancing the confidence of players in their technical abilities which positively reflects on the performance of their team during matches. With technological progress electronic devices have emerged as an innovative educational method that helps to improve learning efficiency and develop motor performance. These devices contribute to an interactive learning environment that provides instant feedback allowing the learner to correct errors quickly and accurately (Ahmed Obaid et al. 2024). In a study conducted by Djerou (2019) it was found that the use of electronic devices in the teaching of mathematical skills promotes positive interaction between learners which enhances their ability to get skills. As part of the same framework Weinberg and Gould (2018) found that these devices help in improving concentration and enhancing effectiveness during training which makes them an important component of modern sport education. Since basketball is one of the sports that requires a high mastery of motor

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skills the use of electronic devices can stand for a qualitative leap in the methods of teaching its basic skills.

Therefore hence the importance of the current research to study the effect of exercises using an electronic device designed specifically to teach the performer the skill of shooting from immobility. The research focuses on exploring the effectiveness of these devices in improving skill acquisition and increasing performance accuracy in physical education and sports science students in line with recent developments in educational curricula.

Methodology

The experimental approach in this research involves the division of participants into two groups the first is the experimental group using the innovative electronic device and the second is the control group that continues training using traditional methods. This distribution allows the researcher to compare the performance between the two groups and determine whether the use of an electronic device has an effective effect on learning and improving the shooting skill of constancy.

According to Cohen et al. (2007) the experimental approach is best suited for research that requires measuring the impact of specific interventions on a certain group of motor skills. Mertens (2019) also noted that this approach allows a careful analysis of the results by controlling for variables that may affect the experiment enhancing the accuracy of the results that can be reached. Through the use of an innovative electronic device the research provides students with interactive training with instant feedback which helps to improve the technical performance of the shooting skill faster and more accurately compared to traditional training. The experimental approach demonstrates how these effects can be objectively evaluated which enhances the value and feasibility of research in the development of methods for teaching basketball skills in academic programs for physical education students.

Study design

The study is an experimental study using a Quasi-experimental design comparing two groups:

1-experimental group: uses an innovative electronic device to teach the skill of shooting from constancy.

2-the control group: practice using traditional methods without using the electronic device.

The study aims to measure the impact of using an electronic device on improving the accuracy of shooting compared to traditional methods and the data is collected through a pre-and post-test to measure the difference in performance between the two groups.

Participants

The research community included the students of the first academic year of evening study at the Faculty of Physical Education and sports sciences at Mustansiriya University for the academic year (2024-2025) Evening study numbering (94) students who belong to (3) classes (A

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B C) Class (C) was excluded from the research experiment for use in the exploration experiment. As shown in table 1.

Table1. *Shows the number of research sample members and experimental totals*

classes	groups	The method used	Total No of students	No of excluded students	Remaining No of students
A	experimental group	electronic device to teach the skill of shooting from constancy	31	8	23
B	control group	traditional methods without using the electronic device	31	8	23
Total			62	16	46

The research sample was deliberately selected from the grades (A B) and the number of (46) students to apply the research experiment according to the following methods:

The first Group (A): uses the innovative electronic device to learn the skill of shooting from constancy with a basketball.

Group II (B): traditional methods are used to learn the skill of shooting from constancy with a basketball.

A number of students were excluded from the sample to achieve parity between the two groups according to the following criteria:

- Failing students.
- Students who represent the college or university in sports.
- Students who practice basketball games in sports clubs or institutions.

The percentage of the sample was (48.93) % of the community of origin.

In order to achieve parity between the research groups to prove the effect of the independent variable in learning the performance of the shooting skill from constancy in basketball the researcher used one-way variance analysis between the groups to find the significance of differences between the variables of age weight and height. As shown in table 2.

Table 2. *Shows the analysis of the variation between research groups in variables (age weight height)*

Variables	Measurement Unit	Source of variability	Sum of Squares	Degree of freedom	Mean Squares	Calculator
Age	Years	Among the groups	21.748	1	21.748	2.921
		Within the groups	331.555	48	6.902	
Weight	Kg	Among the groups	15.856	1	15.856	1.988
		Within the groups	476.065	48	9.919	
Length	Cm	Among the groups	11.239	1	11.239	1.378
		Within the groups	527.348	48	10.999	

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Where the Critical F-value of the two degrees of freedom (1.48) at the error level of 0.05 is 4.06. Since the computed F-value in the case of age weight and height is less than this critical F- value it can be concluded that there are no significant differences between the groups in these variables and is evidence of the equivalence of the totals in these variables.

Tools

The main tool in the study is an innovative electronic device that is specially designed to teach the skill of shooting from Persistence. The device is based on providing instant feedback on the motor angles of the elbow and wrist while performing a shot as well as directing sound signals to correct errors in movement.

Device Working Details

The purpose of the device: teaching the shooting skill of basketball fastness.

Working device: this device gives instant alerts about measuring the angles of movement of the skill to be corrected at once.

Device description: the device was manufactured by the microcontroller board (Arduino Uno R3). The device is connected by a special rubber backrest designed for the device to given vivacity when performing as the research sample wears it for test performance. The device has two input ports the first for the purpose of connecting electricity to the device as it works at voltages (5V) and the second port (USB) for the purpose of giving commands and programming the device. The device in turn holds two outputs for the purpose of connecting voltages (L N) in addition to signaling to the sensors.

The following tools were also used in the study:

- SPSS Version 26
- Surface Laptop Computer
- Basketball Hall.
- (8) basketballs
- Data registration form
- Tape measure
- Whistle

Shooting test of basketball constancy: (Hamoudat and Jassim 1999)

Name of the test: measuring the accuracy of shooting at players from the free throw line.

Method of performance

- The player stands in front of the free throw line from the outside of the forbidden zone inside the semicircle drawn above the forbidden zone.
- The player is given 25 attempts to shoot from the free throw line.
- The player starts shooting from the free throw line on the basket after being allowed to Shoot.
- The player scores the maximum number of successful shot attempts.

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Recording

- The player is awarded one point for each of the successful shot attempts.

Instructions

The player executing the free throw must follow the following:

- The player can use any method of shooting from the free throw in such a way that the ball enters the ring from above or touches the ring without touching the ground.
- The player must shoot towards the basket within five seconds from the time the ball was placed in his reach by the test operator.
- The player must not touch the free throw line or the forbidden area behind the free throw line before the ball enters the ring.

Data collection

The data was collected in four stages:

1-exploratory stage: the exploratory stage aims to test the effectiveness of the innovative electronic device in learning to perform the skill of shooting from stability in basketball as well as to find out the suitability of the tools used and the experimental approach to be followed in the research. This stage aims to identify the challenges that may arise during the main experiment and ensure the accuracy of the procedures followed and was conducted on Sunday 08-09-2024 on a small sample from outside the research sample where students applied various exercises that depend on the device in order to learn the skill of shooting from stability.

2-the initial stage (pre-test): the shooting performance of the constancy of all participants was measured before the start of the experiment. The number of successful and failed shots was recorded and all the required data was taken into consideration for the variables.

3-training phase (experimental curriculum):

- Objective: the Objective of the training stage is to assess the impact of using an innovative electronic device on improving the shooting skill of stability in basketball in comparison with traditional methods in training. The focus was on examining the effectiveness of the electronic device in enhancing the accuracy of shooting and improving the overall performance of students in learning the skill of shooting from stability. The members of this group were trained using the innovative electronic device which helps to learn and improve the skill of shooting from stability.

-Duration of training: the training period has been set to be 8 continuous weeks. This period was distributed over two training units per week the duration of each training unit is 60 Minutes. Each training module was divided into dedicated training periods including shooting training using the device where the time structure of training was divided from the first week to the fourth week. Training on electronic devices is combined with the traditional method to stimulate improvement. From the fifth to the eighth week work is conducted to improve performance through continuous repetition and direct feedback. At this stage the exercises become more challenging and students are encouraged to focus on the goals set in each training module. The challenges of using the electronic device are increased by adding features such as providing real-time analysis of performance during training.

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- Evaluation and follow-up: at the end of each week students' performance is evaluated using the free shooting test (with an average of 10 free throws) to measure progress. At the end of the eighth week students' performance is assessed using the same free shooting Test as well as on-the-spot analytical tests using the electronic device

4-the final stage (post-test): the goal of the final stage (post-test) is to evaluate the effect of the exercises applied during the training phase on the shooting skill of stability in basketball in participants of both the experimental group (which used the electronic device) and the control group (which used traditional methods). During this stage the improvement in the accuracy of shooting is measured in comparison with the performance in the pre-test (the test before the start of training) and the test was conducted on Sunday 10-11-2024.

Result

Table 3. *Shows the arithmetic mean standard deviations and the value (T) computed for the control groups experimental and for the pre-and post-tests of the shooting from constancy in basketball*

Statement	pre-test	post-test	Arithmetic mean difference	Computed T-value	Degree of freedom	critical value of T	Semantics
Control Group (B)							
mean	5.1	6.3	1.2	4.5	48	2.01	P)(0.05 >
Standard deviation	1.35	1.25					
Experimental Group (A)							
mean	5.2	7.8	2.6	8.85	48	2.01	)P(0.05 >
Standard deviation	1.45	1.2					

As shown in table 3The results showed that the control group achieved a difference in the arithmetic mean between the pre-test and post-test of 1.2 where the arithmetic mean of the Pre-test was 5.1 and the standard deviation was 1.35 while the arithmetic mean of the post-test was 6.3 and the standard deviation was 1.25. The computed T-value was 4.5 which is greater than the critical T-value of 2.01 at 48 degrees of freedom and a significance level (0.05>P) which indicates the presence of statistical significance.

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As for the experimental group it achieved a difference in the arithmetic mean of 2.6 between the pre-test and post-test where the arithmetic mean of the tribal test was 5.2 and the standard deviation was 1.45 while the arithmetic mean of the dimensional test was 7.8 and the standard deviation was 1.2. The computed T-value was 8.85 which is higher than the critical T-value of 2.01 at the same degree of freedom and level of significance which also indicates the presence of statistical significance.

Discussion

1-results for the control group

in connection with the pre-test and the post-test of the control group an increase in average performance from 5.1 to 6.3 was noted reflecting an improvement of 1.2 points. This improvement reflects the influence of traditional training on the skill of shooting from constancy. This improvement may be due to several factors such as exercise frequency direct guidance from instructors and student motivation within the classroom which can contribute to enhancing motor and technical interaction with the skill. However we find that this improvement is not significant enough since the computed T-value (4.5) was greater than the critical T-value (2.01) which indicates that the differences between the two tests were statistically significant at the level of 0.05.

On the other hand the standard deviation in the control group was slightly reduced from 1.35 to 1.25 which indicates a better stabilization of performance among students after exercise. A decrease in the standard deviation may indicate that students have become more consistent in their performance which reflects some improvement in the level of accuracy in shooting. These results are consistent with the results of several previous studies that found that traditional training has an effect on performance improvement but its effect may be slow compared to modern training methods such as training using electronic devices (Hussain 2023).

2-results for the experimental group

as for the experimental group that used the innovative electronic device in training it showed exciting results as the arithmetic mean increased from 5.2 in the pre-test to 7.8 in the post-test indicating a significant increase of 2.6 points. This The obvious increase reflects the significant effect of the electronic device in improving the shooting skill of steadiness. This improvement can be explained in the light of many factors the most notable of which is that the electronic device provides instant and accurate feedback on imaging techniques allowing students to adjust their skills faster and more effectively. In addition the device helps to enhance reactivity and feedback which contributes to better motor learning and better application of skills.

The calculated t-value in this group (8.85) was significantly higher than the critical t-value (2.01) which shows that the difference between the pre-test and post-test was statistically significant (0.05>R). This suggests that the electronic device has a noticeable performance-improving effect compared to traditional training. Moreover we find that the standard deviation in the experimental group decreased from 1.45 to 1.2 which indicates an improvement in the stability of performance among students. This improvement in the standard deviation reflects the

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increased compatibility of students in the level of performance reflecting greater progress in learning the skill.

These results are supported by numerous studies such as (omoreji 2016) which confirmed the effectiveness of technology in the development of sports skills as these devices provide accurate information and instant feedback because they contribute to significantly improving performance techniques. Also a study (Salim et al. 2022) explained that technological systems help accelerate the learning of complex motor skills such as shooting in basketball providing accurate data that makes players able to analyze and improve their performance more quickly.

3-Comparison of the two groups

when comparing the two groups (experimental and control) we note that the difference between the pre-test and the post-test in the experimental group (2.6 points) was much greater than the difference in the control group (1.2 points). This suggests that the effect of the electronic device was greater and faster in improving the shooting skill of steadiness compared to traditional training. In addition we note that the changes in performance were statistically significant in both groups but the effect of the electronic device was more pronounced. This result confirms the findings of many recent studies that have shown that traditional methods may lead to gradual improvement but modern methods such as electronic devices achieve faster and more accurate improvement the results shown by the experimental group are in line with what many researcher have stated that the use of technology in training mathematical skills not only increases efficiency but also leads to improved learning strategies and increased motivation for students. Technological tools provide a platform for more interactive and more personalized training (Idris et al. 2022).

Scientific interpretation of the results: the improvement in performance in the experimental group can be explained by the benefits provided by electronic devices such as providing instant feedback allowing participants to quickly adjust their techniques. These devices also allow users to review their performance in real time which helps them identify and optimize errors when they occur. According to a study (Idris et al. 2022) feedback is one of the main factors in accelerating the process of learning mathematical skills and modern training technology is an effective tool in accelerating the acquisition of skills and reducing the time it takes to learn.

As for the control group the limited improvement in performance can be interpreted as a consequence of traditional training that lacks immediate and accurate feedback. Traditional training may contribute to the improvement of skills over time but it does not provide the same level of reactivity and the ability to quickly correct mistakes as in the use of electronic devices.

Conclusions

The study concluded that the use of an innovative electronic device in training has a significant impact on improving the shooting skill of stability in basketball. The experimental group showed a significant improvement in its performance by 2.6 points between the pre-test and the post-test. By contrast the control group using traditional methods showed an improvement of only 1.2 points. Real-time feedback from the device enabled players to quickly correct mistakes speeding up the learning process and achieving better results. These results support the use of technology in sports training in particular for complex motor skills such as shooting. It is

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recommended to intensify the use of electronic devices especially at the initial stages of learning skills to achieve quick and effective results.

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Appendices

Appendix 1. Sample of the training curriculum (training modules)

Training module	Content	Duration of time	Exercises using an electronic device	Exercise intensity	Redundancy	Comfort	Objectives
Module 1: electronic device recognition	Learn how to use the electronic device and payment techniques.	60 Minutes	Practice shooting using the device to analyze the shooting motion of the fastness.	Medium	10 repetitions for each angle	30 seconds	Teach participants how to use the device and analyze their performance.
Module 2: Improve shooting accuracy	Use the device to analyze the accuracy of the shot from the fastness.	60 Minutes	Shooting from constancy with interaction with the device to find out the errors of shooting.	Medium	12 repetitions	30 seconds	Improve the shooting accuracy of the fastness by using instant feedback.
Module 3: multi-angle shooting	Shooting drills from different angles using the electronic device.	60 Minutes	Shooting from several angles using the device to measure the accuracy of shooting.	Medium	10 repetitions for each angle	45 seconds	Optimize shooting from different angles accurately using the device.
Module 4: advanced training on shooting from constancy	Advanced training using the device to increase confidence in shooting.	60 Minutes	Use the device to analyze and improve performance through instant feedback.	Medium	15 repetitions	20 seconds	Improve the shooting performance of fastness using technology

Appendix 2.

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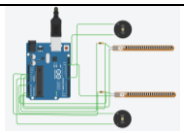
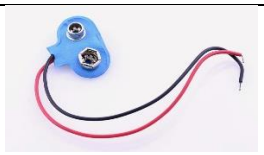
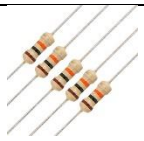
The electrical circuit of the device shows	
the final form of the device	
Microcontroller board (Arduino Uno R3)	
Connecting wire (Row Dupont Cable M-F)	
Connecting wire (Row Dupont Cable F-F)	
Breadboard Jumper Wires	
battery connecter	
Carbon Film 10K Resistor	
Arduino Acrylic Transparent Case	

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mobile vibration motor	
Flex sensor	

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