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RESEARCH ARTICLE

The Role of Physical Education and Sports in Achieving Motor Coordination in Basketball Among Secondary School Students (Years 14–15)

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Abstract

The study aims to identify the role of physical education and sports sessions in achieving motor coordination in basketball among secondary school students during the 2014–15 academic year. To this end, an experimental method with an equivalent group design was employed, involving a sample of 16 students who were purposefully selected to be matched on educational level, gender, age, weight and height. Data were collected using scientific research tools and appropriate devices, alongside a preliminary experiment. A pre-test was then conducted, followed by the implementation of an 8-week curriculum comprising three teaching units per week. After completing the curriculum, post-tests were conducted and the results were analysed statistically. The findings indicated that the educational units had a significant positive impact on the development of motor coordination in basketball among the participants in the experimental group. Based on these findings, the study recommended incorporating sports games into the curriculum for basketball and other sports, to develop mental processes and motor coordination in students. The study emphasised the importance of teachers focusing on these exercises to enhance motor coordination, ultimately improving the accuracy with which secondary school basketball players execute fundamental skills.

Citation

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Introduction and study problem:

Physical education and sports are considered crucial for the development and sustainability of society in general, as well as for the development of various sports in particular. Many sports have grown tremendously, progressing from the school environment to achieving top results at an international level. Physical education encompasses a variety of general motor activities, which are addressed using recognised methods that aim to develop physical fitness and intellectual, psychological and motor skills. This contributes to the personality development of students, particularly at secondary level, and helps them to acquire the competencies required for their future educational journey (Muhammad Tawfiq Al-Wilili, 1994, p. 204). Physical education=x occupies an important position within general education and is a fertile field; it is a pedagogical subject that plays a significant role in the educational system. Charles Beauchard defined it as 'an integral part of general education and an experimental field aimed at forming proper citizens physically, emotionally and socially by engaging them in various physical activities chosen to achieve these goals' (Kamal Aref Zaher and Saad Mohsen, 1993, p. 125). Thus, it enhances students' intellectual, psychological and motor skills in secondary education based on their acquired abilities, transforming ordinary practice into beneficial practice (Ahmed Arabi, 2000, p. 11). It enhances students' motor abilities, which require effective motor execution capabilities (Ahmed Alabi, 2000, p. 14).

To achieve its objectives, physical education draws on a variety of sports activities derived from social reality. One of the most popular team sports among male and female students is basketball, which is particularly popular in secondary schools. Due to its dynamic and varied nature, playing basketball requires reasonable physical fitness and the mastery of certain fundamental skills, particularly the development of motor coordination (Ali Turki & Shakir, 1994, p. 20). Therefore, it is essential to design programmes that consider various factors, with the development of physical qualities and the learning of motor skills being the most important. Additionally, performing athletic movements requires coordination between the nervous and muscular systems (Hassan Zaki Muhammad, 2001, p. 35). The importance of coordination in basketball is demonstrated by a player's ability to organise motor actions within the essential skills of the game. Motor coordination is one of the most critical skills in basketball and the result of the team's collective efforts to succeed. These skills depend on players' ability to utilise their motor capabilities appropriately (Ali Turki & Shakir, 1998, p. 20). Saad Mohsen Ismail emphasised that all movements performed by an individual, whether ordinary daily movements or those related to athletic performance, require a certain degree of coordination between the nervous and muscular systems. Good coordination necessitates balance, agility, flexibility, proprioception and precision in motor performance. Coordination is considered one of the most important mechanisms contributing to a player's success in fulfilling motor tasks (Abu Al-Ala Ahmed Abdul Fattah, 1997, p. 65).

Previous or similar studies are considered resources and focal points that researchers must engage with and build upon in their own work. The purpose of these studies is to facilitate comparison, verification and refutation. I have relied on a set of studies from various categories, extracting the main points added by each one. Among those studies is:

Study by Murtaza Hassoun Abdel Hadi (2015), titled 'The motor coordination between the eyes and legs and its relationship to the performance of some offensive skills in basketball for ages 11–13'. This study aimed to identify the relationship between motor coordination and the accuracy of offensive skill performance in basketball for players aged 11–13. The research hypothesis was that there is a statistically significant correlation between motor coordination and offensive skill performance in basketball for this age group.

The researcher employed a descriptive method involving correlational techniques and a sample of 20 players aged 11–13. Various tools and measures were used to obtain results, which were statistically analysed using SPSS software. The main findings indicated statistically significant correlations between motor coordination and dribbling skills, and between motor coordination and passing and receiving skills.

Key recommendations from the study included allocating time at the beginning of training sessions to develop coordination, given its importance for fundamental basketball skills, and conducting periodic coordination assessments to evaluate players' overall performance.

The study, titled 'The Effect of Specialized Exercises on Developing Sensory-Motor (Spatial) Perception Abilities in First Division Basketball Players in the Northern Region', was conducted by Houda Najy Zidan (2007). The study aimed to develop a set of specialised exercises to enhance the sensory-motor (spatial) perception abilities of basketball players, as well as examining the effect of these exercises on this ability.

The researcher reviewed previous studies and theories related to the research topic, including the importance of cognitive processes in learning new movements, and the significance of sensory-motor (spatial) perception for basketball players. Prior studies were presented to support the scientific validity of the message.

Using an experimental method with a one-group design and pre- and post-testing appropriate to the nature of the research, a purposive sample of five female basketball players from the Sulaymaniyah Sports Club was selected. After conducting the pre-test on the sample, the specialised sensory-motor (spatial) perception exercises were implemented over a period of eight weeks, totalling three training units per week. Post-tests were then conducted and the data were statistically analysed by presenting, analysing and discussing the results.

The researcher concluded that the proposed exercises had a positive effect on developing sensory-motor (spatial) perception abilities, as evidenced by the post-test results.

From our review of previous studies, we found that our current study resembles previous research in considering perception and motor coordination exercises as independent variables and utilising them within an experimental framework. However, our study differs in terms of the sport, the sample population and the application of an educational training methodology to develop motor coordination in basketball.

Therefore, the research problem is to understand the role of motor coordination and its development in basketball during physical education classes for secondary school students. Based on our exploration of the various aspects and variables of this issue, we pose the following question:

Is there a role for physical education and sports in developing motor coordination in basketball among secondary school students?

To address this issue, we have formulated the following sub-questions:

1. Does physical education and sports play a positive role in developing motor coordination in basketball among secondary school students?
2. Do sports activities in educational settings contribute positively to the development of motor coordination in basketball among secondary school students?

To address the general question, we propose the following hypothesis:

Physical education and sports play a role in developing motor coordination in basketball among secondary school students.

Additionally, we present the following sub-hypotheses:

1. Physical education and sports positively impact the development of motor coordination in basketball among secondary school students.
2. Sports activities in educational units play a positive role in developing motor coordination in secondary school students playing basketball.

From this perspective, our research aims to identify:

1. The role of physical education and sports in developing and enhancing motor coordination in basketball during physical education classes for secondary school students; and
2. The role of sports activities in developing motor coordination in basketball among secondary school students during physical education classes.

The significance of the research lies in utilising sports activities in basketball with secondary school students. This constitutes a scientific attempt to study an important aspect that contributes to the proper athletic development of basketball players by enhancing their motor coordination.

Applied Aspect

1. Methodological approaches used:

2. Exploratory study

This refers to 'a preliminary experimental study that is smaller in scale and similar to the main experiment conducted by the researcher on a small sample prior to the main research, aiming to select research methods and tools' (Adel Fadhil Ali, 2000, p. 65). It allows a sufficient number of significant observations to be obtained" (Adel Fadhil Ali, 2000, p. 65).

Based on this definition, the researcher conducted a pilot exploratory experiment on 5 students from a secondary school in Chlef Province on 10 November 2024, outside the main research sample. The researcher carried out this experiment for several purposes, including:

1. Ensuring the accuracy of data collection.
2. identifying any difficulties encountered during the tests.
3. Assessing the suitability of the necessary devices and tools.
4. Evaluating the time required to perform the tests.
5. Confirming the team's understanding of the nature of the tests and how to carry them out.

Research domains:

A. Human domain: students of Haj Miloud Abdel Hamid Secondary School in Chlef Province.

B. Spatial domain: the tests and exercises were conducted in the school's gymnasium.

C. Temporal domain:

Exploratory study: From 10 to 15 November 2024.

- Applied aspect: Pre-tests: 18–19 November 2024.
- Development of Motor Coordination: From 22 November 2024 to 21 January 2025.

Post-tests: From 24 to 25 January 2025.

Research Methodology and Field Procedures:

1. Research method: The researcher adopted an experimental method with an equivalent group design to suit the nature of the research.

2. Research population and sample: The research population consisted of 75 students from Haj Miloud Abdel Hamid Secondary School in Chlef Province, aged between 14 and 15 years. Of these, 40 were male. Ten students older than 14–15 years were excluded from this group, resulting in a sample of 30 students. Of these, 16 students of a similar height and weight were selected to represent the research sample, which was divided into control and experimental groups. Thus, the research sample percentage is 40%.

Sample homogeneity and equivalence of research groups:

Homogeneity of the sample: the researcher conducted a homogeneity check among the sample members based on the following variables: age, height and weight. This was done to control the research variables, as shown in Table 1.

Table 1 shows the means, standard deviations, mode and skewness coefficient for the homogeneity of the research sample.

variables	Arithmetic mean	standard deviation	Mode	Skewness coefficient
Age (years)	14.89	0.68	14	1.30
Height (cm)	166.51	3.10	164	0.80
Weight (kg):	62.51	2.81	61	0.53

Source: Afrit Leila (2024), p. 78.

The results in Table 2 show that the values of the skewness coefficient range between ±2, indicating that the data is free from defects related to non-normal distribution and showing the homogeneity of the research sample.

Equivalence of research groups:

Before applying the research experiment, the researcher conducted an equivalence process between the research groups in some of the tests under investigation, as shown in Table 2.

Table 2 shows the means, standard deviations and calculated t-test results between the control and experimental groups in some of the pre-tests under investigation

Statistical characteristics / Variables	Control		Experimental		Calculated (t) value	Type of significance
	S	X	S	X		
Hand-eye coordination (seconds)	7.29	2.11	8.02	1.98	0.56	Non-significant
- Eye-arm coordination (count)	8.96	1.74	9.22	1.34	0.26	Non-significant

Source: Afrit Leila, 2024, p. 78

The results in Table 2 indicate that the calculated values of t are smaller than the tabulated value of 2.16 at a significance level of 0.05 and with 12 degrees of freedom. This suggests that the research groups are equivalent in some of the tests under investigation.

Research instruments and tools used in the study

The term 'research tools' refers to 'the means through which the researcher can collect data and solve their problem to achieve the research goals, regardless of what those tools may be' (Mohammad Hasan Al-Alaawi, 1998, p. 15). Based on this definition, the researcher employed the following tools and devices:

1. Research means: The researcher used Arabic sources, tests, measurements, observation, interviews and data collection forms.

2. Training means:

1- Motor coordination tests:

A. Throwing a tennis ball against a wall and catching it (Mohammad Hasan Al-Alawi, 1998, p. 224).

B. The numbered circles test (Mohammad Hasan Al-Alaawi, 1998, p. 224).

2. Tools and devices: The researcher used the following (measuring tape, adhesive tape, 16 handballs, tennis balls, markers, flags, a stopwatch, various ropes, 60 cm diameter rings, a weighing scale, a handheld electronic calculator and a laptop computer).

Scientific foundations of the tests:

Validity of the tests

A valid test is one that can measure what it was designed to measure (Nabil Abdul Hadi, 2002, p. 121). To establish the validity of the tests, the researcher relied on content validity. The tests under investigation were presented to four expert specialists in the fields of testing and measurement, sports training, motor learning and basketball. After the forms were collected and the results sorted, the experts agreed unanimously that the tests were appropriate for their intended purpose. The calculated Kappa value (K^2) was 7, which is greater than the tabulated value of 3.84 at one degree of freedom and a significance level of 0.05. This indicates that the selection in favour of those who agreed (valid) is significant. This demonstrates the validity of these tests, as shown in Table 4.

Reliability of the tests: The researcher established the reliability of the employed tests. Reliability is one of the most important scientific foundations of tests and is defined as 'the test giving the same results when retested on the same

individuals under the same conditions' (Risan Kharbit Majid, 1989, p. 88). To obtain the reliability coefficient of the tests, they were conducted twice on the same sample. Testing was carried out on a group of five first-year secondary school students outside the main research sample. The tests were reapplied after seven days, which Nizar Al-Talib and Al-Samarani (p. 134) describe as "a suitable period for retesting".

Field research procedures:

1. Pre-tests

The pre-tests for the research sample were conducted on 18 November 2024 in the basketball gymnasium of Haj Miloud Abdel Hamid Secondary School in Chlef Province, with the support team's assistance.

Implementation of training means:

The researcher trained both the control and experimental groups as follows:

The experimental group underwent an experimental programme that included sports activities designed to develop motor coordination.

The control group followed the educational training method used by the teacher, excluding the specific sports activities of the training programme. As a physical education teacher, the researcher was responsible for supervising and monitoring the practical implementation of the training unit components. The training programme lasted for eight weeks, with three training sessions per week, resulting in a total of 24 sessions. Each training unit lasted 90 minutes.

2. Post-tests

After completing 24 training units over eight weeks to develop motor coordination and shooting accuracy (three training units per week), post-tests were conducted for both the experimental and control groups under the same conditions as the pre-tests for these two skills. These post-tests were carried out on 24 January 2025.

3. Statistical methods

The results of the research were analysed using the Statistical Package for the Social Sciences (SPSS), including percentage, mean, standard deviation, mode, skewness coefficient, coefficient of variation, simple correlation coefficient (Pearson) and t-tests for paired and independent samples.

Presentation of Results, Interpretation, and Discussion:

3.1 Presentation of Motor Coordination Test Results in Basketball for the Control and Experimental Groups and Their Analysis:

3.1.1 Presentation and analysis of motor coordination test results in basketball for the control group:

Table 3 shows the means, standard deviations and calculated t-value for the pre- and post-tests in the motor coordination test for the control group.

Statistical characteristics / Variables	Pre-tests		Post-tests		Calculated (t) value	Type of significance
	S	X	S	X		
Hand-eye coordination (seconds)	6.29	1.49	9.36	.107	3.28	significant
- Eye-arm coordination (count)	8.96	0.74	6.82	0.69	2.92	significant

Source: Afrit Leila, 2024, p. 103.

The results in Table 3 show that the calculated t-values for the motor coordination tests in the control group are greater than the tabulated value of 2.45 at a significance level of 0.05 and under 6 degrees of freedom. This suggests that there are statistically significant differences in favour of the post-tests.

3.1.2 Presentation and analysis of motor coordination test results in basketball for the experimental research group:

Table 4 shows the means, standard deviations and calculated t-values for the pre- and post-tests in the motor coordination tests for the experimental research group.

Statistical characteristics / Variables	Pre-tests		Post-tests		Calculated (t) value	Type of significance
	S	X	S	X		
Hand-eye coordination (seconds)	7.54	1.62	12.78	.125	4.08	significant
- Eye-arm coordination (count)	8.78	0.82	5.43	0.34	4.54	significant

Source: Afrit Leila, 2024, p. 104.

Table 4 shows that the calculated t-values for the motor coordination tests in the experimental research group are greater than the tabulated value of 2.45 at a significance level of 0.05 and under 6 degrees of freedom. This suggests that there are statistically significant differences in favour of the post-tests.

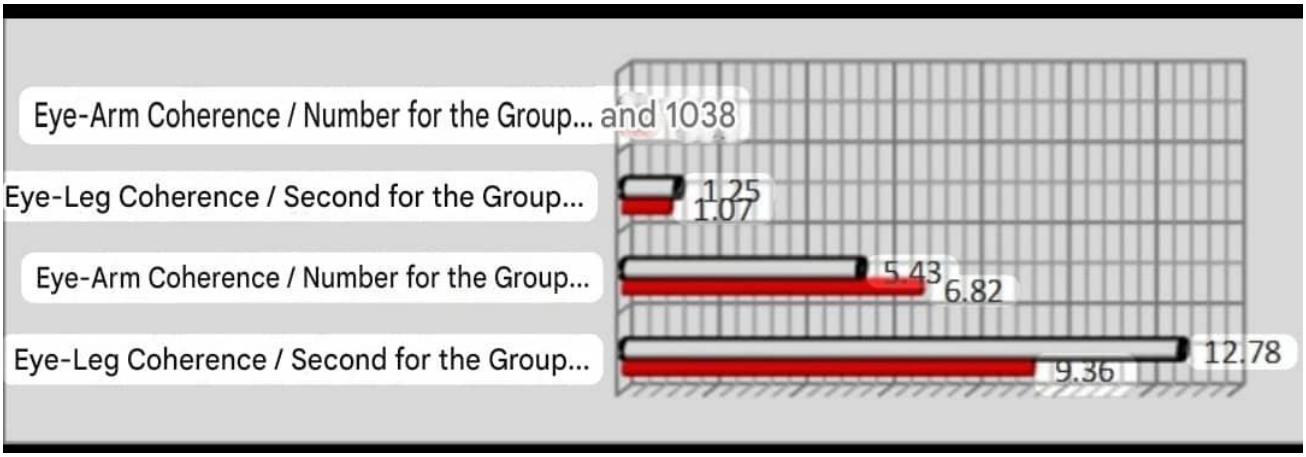
3.1.3 Presentation and analysis of the post-test motor coordination results in basketball between the control and experimental research groups:

Table 5 shows the means, standard deviations and calculated t-values for the post-test motor coordination tests between the control and experimental research groups.

Statistical characteristics / Variables	Control		Experimental		Calculated (t) value	Type of significance
	S	X	S	X		
Hand-eye coordination (seconds)	9.36	1.07	12.78	1.25	4.65	significant
- Eye-arm coordination (count)	6.82	0.69	5.43	0.34	4.04	significant

Source: Afrit Laila, 2024, Page 106

Figure 1: Shows the difference between the means, standard deviations, and calculated t-value in the post-test motor coordination tests between the control and experimental research groups.



Source: Afrit Leila, 2024, p. 106.

The results in Table 5 show that the calculated t-values between the control and experimental groups in the post-test motor coordination tests are greater than the tabulated value of 2.45 at a significance level of 0.05 and with 12 degrees of freedom. This suggests that the post-test results favour the experimental group.

4. Discussion of Results:

Based on the results presented in Tables 2, 3, 4 and 5 for the motor coordination tests in basketball for both the control and experimental groups, there are statistically significant differences in favour of the post-tests for both groups. The researcher attributes these differences in the control group to the impact of the teacher's methodology. Furthermore, the commitment of the student players, their regular training and continuous performance and repetition of the skill clearly played a role in their development in the researched variables. Sources have confirmed that 'the many repetitions that players practise during practical application help them to acquire and develop performance' (Adel Fadel Ali, 2000, p. 95). Additionally, motor coordination in its various forms is considered an important skill in basketball, as scoring in the basket is the final outcome of performance and the decisive factor in determining the match result. This prompted members of the control group to increase their training, practising this skill from all distances and angles on the court, as well as with all skills, in order to obtain the greatest number of points for their team during matches.

As for the experimental group, which incorporated specialised training methods in the form of sports activities, the researcher attributes the significant differences observed between the pre- and post-tests to the ample scope for motor coordination training provided by the various sports activities used in the training sessions. This approach aligns with the specific capabilities of the student players, enhancing their understanding of the necessity to develop motor coordination, which clearly impacts their technical performance and accuracy. As Mohammad Hassan Al-Alawee et al. (2003, p. 48) note, 'the aesthetics and development of performance depend on the enhancement of cognitive processes resulting from players undergoing exercises with supportive training tools that develop these capabilities, leading to improvement in their motor performance'.

The results also indicated significant differences in the post-test scores of the control and experimental groups, demonstrating the superiority of the latter. The researcher attributes this to the influence of the training tools represented by the various sports activities included in the training units. These activities contributed to the development of motor coordination, which in turn led to success in skill performance. As Muhammad Hassan Al-Alawee et al. (1998, p. 127) state, "motor perception enables the athlete to succeed with their movements, providing the ability to discover new tactics and the capability for motor coordination".

Furthermore, developing good motor coordination directly impacts skill performance and precision, as well as the acquisition of new skills in gameplay situations, particularly during shooting. The training tools used in the programme aimed to enhance motor coordination, which is linked to other physical and motor capabilities such as speed, agility, balance and accuracy. It has been asserted that 'the relationship between coordination and speed arises in terms of the spatial-temporal requirements of motor performance, while agility, balance and accuracy emerge in terms of the formal and spatial movement requirements — that is, the precise movement of the body and its parts within the required dimensions' (Abu Al-Ala Ahmed, 1997, p. 205).

5. Conclusions and suggestions:

5.1 Conclusions:

The use of sports activities in training has significantly improved motor coordination in basketball among the experimental group.

The curriculum implemented by the physical education teacher has noticeably improved motor coordination in basketball among the control group.

- The experimental group performed significantly better than the control group in the basketball motor coordination tests.

Sports activities refine and enhance skill performance and improve accuracy by providing opportunities for secondary school student athletes to perceive distance and timing, enabling players to correct their movement paths and reduce errors.

The training tools contributed to the exercises by adding an element of excitement and motivation.

5.2 Recommendations:

It is essential to emphasise the inclusion of certain sports activities in the educational training curriculum for secondary school basketball students in the early stages of their education, in order to develop cognitive processes and motor coordination. This will facilitate thorough and rapid skill acquisition and development in all other team sports and at future educational levels.

Physical education teachers should prioritise developing motor coordination and physical abilities in secondary school students, especially younger ones.

There should be a focus on specialised motor coordination training when teaching students in physical education classes, as well as awareness of the perceptual variables specific to basketball and strategies for their development.

Physical education teachers should adopt exercises specifically designed for basketball to enhance motor coordination and improve the accuracy of fundamental skills, particularly for secondary school age groups.

- Basketball-specific physical education teachers should utilise various sports activities that develop skills characterised by difficulty and precision, as these activities require multiple cognitive, motor and physical demands, facilitating teaching to the secondary school age group.

Conduct studies and research on age groups with similar characteristics for both genders in basketball and other sports (both team and individual).

6. Appendices

Test of Motor Coordination from a Forward Fall on Squares (Samer Youssef Mutab, 1999, p. 19).

Purpose of the test: To measure motor coordination.

Test requirements:

- Basketball court
- Squares (50 cm x 50 cm) suspended from the top corners of the basketball goal.
- Ten basketballs

Performance specifications:

The player stands six metres in front of the line with the goal behind them and a teammate in front to pass the ball to. They then turn to face the goal, lean and shoot at the squares before falling to the ground. Upon hearing the whistle or receiving a visual signal, the player must shoot three balls at each square consecutively.

Evaluation: The number of successful attempts is recorded, with scores calculated as follows:

- 2 points for each ball that enters the square.
- If the ball hits one of the edges of the square, the player receives one point.

If the ball goes outside the target, the player receives 0 points.

Thus, the maximum score a participant can achieve is 12 points.

Coloured circles on the smooth wall: These are drawings of coloured circles of various sizes. Players perform shooting exercises at them from different distances and angles, aiming to get the ball into the circles. The primary purpose of these circles is to improve throwing distance and motor coordination between the arm and eye.

Ladder: This device is made of ropes arranged in the shape of a ladder on the ground. Players perform leg movement exercises without touching the ladder and dribble between the rungs. The primary function of this is to improve perception of horizontal distance between the rungs, as well as motor coordination between the legs and eyes.
Wooden marker: This consists of a wooden box that is 70 cm wide and of various heights. Upon receiving a signal, the player performs vertical jump exercises in front of this marker.

Ethical Considerations

This study was conducted in accordance with accepted ethical standards for research involving human participants in educational settings. Prior approval was obtained from the relevant educational authorities and school administration. Informed consent was secured from all participants and their legal guardians before participation. The students were informed of the study's objectives and procedures, and participation was entirely voluntary. Confidentiality and anonymity were ensured throughout the research process, and all collected data were used exclusively for scientific purposes. The study posed no physical or psychological risk to participants and adhered to principles of fairness, respect, and integrity in data collection and analysis.

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Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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