



Hand-Eye Coordination in Improving the Accuracy of Volleyball Underhand Passes

Koordinasi Mata Tangan dalam Meningkatkan Akurasi Passing Bawah Bola Voli

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Abstrak

Keakuratan siswa dalam passing bawah bola voli cukup rendah. Hal ini terkait dengan kesulitan dalam koordinasi mata-tangan. Penelitian ini bertujuan untuk mengetahui bagaimana koordinasi mata-tangan membantu meningkatkan keakuratan passing bawah dalam bola voli. Metode kuantitatif dengan desain korelasional digunakan. Populasi penelitian ini adalah siswa SMA Negeri 6 Kendari, sebanyak 250 siswa: 106 laki-laki, 144 perempuan. Sampel sebanyak 30 siswa diperoleh melalui teknik purposive sampling. Pengumpulan data menggambarkan koordinasi mata-tangan melalui tes melempar dan menangkap bola tenis, serta tes keterampilan passing bawah dalam bola voli. Hasil uji korelasi dianalisis menggunakan SPSS versi 21. Hubungan antara koordinasi mata-tangan dan keakuratan passing bawah menunjukkan korelasi positif dan signifikan dengan koefisien korelasi (r) sebesar 0,583 dan tingkat signifikansi sebesar 0,000 yang $< 0,05$. Nilai koefisien determinasi (r^2) sebesar 0,340 berarti bahwa koordinasi mata-tangan berkontribusi sebesar 34% terhadap kemampuan passing bawah dalam bola voli. Meningkatkan koordinasi mata-tangan meningkatkan kemampuan seseorang dalam melakukan passing bola voli secara akurat. Oleh karena itu, semakin tinggi koordinasi mata-tangan, semakin besar kendali dan keakuratan passing bola.

Kata kunci: koordinasi mata tangan, passing bawah, bola voli

Abstract

Students' accuracy in volleyball underhand passing is quite low. This is related to difficulties in hand-eye coordination. This study aims to determine how hand-eye coordination helps improve the accuracy of underhand passing in volleyball. A quantitative method with a correlational design was used. The population of this study was 250 students of SMA Negeri 6 Kendari: 106 males, 144 females. A sample of 30 students was obtained through a purposive sampling technique. Data collection describes hand-eye coordination through a tennis ball throwing and catching test, as well as a volleyball underhand passing skill test. The results of the correlation test were analyzed using SPSS version 21. The relationship between hand-eye coordination and underhand passing accuracy showed a positive and significant correlation with a correlation coefficient (r) of 0.583 and a significance level of 0.000 which is < 0.05 . The coefficient of determination (r^2) value of 0.340 means that hand-eye coordination contributes 34% to underhand passing ability in volleyball. Improving hand-eye coordination improves a person's ability to pass the volleyball accurately. Therefore, the higher the eye-hand coordination, the greater the control and accuracy of passing the ball.

Keywords: hand eye coordination, underhand passing, volleyball

INTRODUCTION

Physical education, sports, and health is an integral part of the education system that aims to develop students' potential comprehensively, including physical, psychomotor, cognitive, and affective aspects (Putri et al., 2024; Gunadi, 2018; Arisandi & Neldi, 2023). Through physical activities and sports, students are not only trained to have good physical fitness, but also directed to develop motor skills, thinking skills, sportsmanship, cooperation, and discipline. One sport widely taught in secondary schools is volleyball, because it has high educational, recreational, and competitive values (Iksal et al., 2023; Marsuna, 2023; Mongsidi & Arwih, 2025).

Volleyball is a team game that requires good basic technical skills for effective play (Alwi & Asshagab, 2024). Basic techniques in volleyball include serving, overhand passing, underhand passing, smashing, and blocking (Saputra et al., 2023). Di Among these techniques, underhand passing is a fundamental skill that is crucial for a team's success, particularly in receiving serves and initiating attacks (Andini, 2023). Accurate underhand passing makes it easier for subsequent players to control the ball and develop effective attack patterns. However, in physical education learning practices in schools, underhand passing skills often present a challenge for students (Saputra & Gazali, 2023). Many students experience difficulty directing the ball accurately, maintaining consistent bounces, and adjusting their body position to the direction the ball is coming from. This problem demonstrates that technical ability alone is not enough; it must be supported by adequate biomotor and coordinative skills, one of which is hand-eye coordination.

Hand-eye coordination is the ability to integrate vision with hand movements in a harmonious and controlled manner to produce precise and efficient movements. In the context of volleyball, hand-eye coordination plays a crucial role in observing the direction, speed, and height of the ball, then adjusting it to match hand movements and body position when executing an underhand pass. Without proper coordination, underhand passes tend to be inaccurate and difficult to control (Alwi & Asshagab, 2024). Based on initial observations, it was found that some students still demonstrated suboptimal underhand passing skills. The ball often lacked proper direction, bounced unstably, and was difficult for teammates to control. This condition indicates underlying factors

that have not yet fully developed, particularly hand-eye coordination. Therefore, research into the role of hand-eye coordination in improving volleyball underhand passing accuracy is important and relevant.

Coordination is a component of physical condition related to the central nervous system's ability to integrate various muscle movements efficiently and purposefully. According to Karlia & Sawali, (2024), coordination is the ability to control and regulate body movements precisely according to the demands of the activity being performed. Good coordination enables a person to perform movements effectively, efficiently, and economically. Eye-hand coordination specifically refers to the ability to integrate visual information received by the eyes with motor responses in the hands. Amanda & Sepriadi, (2024) explain that eye-hand coordination involves the processes of visual perception, decision-making, and simultaneous execution of motor movements. This ability is very dominant in sports that use ball objects, including volleyball. In volleyball, eye-hand coordination is needed to predict the ball's trajectory, determine the right time of contact, and direct the ball to the desired target. Accuracy in underhand passing is highly dependent on the player's ability to coordinate vision of the ball with arm and hand movements when contact occurs.

The underhand pass is a basic technique used to receive the ball from an opponent, especially a low serve or attack. According to Sahabuddin & Hakim, (2021), an underhand pass is performed using both arms held together, with the aim of accurately controlling and directing the ball to a teammate. The accuracy of an underhand pass is determined by several factors, including body position, arm angle, power of the push, and timing of contact with the ball. In addition to technical factors, coordination skills such as eye-hand coordination also significantly influence the success of an underhand pass. Without good coordination, players will have difficulty adjusting their arm movements to the direction the ball is coming, resulting in low passing accuracy.

A large body of research has analyzed the relationship between hand-eye coordination and specific skill development across various sports. Prasetio & Erianti, (2026) found that high school students' underhand passing ability was significantly

related to their hand-eye coordination. Firdaus & Fahrizqi, (2023) found that students who demonstrated high hand-eye coordination also demonstrated better passing ability. Among adolescent volleyball athletes, hand-eye coordination is a critical factor for successful execution of fundamental volleyball skills. However, most of these studies focused on athletes or school settings in urban areas, leaving room for further research on this phenomenon. Furthermore, previous studies have primarily examined the relationship between hand-eye coordination and volleyball performance in athletes or general student populations, with limited evidence specifically addressing underhand passing accuracy among junior high school students in the context of physical education. This lack of context-specific evidence limits the development of evidence-based instructional strategies for improving fundamental volleyball skills in schools.

To address this research gap, the present study investigates the contribution of hand-eye coordination to the accuracy of volleyball underhand passing among junior high school students. The novelty of this study lies in its focus on school-based physical education using a simple and practical measurement of hand-eye coordination that can be readily applied by teachers. The findings are expected to provide empirical evidence for developing more effective volleyball learning and training programs in schools. This study aims to determine and examine the extent to which eye-hand coordination affects the accuracy of underhand passing in volleyball. The expected results of this study are, For Theoretical contribution, providing more scientific work and studies in the field of physical education and sports, specifically, studies on the relationship between coordination abilities and skills in the basic technical aspects of volleyball. Practical contribution, providing additional information to physical education teachers regarding the importance of helping students' eye-hand coordination and other related skills in learning volleyball. Finally, empirical contribution, providing material for other research studies that aim to examine and/or explain the factors that influence the development of volleyball skills in school students at the basic technical level.

METHODS

This research employed a quantitative method with a correlational approach. The method employed was a survey, with data collection techniques utilizing tests and measurements. The population is the entire population being studied, or the entire research subject. Therefore, the population in this study was all 250 students at SMA Negeri 6 Kendari, of which 106 were male and 144 were female. The sample represents a portion of the population or a subset of the population. The sampling technique used in this study was purposive sampling, which is based on female gender and students who are capable of underhand passing. Therefore, the sample size for this study was planned to be 30 students.

The instrument for measuring eye-hand coordination used the tennis ball throw-catch test (Ismaryati & Sarwono, 2018). The tennis ball throw-catch test involved a round target (made of paper, cardboard, or contrasting colored tape) with a diameter of 30 cm. The target was attached to a wall with its bottom level with the testee's shoulder height. A line was drawn on the floor 2.5 meters from the target wall using chalk. Each ball that hits the target and is caught by the hand earns one point. To earn one point, the ball must be thrown from below (underarm). The ball must hit the target. The ball must be caught immediately by the hand without any prior obstruction. The testee must not move or move outside the boundary line to catch the ball. The total score is the result of the first 10 throws and the second 10 throws. The total possible score is 20. The instrument for measuring underhand passing ability is the volleyball underhand passing skills test (Widiastuti, 2015). To implement the underhand passing ability test, participants stand in the center of a 4.5 x 4.5 meter area. Students are given 60 seconds to perform an underhand pass. After the signal "yes," participants toss the ball and then perform an underhand pass to a height of 2.30 meters for men. If a participant fails to execute an underhand pass and the ball goes out of the area, the participant must immediately retrieve the ball and continue. If a participant performs an underhand pass outside the area, the score is not counted. The scoring method is the number of times the participant can execute a correct underhand pass. The data analysis technique used in this study

was correlation analysis. Prior to conducting the correlation analysis, prerequisite tests were first conducted, including normality and linearity tests, using SPSS 25.

RESULT AND DISCUSSION

The purpose of describing the data from the research findings is to provide a basic understanding of the data distribution. The raw data, processed using descriptive statistical techniques, are presented in figures that include the mean, standard deviation (SD), maximum (max), and minimum (min), frequency distribution, and histogram. The results of the statistical calculations are summarized as follows.

Table 1. Descriptive statistics of hand-eye coordination (X) and underhand passing ability (Y)

Variable	Mean	Standard Deviation	Maximum Value	Minimum Value
X	14,00	3,434	19	8
Y	38,80	6,875	48	25

Table 1 shows that the mean score for hand-eye coordination (X) was 14.00 (SD = 3.434), with scores ranging from 8 to 19, indicating moderate performance and relatively low variability among participants. Meanwhile, the mean score for underhand passing ability (Y) was 38.80 (SD = 6.875), with scores ranging from 25 to 48, suggesting generally good performance but greater variation among students. Overall, the descriptive statistics indicate that both variables have sufficient score variation, providing an appropriate basis for further inferential analysis to examine the relationship between hand-eye coordination and underhand passing ability.

Table 2. Frequency distribution of hand-eye coordination data (X)

Interval Class	Absolute Frequency	Relative Frequency
8-9	4	13%
10-11	4	13%
12-13	5	17%
14-15	6	20%
16-17	6	20%
18-19	5	17%
Total	30	100%

Table 2 shows that the distribution of hand-eye coordination scores is relatively balanced across all interval classes. The highest frequencies were observed in the 14-15 and 16-17 intervals, each with 6 students (20%), indicating that most participants demonstrated moderate to high levels of hand-eye coordination. Meanwhile, the lowest frequencies occurred in the 8-9 and 10-11 intervals, each with 4 students (13%).

Overall, the frequency distribution suggests that the participants' hand-eye coordination was fairly evenly distributed, with a greater concentration in the middle-to-upper score ranges, indicating generally good hand-eye coordination among the students.

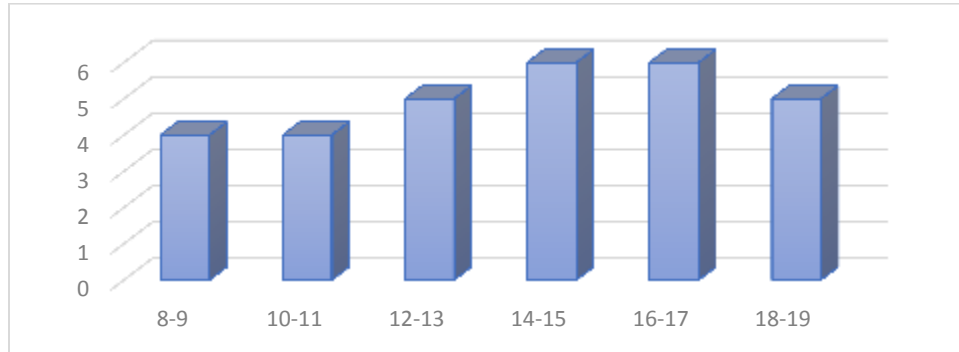


Figure 1. Histogram of hand-eye coordination data distribution

Table 3. Frequency distribution of underhand passing ability data

Interval Class	Absolute Frequency	Relative Frequency
25-28	4	13%
29-32	1	3%
33-36	5	17%
37-40	5	17%
41-44	7	23%
45-48	8	27%
Total	30	100%

Table 3 indicates that the underhand passing ability scores were concentrated in the higher score intervals. The largest proportion of students was found in the 45-48 interval, with 8 students (27%), followed by the 41-44 interval with 7 students (23%). In contrast, the 29-32 interval had the lowest frequency, with only 1 student (3%). Overall, the distribution demonstrates that most participants achieved relatively high underhand passing scores, suggesting that the majority of students possessed good underhand passing ability.

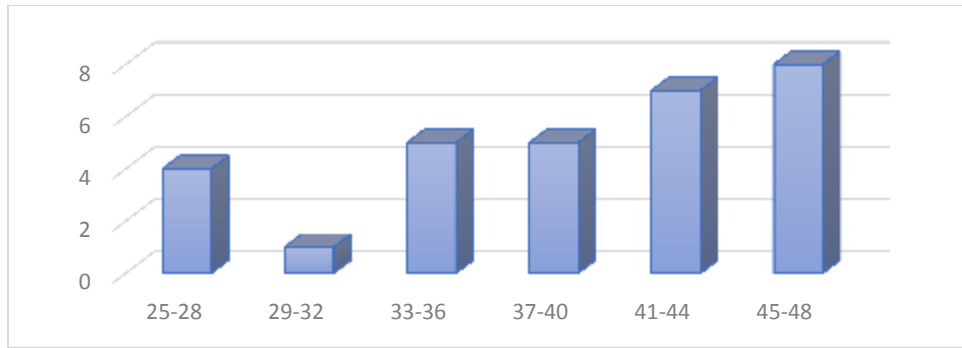


Figure 2. Distribution diagram of underhand passing ability data

Table 4. Results of normality test calculations

Variable	N	Sig	Asymp.Sig	Information
Hand-eye coordination	30	0,314	0,05	Normal
Underhand passing ability	30	0,546	0,05	Normal

Table 4 shows that the normality test results indicate both variables are normally distributed. The hand-eye coordination variable obtained a significance value of 0.314, while the underhand passing ability variable obtained a significance value of 0.546. Since both significance values are greater than the alpha level of 0.05, the data satisfy the assumption of normality. Therefore, the dataset is appropriate for further analysis using parametric statistical tests, such as the Pearson correlation test, to examine the relationship between hand-eye coordination and underhand passing ability.

Table 5. Results of linearity test calculations

Variable	N	Significance	Information
Hand eye coordination with underhand passing ability	30	0,965	Linear

Table 5 presents the results of the linearity test between hand-eye coordination and underhand passing ability. The analysis produced a significance value of 0.965, which is greater than the significance level of 0.05. This result indicates that the relationship between the two variables is linear. Therefore, the assumption of linearity is satisfied, confirming that parametric analyses, such as the Pearson correlation test, can be appropriately used to examine the relationship between hand-eye coordination and underhand passing ability.

Table 6. Results of the correlation test between eye-hand coordination (X) and underhand passing ability (Y)

Correlation Type	R count	Sig 0,05	R Squared (coefficient of determination)	Information
X-Y	0,583	0,000	0,340	Significance

Table 6 presents the results of the Pearson correlation analysis between hand-eye coordination (X) and underhand passing ability (Y). The analysis yielded a correlation coefficient (r) of 0.583 with a significance value of 0.000, which is lower than the alpha level of 0.05. This indicates a moderate, positive, and statistically significant relationship between the two variables. Furthermore, the coefficient of determination ($R^2 = 0.340$) shows that 34.0% of the variance in underhand passing ability can be explained by hand-eye coordination, while the remaining 66.0% is influenced by other factors not examined in this study. These findings suggest that students with better hand-eye coordination tend to demonstrate better underhand passing ability in volleyball.

The study revealed a significant relationship between improved ability to perform underhand volleyball passes and eye-hand coordination. This means that students or players with higher levels of eye-hand coordination are able to execute underhand passes with greater precision. This skill is related to the ability to increase the accuracy of the ball's intended target, control the ball's contact with the arm, and manage the intensity of the push when passing. From a theoretical perspective, eye-hand coordination describes a person's ability to combine visual stimuli with movements of the hand or other parts of the body in a timely and accurate manner. This is crucial in volleyball because players need to be able to visualize the ball's direction and effectively position their bodies to hit the ball to a specific target. Coordination, according to Efran et al., (2025), is one of the most important elements in the biomotor component of sports that require precise movement and ball control. This means that players who demonstrate superior coordination will find it easier to control the ball when executing underhand passes.

The findings of this study also align with the concept of motor skills in physical education learning proposed by Addivinola et al., (2021), who stated that coordination is part of the motor skills that enable a person to perform movements effectively, efficiently, and with direction. In volleyball, eye-hand coordination helps players adjust their body position to the speed and direction of the ball, thus optimally receiving the ball. Furthermore, the results of this study reinforce previous research showing that eye-hand coordination influences various technical skills in sports, including volleyball. Research by Batseran et al., (2024), explains that one factor influencing the success of an underhand pass is the player's ability to read the direction of the ball and adjust arm movements appropriately. This confirms that coordination between vision and hand movements is a crucial factor in improving passing accuracy.

From a sports pedagogy perspective, these findings have important implications for the physical education learning process in schools. Physical education teachers need to provide exercises that specifically develop eye-hand coordination, such as catching and throwing exercises, reaction exercises to the ball's direction, and pair passing exercises with varying distances and directions. Structured and repetitive exercises can help students improve coordination skills, thus optimally developing underhand passing skills. A new aspect that can be emphasized from these research findings is that eye-hand coordination plays a role not only as a supporting skill but also as a fundamental factor determining the successful mastery of basic volleyball techniques. Therefore, coordination development should be an important part of physical education training and learning programs, especially during the basic technique learning stage.

The findings of this study indicate that improving hand-eye coordination can be an effective strategy for improving the quality of volleyball learning in schools. With good coordination, students are not only able to pass more accurately but also increase their confidence in playing and improve teamwork. However, this study has several limitations (Karlia & Sawali, 2024). First, the study focused only on one component of physical condition, namely hand-eye coordination, while underhand passing skills are also influenced by other factors such as arm muscle strength, agility, concentration, and

playing experience. Second, the limited sample size may affect the generalizability of the study results. Therefore, future research is recommended to involve a wider sample and consider other variables that could potentially influence underhand passing skills in volleyball. Overall, the results of this study confirm that hand-eye coordination plays a crucial role in improving the accuracy of underhand passing in volleyball. The better a player's or student's hand-eye coordination, the higher their success rate in executing precise and targeted underhand passes. Therefore, developing coordination skills needs to be an integral part of the volleyball learning and training process in educational and sports coaching environments.

CONCLUSION

Based on the research results, it can be concluded that eye-hand coordination plays a significant role in improving the accuracy of underhand passing in volleyball. The better the level of eye-hand coordination possessed by students, the higher the level of accuracy in executing underhand passes. This finding indicates that eye-hand coordination is one of the physical factors that supports the successful mastery of basic volleyball techniques. However, this study has several limitations. First, the sample size was relatively limited and involved participants from only one school, which may restrict the generalizability of the findings to broader populations. Second, this study focused solely on the relationship between eye-hand coordination and underhand passing accuracy without considering other factors that may also influence performance, such as arm muscle strength, concentration, reaction time, motivation, and playing experience. In addition, the use of a correlational research design does not allow for conclusions about causal relationships between the variables. Therefore, this study recommends that physical education teachers and coaches include eye-hand coordination training as an important component of volleyball learning and training programs to improve students' technical skills. Future research is encouraged to involve larger and more diverse samples, apply experimental or longitudinal research designs, and examine additional physical, psychological, and technical factors that contribute to

underhand passing performance so that the findings can be generalized more comprehensively.

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