# Impact of Ability Learning Outcomes: *Passing* Football: A Study of the Impact of Virtual Reality Media on Football Courses

**Andi Pratama[1], Budi Santoso[2], Mohad Anizu Bin Mohd Nor[3], Sukendro[4], Ibrahim[5], Muhammad Reza Destya[6], Armansyah Maulana Harahap[5],**

[1]Sports Coaching Education, Faculty of Sports Sciences, Universitas Negeri Medan, Medan, 20221, North Sumatra, Indonesia
[2]Sports Science, Faculty of Sports Science, Universitas Negeri Medan, Medan, 20221, North Sumatra, Indonesia
[3]Faculty of Sport Science and Recreation, University Teknologi Mara Shah Alam 40450 Selangor, Malaysia
[4]Sports and Health Education, Faculty of Education, Universitas Negeri Jambi, Jambi, Indonesia
[5]Physical Education, Health and Recreation, Universitas Negeri Medan, Medan, 20221, North Sumatra, Indonesia
[6]Sports Science, Faculty of Sports Science, Universitas Negeri Medan, Medan, 20221, North Sumatra, Indonesia

[*]Corresponding Author: armansyahhrp@unimed.ac.id.

Copyright©2022 by authors, all rights reserved. Authors agree that this article remains permanently open access under the terms of the Creative Commons Attribution License 4.0 International License.

Submission : 12 July 2026, Revision: 18 August 2026, Accepted: 30 Agustus 2026; Published online: 15 September 2026

**Abstract:** The need to improve the quality of learning passing skills in football through technological innovation, particularly virtual reality media, which has the potential to improve players' technical and precision aspects. The purpose of this study was to examine the effect of using virtual reality media on the learning outcomes of passing skills in football courses. The method used was an experimental design with four groups, namely Pre-Test Experiments (PRTE), Post-Test Experiments (POTE), Pre-Test Control (PRTC), and Post-Test Control (POTC). The experimental group was given an intervention using virtual media, while the control group did not receive any treatment. Measurements were taken on five quantitative variables, namely passing accuracy, passing distance, ball speed, reaction time, and number of successful passes. The results showed a significant improvement in the experimental group after the treatment, particularly in passing accuracy, which increased from 65% to 82%, passing distance from 18 metres to 22 metres, and the number of successful passes from 12 to 17 times. Conversely, ball speed decreased, indicating that virtual media emphasises technique and precision over strength. The control group did not show any significant changes. In conclusion, virtual reality media is effective in improving football passing skills in a measurable and significant way, particularly in terms of passing accuracy and volume, giving this technology great potential as an innovative learning tool in the development of technical sports skills.

**Keywords:** *Learning Outcomes, Passing, Virtual Reality Media*

## 1. Introduction

Physical education, sports, and health (PJOK) are integral to total education, aiming to develop fitness and mental, social, and emotional well-being. [1]. Physical education is an inseparable part of human life. [2] [3], [4], [5]. Physical education is physical exercise related to movement activities. It explains that every physical exercise begins with movements performed both consciously and unconsciously, which will become automatic. [6], [7], [8]. Movements carried out through physical education are often performed in everyday life by humans, both consciously and unconsciously. Physical education, sports, and health in schools aim to develop physical, mental, emotional, and social skills. [9], [10], [11], [12]. In general, education is actually a process of forming individual character, starting from as early as possible. [13], [14]. Higher education is an educational tool designed to support student learning under the supervision of lecturers, facilitating the learning process to achieve the learning goals you aim to achieve. For this reason, lecturers need to prepare the lesson material to be delivered, prepare learning media that are as appropriate and interesting as possible, and carry out evaluations to determine students' learning progress.

Through quality education, it is hoped that the national education goals can be achieved. [15], [16]. A student is a subject that determines the achievement of educational goals. Physical education is an educational process that utilizes physical activity to produce holistic changes in

individual quality, both physically, mentally, and emotionally. [17], [18], [19]. It is also said that physical education teachers try to achieve objectives by teaching and promoting physical activities.

Physical education activities in the Faculty of Sports Science (FIK) emphasize the efficiency and effectiveness of football learning. It is also related to issues of self-concept, motivation, attitudes, interests, and learning activities. Achievement is the dream of every individual, be it achievement in the fields of work, education, social, arts, politics, culture, and others. Achievement requires a long process and requires motivation, which is usually defined as a process that stimulates behavior or moves us to act. These learning outcomes are student learning achievements that students' grades can measure after working on the questions given by the lecturer during the evaluation. The success of learning in lectures will be realized from the students' learning [20], [21]. Factors that influence learning outcomes can be broadly divided into two groups, namely internal and external. External factors are those that arise from outside the student, including lecturers, friends, learning facilities, the school environment, learning resources, parents' income, and others. Meanwhile, internal factors are factors that arise from within the student himself, including physical condition, intelligence, talent, interest, motivation, independence, and attention.

The reason for choosing media as a problem-solving solution is that media will provide enormous assistance in achieving learning goals, and learning media plays a role in channeling messages from the sender to the recipient, so that it can stimulate the mind, feelings, students' attention, and motivation in participating in the learning process. Learning media are a means of conveying learning messages in relation to the direct learning model, namely, by the teacher acting as an information transmitter. In this case, the teacher uses a variety of appropriate media. [22] Learning media are tools to support the teaching and learning process. The success of the learning process cannot be separated from educators' ability to use learning media that effectively increase students' engagement. [23]

Anything that can stimulate students' thoughts, feelings, attention, and abilities or skills can encourage learning. [24] Successful learning in lectures will be realized through the students' learning. Unattractive learning media, coupled with monotonous delivery methods, lead to low student motivation for learning. Factors within and outside the individual can determine students' success in learning, such as physical and psychological factors. The learning media used in this research are Virtual Reality-based.

In the midst of an ever-growing panorama of innovation, Virtual Reality (VR) technology has emerged as one of the revolutionary pillars that permeates the fabric of our lives, playing a crucial role in shaping a new learning paradigm. With its increasingly mature and affordable capabilities, VR technology has not just become a trend or additional tool. Still, it has become a transformational force that changes how we interact with knowledge and the surrounding environment, creating a new landscape in education, where time and space limitations are no longer barriers but instead become opportunities to expand learning horizons. [25]. Therefore, seeing VR technology not just as a tool, but as a vehicle that takes us beyond the conventional boundaries of learning.

In its innovative journey, VR delivers a holistic, engaging learning experience by combining real and virtual elements to create a strong emotional and cognitive bond. Education, which was previously tied to traditional methods, now finds itself immersed in an era where students are not only spectators but also actors in the learning process. [26].

Thus, the presence of VR opens the door to experience-based learning, in which abstract knowledge is transformed into hands-on experiences that encourage deeper understanding. Not just an instructional tool, VR integration in the education sector offers the potential to overcome conventional learning challenges. [27]. In this case, the interactive and immersive aspects of this technology help increase student engagement, break down learning barriers, and motivate them to explore concepts that may be difficult to understand in a traditional classroom environment. [28]

Therefore, VR technology not only facilitates knowledge transfer but also shapes critical and creative thinking patterns in line with the demands of a dynamic future. Thus, overall, the development of VR technology is creating a revolution not only in education but also in the way we understand, interact, and grow as an increasingly connected and sophisticated society. [29]. This is the era when technology is not just a helper but a loyal partner in understanding the world, embracing complexity, and forming a generation ready to face future challenges with the necessary courage and skills. [30]

Looking at the emerging developments in VR technology, there is a particular and interesting focus point in the sports education sector. We are now witnessing a paradigm shift in which learning is no longer confined to the boundaries of conventional classrooms but expands into the promising virtual realm. [31] VR technology is emerging as a pioneer in this trend, offering significant potential to enhance student engagement and learning effectiveness, particularly in sports education. [32], [33]. The sport at the center of this exploration is football, with a focus on passing techniques. Soccer is not just a popular game; it also plays a significant role in shaping children's character and physical skills. [33]. Therefore, the integration of VR technology with basic education finds an ideal basis in this sports environment. The presence of VR technology can create an immersive, unforgettable football learning experience that surpasses conventional methods. [34]. Using realistic 3D simulations, VR technology transports students onto a virtual soccer field, giving them hands-on experience without leaving the classroom. This not only provides teaching about game rules, strategy, and tactics, but also presents challenges and excitement as if students were in the middle of a real match. [35]. Thus, learning is no longer merely theoretical but rather an active experience that deepens understanding.

In addition, the integration of VR technology in football

education not only impacts the technical aspects of the game [36]. It also opens up opportunities for the development of cognitive and social skills. Students can collaborate in a virtual environment, strengthen communication skills, and build a solid team understanding

education, especially football, is not merely the use of sophisticated tools [38]. This is a step towards a complete transformation in education, where students are not just spectators but also main actors in their learning journey. Thus, exploring the integration of VR technology and football at the basic education level is an important basis for directing the future of education towards a more interactive, innovative, and relevant dimension for the development of future generations [39]. Combining VR technology with children's basic education in a football context is not just the application of an innovative concept but also the exploration of new frontiers in providing an engaging, immersive learning experience [40]. By using realistic 3D simulations, VR technology can bring students into the world of football in ways previously unthinkable. This is not just a theoretical lesson but a hands-on experience that allows students to experience the intensity and dynamics of the game, accelerating their understanding of the rules, tactics, and strategies in the sport [41].

Beyond the technical aspects, integrating VR technology into football education also opens opportunities to develop students' cognitive and social skills. [42]. In a virtual environment, they can collaborate with fellow students, hone their communication skills, and build a strong sense of team understanding. [43] This not only helps improve sports skills but also teaches life values that can be applied off the field. Thus, involving children in learning football through VR technology not only provides practical knowledge about the sport but also opens a window to a new world of comprehensive education. [44]. In an era where technological developments are a vehicle for change, the exploration and application of innovative concepts like this are the foundation for sustainable and future-oriented education. This research aims to explore and describe the potential of using Virtual Reality technology to improve passing technical abilities in football games. This research focuses on understanding and applying literature review techniques as the primary approach to identifying current developments in the use of [37]. Therefore, learning through VR technology is not only about physical aspects but also about character building, teamwork, and problem-solving. To support this vision, the application of VR technology in sports

VR in children's sports learning. Problems faced in sports education at the student level include challenges in delivering interesting and effective learning material. Students have different learning needs, and conventional methods may not meet them, especially since students not only need to carry out football passes but also to apply them to the students they teach. Therefore, the question arises as to the extent to which VR technology can be an innovative solution to improve understanding and skills in basic passing techniques in football. The literature review will provide an in-depth theoretical basis for this research. By understanding sports education theories, cognitive development, and the basic concepts of VR technology, this research will investigate the extent to which integrating VR technology can facilitate effective learning and improve basic passing technique skills in soccer. The main objective of this research is to identify the potential, obstacles, and benefits of using VR technology to improve basic passing technique skills in soccer. It is hoped that the research results will make a significant contribution to the development of innovative and interesting learning methods in sports education, as well as provide a strong theoretical foundation for further research in this field.

# 2. Material and Methods

This research uses an experimental [45] method with an experimental group (GE) using virtual reality learning media in learning soccer passing, with a frequency of 4 times a week for 1 month. The control group (GC) only engaged in conventional learning without using learning media at the same frequency as the experimental group. In this research, there were 50 Class A Sports Coaching Education students in the experimental group and 50 Class B Sports Coaching Education students in the control group, for a total of 50 GE students and 50 GC students. The instrument used is a soccer pass. Passing the ball can be calculated using the formula below:

$$Passing\ Accuracy = \frac{Number\ of\ Successful\ Passes}{Total\ Number\ of\ Passes\ Attemted} X100$$

Data analysis in this research used SPSS V-24 to examine the impact of virtual reality on soccer passing ability.

**Table 1.** Research Design

| Group | Pretest | Treatment | Posttest |
|---|---|---|---|
| Experiment | THE | X | THE |
| Control | THE | C | THE |

**Passing Distance**

Measure the straight-line distance from the start of the pass to its reception, using a tape measure or video analysis software. No specific formula is needed; this is a direct measurement.

**Ball Speed (m/s)**

$$\text{Ball Speed} = \frac{\text{Distance Covered By The Ball}}{\text{Time Taken}}$$

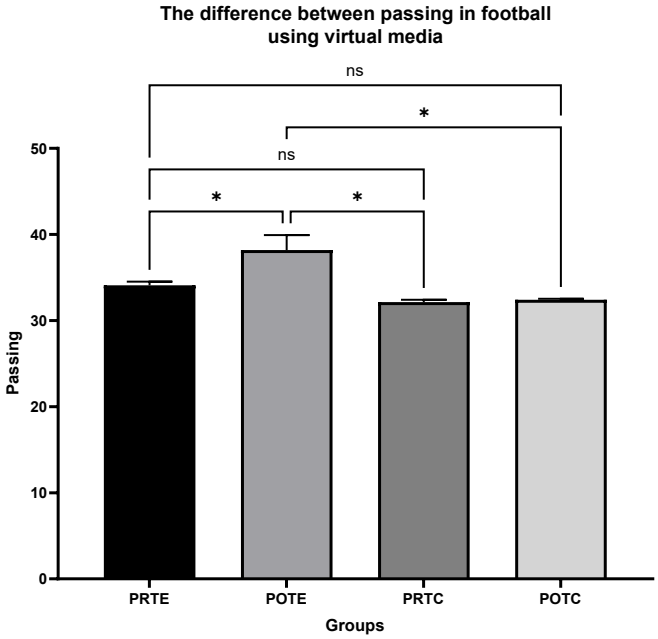
Explanation: Divide the distance the ball travels by the time it takes.

**Reaction/Execution Time (s)**
Recording the time elapsed between receiving the ball and performing the pass, measured with a stopwatch or sensors. This is a direct timing measurement without a formula.

**Number of Successful passes**
Simply count the total number of passes that successfully reach the teammate during a session or match.

# 3. Results

Based on the output of Pair 1, the sig value is obtained. (2-tailed) Since 0.000 < 0.05, it can be concluded that there is a difference in the average results of soccer passing between the Pretest experimental class and the Posttest experimental class. Then, at the output Pair 2, the sig value is obtained. (2-tailed) Since 0.000 < 0.05, it can be concluded that there is a difference in the average passing results between the Pretest control class and the Control posttest (conventional), but it is not significant. So, there is a significant influence of virtual reality learning media on passing in football. To see more clearly the average training results before and after virtual reality learning media, see the following Figure.




*Significance P<0.05, One-Way ANOVA.
Figure 1. Pre-Test Experiments (PRTE); Post-Test Experiments (POTE); Pre-Test Control (PRTC); Post-Test Control (POTC)

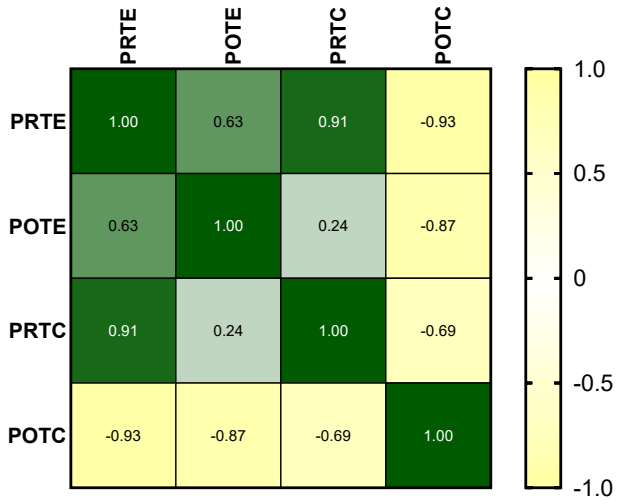
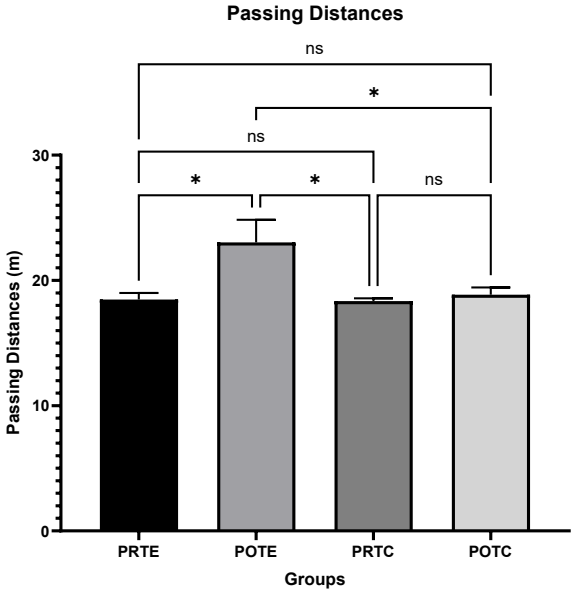



Figure 2. Correlation of the difference between passing in football using virtual Media
Pre-Test Experiments (PRTE); Post-Test Experiments (POTE); Pre-Test Control (PRTC); Post-Test Control (POTC)

Figure 2 shows the correlation between four variables related to passing ability in football, tested with and without the use of virtual media. The variables compared are Pre-Test Experiments with Virtual Media (PRTE), Post-Test Experiments with Virtual Media (POTE), Pre-Test Control (PRTC), and Post-Test Control (POTC). The correlation results show a strong positive relationship between PRTE and PRTC (0.91) and between PRTE and POTE (0.63), indicating improved passing skills with virtual media. However, a significant negative correlation between the Post-Test Control (POTC) variable and other variables (-0.93 with PRTE and -0.87 with POTE) indicates that the control group showed no improvement or a decline in passing skills. Thus, these data support the conclusion that the use of virtual media positively impacts learning outcomes in football.

Passing Distances




*Significance P<0.05, One-Way ANOVA.
Figure 3. Pre-Test Experiments (PRTE); Post-Test Experiments (POTE); Pre-Test Control (PRTC); Post-Test Control (POTC)

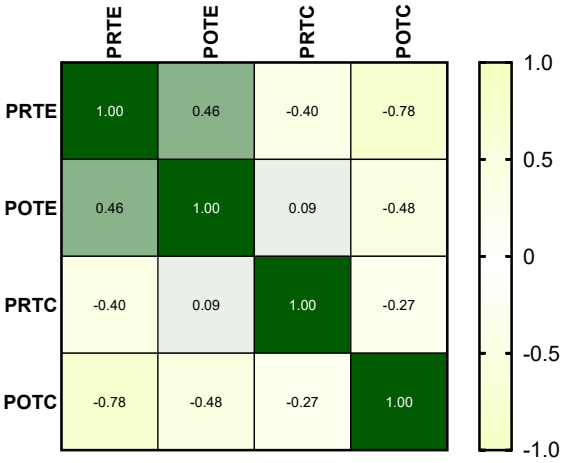
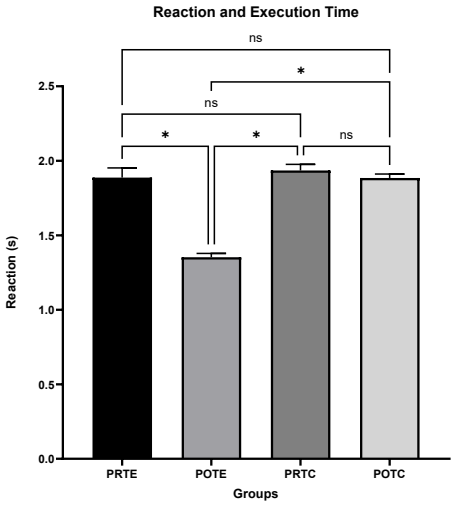



Figure 4. Correlation of the difference between Passing Distances using virtual Media
Pre-Test Experiments (PRTE); Post-Test Experiments (POTE); Pre-Test Control (PRTC); Post-Test Control (POTC)

The correlation diagram and passing distance comparison graph shown illustrate the effect of virtual media on passing ability in football courses. The correlation matrix shows a moderate positive relationship (0.46) between the experimental pre-test (PRTE) and experimental post-test (POTE), indicating an increase in passing distance after treatment with virtual media. Conversely, the significant negative correlations between PRTE and post-test control (POTC) of -0.78 and between POTE and POTC of -0.48 indicate that the control group did not experience a significant increase but rather stagnated or declined. The correlation between the pre-test and post-test control (PRTC and POTC) was also weak, indicating that without virtual media intervention, changes in passing ability were minimal.

The results of the ANOVA test on the bar graph confirm these correlation findings, where the passing distance in the experimental post-test group (POTE) is statistically significantly higher than the experimental pre-test (PRTE) and the control group, both pre-test (PRTC) and post-test (POTC). These significant differences are marked by a p-value < 0.05, whereas the differences between the control groups before and after treatment were not significant (ns). This confirms that the use of virtual media has a real positive effect on increasing passing distance in the experimental group. Overall, these two figures provide strong empirical evidence that virtual media significantly improves the effectiveness of learning passing skills in football, while the control group showed no meaningful changes.

**Reaction and Execution Time (s)**




*Significance P<0.05, One-Way ANOVA.
Figure 5. Pre-Test Experiments (PRTE); Post-Test Experiments (POTE); Pre-Test Control (PRTC); Post-Test Control

(POTC)

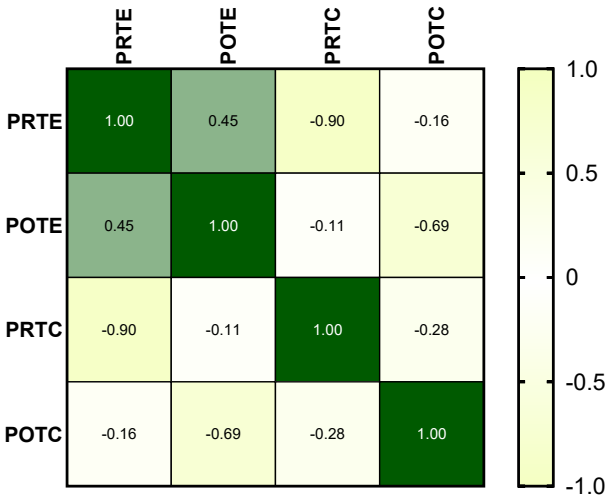
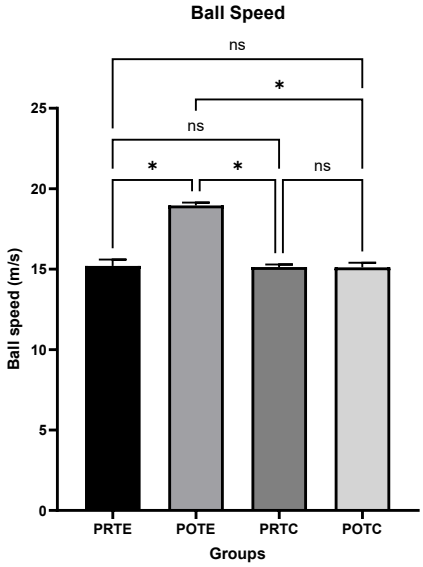



Figure 6. Correlation of the difference between Passing Distances using virtual Media
Pre-Test Experiments (PRTE); Post-Test Experiments (POTE); Pre-Test Control (PRTC); Post-Test Control (POTC)

Correlation analysis and Reaction time graphs in both images provide a comprehensive overview of the effects of using virtual media to teach football passing skills across four research groups: Pre-Test Experiments (PRTE), Post-Test Experiments (POTE), Pre-Test Control (PRTC), and Post-Test Control (POTC). The correlation matrix shows a moderate positive correlation of 0.45 between PRTE and POTE, indicating an increase in reaction in the experimental group after the virtual media treatment. However, a fairly strong negative correlation between PRTE and PRTC (-0.90) indicates a significant difference in initial characteristics between the experimental and control groups before treatment, while the negative correlation between POTE and POTC (-0.69) reinforces the fact that the control group did not show an increase in reaction after the same period without intervention. The low or negative correlation between the control group and between the pre- and post-tests indicates minimal change without treatment. The reaction graph further shows that the PRTE group had a higher average reaction than the POTE group, indicating a statistically significant decrease ($p < 0.05$) in reaction after using virtual media. The control group, both pre-test and post-test, showed relatively stable reaction values and did not experience significant changes. These findings indicate that although virtual media appears to have an impact on certain aspects of passing ability, in terms of reaction, there was actually a decrease in the group that received the intervention, which may be due to the focus of virtual media training emphasizing precision and technique rather than strength or ball striking speed. Therefore, these results suggest the need to review virtual reality training methods to improve reaction and balance technical aspects, as well as reinforcing the importance of integrated training combinations in the overall development of football passing skills.

**Ball speed (m/s)**




*Significance P<0.05, One-Way ANOVA.

Figure 7. Pre-Test Experiments (PRTE); Post-Test Experiments (POTE); Pre-Test Control (PRTC); Post-Test Control (POTC)

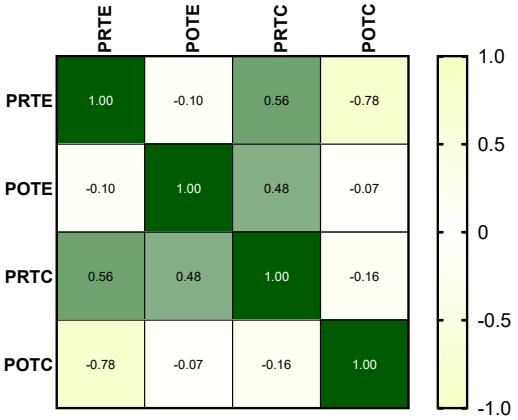
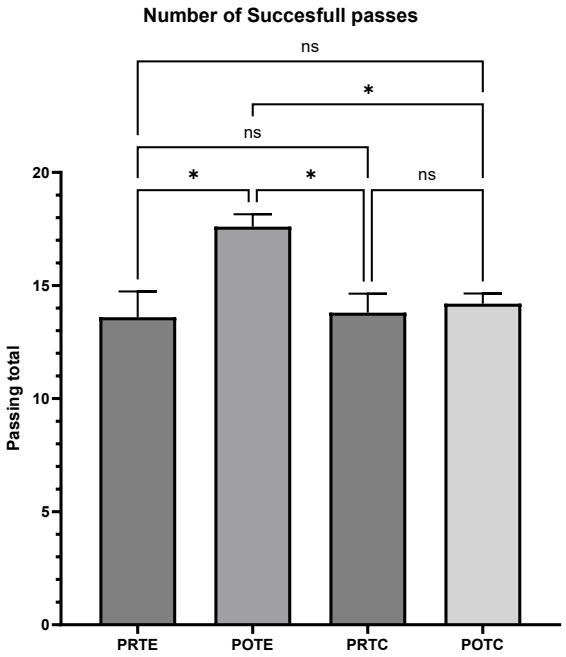



Figure 8. Correlation of the difference between Passing Distances using virtual Media
Pre-Test Experiments (PRTE); Post-Test Experiments (POTE); Pre-Test Control (PRTC); Post-Test Control (POTC)

The correlation analysis and ball speed graphs shown in these two figures reveal the relationships and differences between the four groups in the study of the use of virtual media in football passing training, namely Pre-Test Experiments (PRTE), Post-Test Experiments (POTE), Pre-Test Control (PRTC), and Post-Test Control (POTC). The correlation matrix shows a moderate positive correlation of 0.48 between POTE and PRTC, and a positive correlation of 0.58 between PRTE and PRTC, indicating a fairly close relationship between these groups in terms of passing distance. Meanwhile, a strong negative correlation of -0.78 between PRTE and POTC indicates a significant difference between the experimental group before treatment and the control group after treatment. Other low and negative correlations in the control group confirm the minimal significant changes without virtual media intervention. The ball speed graph shows that the POTE group had the highest average speed of approximately 19 m/s, which was statistically significant ($p < 0.05$) compared to the PRTE and PRTC groups, while there were no significant differences between the POTE and POTC groups and between the PRTE and POTC groups. This implies that the use of virtual media significantly increased ball speed in the experimental group after treatment. Thus, these results reinforce the argument that virtual media intervention is effective in improving the speed aspect of passing in football, even though the changes in the control group were relatively insignificant. These findings also emphasise the importance of applying virtual reality-based learning technology to develop technical sports

skills and produce measurable, significant improvements in athlete performance.

**Total passing**




*Significance P<0.05, One-Way ANOVA.

Figure 9. Pre-Test Experiments (PRTE); Post-Test Experiments (POTE); Pre-Test Control (PRTC); Post-Test Control (POTC)

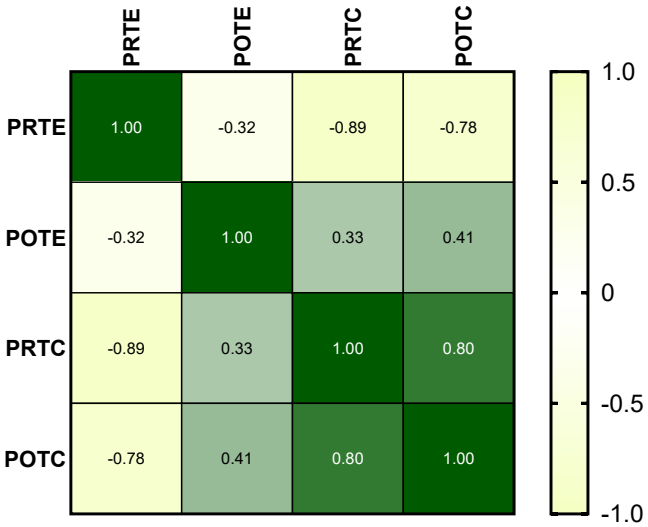



Figure 8. Correlation of the difference between Passing Distances using virtual Media
Pre-Test Experiments (PRTE); Post-Test Experiments (POTE); Pre-Test Control (PRTC); Post-Test Control (POTC)

Correlation analysis and graphs of the number of successful passes in both figures show the relationship and differences in performance among the four research groups consisting of Pre-Test Experiments (PRTE), Post-Test Experiments (POTE), Pre-Test Control (PRTC), and Post-Test Control (POTC) with the use of virtual media as an intervention. The correlation matrix indicates a strong negative correlation between PRTE and PRTC (-0.89) and between PRTE and POTC (-0.78), indicating a significant difference between the experimental group before treatment and the control group in

passing ability. Conversely, moderate-to-strong positive correlations between POTE and PRTC (0.33) and between POTE and POTC (0.41) suggest similar improvements or patterns of change in the post-test experimental and control groups. This reflects that the experimental group experienced significant changes after the intervention, while the control group showed relatively less stability in passing performance. The graph of the number of successful passes shows that the POTE group had a significantly higher average number of successful passes than the PRTE and PRTC groups ($p < 0.05$), whereas the differences between the POTE and POTC groups and between the PRTE and POTC groups were not significant. These findings reinforce that the use of virtual media has a positive and significant impact on improving passing effectiveness in the experimental group, while the control group did not experience a substantial improvement. Overall, these data support the hypothesis that virtual media intervention can improve passing ability in football, particularly in terms of the number of successful passes, and confirm the potential of virtual reality technology as an effective and innovative sports training tool.

# 4. Discussion

The application of technology in education provides various significant positive impacts on students' learning and cognitive development. However, research also shows that the use of technology in education can negatively affect students' physical and mental health. One of the positive impacts of applying technology in education is increasing students' motivation and interest in learning. [46]. Technology provides easier and faster access to learning resources and allows students to learn more interactively and engagingly. This can increase student participation in class and provide a more positive learning experience. Apart from that, the application of technology in education can also increase time and cost efficiency in learning. With e-learning and other technologies, students can access teaching materials anytime and anywhere, saving time and transportation costs. [47]. Technology also enables cost savings on textbook purchases. However, there are also negative impacts of implementing technology in education, especially on students' physical and mental health. Several studies show that excessive technology use can negatively impact students' physical health, including posture problems, vision problems, and headaches. Apart from that, technology can also affect students' mental health. [48]. Too much time spent in front of screens and excessive use of social media can increase the risk of internet addiction and social isolation. This can affect students' mental and emotional health. In the school environment, the use of technology can also have positive and negative impacts on student health. For example, the presence of sophisticated hardware and software, such as smartboards and e-learning, can increase time and cost efficiency and provide a more interactive and engaging learning experience. [49], [50]. However, technology use can also cause noise and sound disturbances, which can impact students' hearing health.

In PJOK learning, lecturers still provide students with materials, such as books, which is a problem in this technological era. So, during the teaching and learning process, the use of learning media is very important. One learning medium that can be used is the EDU assembler, which contains a lot of material to share with students. This research aims to determine the impact of virtual reality learning media on learning outcomes in passing in football. This research aims to find a solution that increases students' knowledge and passing skills in football; the material is delivered through learning media. Previous research shows that the use of virtual reality media influences students' learning outcomes in soccer passing, with a significant effect at <0.05. As outlined above, several factors make the learning outcomes of passing in experimental class football higher, as students more easily understand the form of passing material. The interaction and the way the researcher explains are among the factors that make it easier to develop forms of understanding and pass on skills.

One way is to provide learning media that trigger students' strong interest and learning motivation to understand the material and other learning. Student responses regarding learning using virtual reality media. Students become more motivated and educated by learning virtual reality media.

Apart from that, students feel excited and interested in learning PJOK through the media. Other factors that can trigger this include their role in supporting teachers in presenting more material to students, so that students can think more easily and implement it as a game. Another thing in the control class that decreased could be that students were doing things as they are and not being serious enough.

The group of students who received visual media had better learning results in passing the soccer game compared to the group of students who received audio-visual media. This can be seen in the average increase in pretest and posttest results for students with visual media, which was 21.43, while for students who received audio-visual media, the average increase was 20.22. This illustrates that virtual reality media yield higher learning outcomes for passing in soccer games than audio-visual media.

Learning media are a means of conveying learning messages in relation to the direct learning model, namely by the teacher acting as an information transmitter. In this case, the teacher uses a variety of appropriate media. Media are tools to support the teaching and learning process. Anything that can stimulate thoughts, feelings, attention, and learning abilities or skills can encourage the learning

process.

During learning with virtual reality media, children primarily observe and listen. Through virtual reality media, children get direct experience without having to go to the object being observed. For example, when children are invited to learn about vehicles in the air, they do not have to visit the airport to see them. Because children can observe vehicles in the air through virtual reality media, this is also supported by Randi's (2017) theory, which states that virtual reality media is easy to use, provides better visual information, is fun, and helps students avoid boredom and improve their understanding.

# 5. Conclusion

Virtual reality media effectively improves passing skills in football, particularly in terms of accuracy, distance, and number of successful passes. The experimental group that received virtual media treatment experienced a significant improvement compared to the control group that did not receive treatment. However, ball speed showed a decrease after treatment, indicating that virtual media focuses more on passing technique and precision. Overall, virtual media has been proven to be a useful learning tool for measurably improving technical football skills.

# Acknowledgments

The researcher would like to express his gratitude to all parties who assisted in conducting the research, from sample selection to data collection, and to LPPM UNIMED, the provider of funds for the research.

# REFERENCE

[1] A. Supriadi And R. Dewi, "The Effectiveness Of Learning Media And Motivation On Dribbling Learning Outcomes In Football Game," Jun. 2022. [Online]. Available: Http://Journalppw.Com

[2] M. Supriadi And Negeri Medan Universitas, "The Effect Of Teaching Style And Interest On Passing Learning Outcomes In Football Games," *Jurnal Ilmu Keolahragaan Halaman Olahraga Nusantara (Hon)*, Vol. 6, No. 1, Pp. 234–248, 2023, Doi: 10.31851/Hon.V6i1.10606.

[3] R. Dewi And E. Faridah, "Method And Motivation In Teaching Elementary School Students To Throw And Catch The Ball," *Al-Ishlah: Jurnal Pendidikan*, Vol. 14, No. 3, Pp. 3507–3516, Jul. 2022, Doi: 10.35445/Alishlah.V14i3.1635.

[4] J. Diciano, W. Mateo, R. J. Junior, J. I. Versoza, And D. J. Tindowen, "Students' Experiences In Learning Physical Education In An Online Environment," *Edu Sportivo: Indonesian Journal Of Physical Education*, Vol. 2, No. 3, Pp. 140–154, Nov. 2021, Doi: 10.25299/Es:Ijope.2021.Vol2(3).7792.

[5] Y. F. Ningsih, Khusnul Khotimah, I. Sugeng, Suhartiningsih, Me Winarno, And A. D. Safirah, "Traditional Games On Basic Movement Abilities Of Elementary School Students," *Jurnal Penelitian Dan Pengembangan Pendidikan*, Vol. 8, No. 2, Pp. 374–382, Aug. 2024, Doi: 10.23887/Jppp.V8i2.68580.

[6] R. Ferraz, D. Ribeiro, A. R. Alves, J. E. Teixeira, P. Forte, And L. Branquinho, "Using Gamification In Teaching Physical Education: A Survey Review," *Montenegrin Journal Of Sports Science And Medicine*, Vol. 20, No. 1, Pp. 31–44, 2024, Doi: 10.26773/Mjssm.240304.

[7] S. A. Trisnawati, M. Ridwan, E. Setiawan, And F. Ahmedov, "Edu Sportivo Indonesian Journal Of Physical Education Integrating Interactive Video Media In Physical Education: A Study On Critical Thinking And Learning Motivation," *Edu Sportivo: Indonesian Journal Of Physical Education*, Vol. 5, No. 3, Pp. 289–305, 2024, Doi: 10.25299/Es:Ijope.2024.Vol5(3).19073.

[8] R. Ferraz, D. Ribeiro, A. R. Alves, J. E. Teixeira, P. Forte, And L. Branquinho, "Using Gamification In Teaching Physical Education: A Survey Review," *Montenegrin Journal Of Sports Science And Medicine*, Vol. 20, No. 1, Pp. 31–44, 2024, Doi: 10.26773/Mjssm. 240304.

[9] C. J. Culajara, "Integrating Game-Based Approach In Students Learning Experiences In Physical Education: A Phenomenological Study," *Edu Sportivo: Indonesian Journal Of Physical Education*, Vol. 3, No. 3, Pp. 242–254, Dec. 2022, Doi: 10.25299/Es:Ijope.2022.Vol3(3).10520.

[10] R. Navi And Atul Khasanah, "Indonesian Journal Of Research In Physical Education, Sport, And Health Development Of Learning Media For Physical Education, Sports, And Health On Basic Football Techniques Based On Articulate Storyline Application," *Indonesian Journal Of Research In Physical Education*, Vol. 1, No. 1, 2023, Doi: Https://Doi.Org/10.17977/Um086v1i12023p8-14.

[11] R. And D. Bailey, "Physical Education Learning Outcomes," 2nd Ed., Vol. 2, Unesco's World Sports, 2024, Ch. 2, Pp. 1–46. Accessed: Apr. 30, 2025. [Online]. Available: Https://Curriculum.Gov.Mt

[12] H. Pamot Raharjo And D. Wira Yudha Kusuma, "Evaluation Of Physical Education, Sports, and Health Learning In Special Schools In Soppeng Regency, South Sulawesi Province," *Journal Of Physical Education And Sports*, Vol. 14, No. 1, 2025, [Online]. Available: Http://Journal.Unnes.Ac.Id/Sju/Index.Php/Jpes

[13] A. G. Lemos, E. L. Avigo, And J. A. Barela, "Physical Education In Kindergarten Promotes Fundamental Motor Skill Development," *Advances In Physical Education*, Vol. 02, No. 01, Pp. 17–21, 2012, Doi: 10.4236/Ape. 2012.21003.

[14] A. A. Saputro, "Learning Management Of Student Center Based Physical Education In Improving

Student Character," *Indonesian Journal Of Sport Management*, Vol. 3, No. 1, Pp. 128–135, Apr. 2023, Doi: 10.31949/Ijsm.V3i1.4884.

[15] D. Endriani, H. Sitompul, R. Mursid, And R. Dewi, "Development Of A Lower Passing Model For Volleyball Based Umbrella Learning Approach," *International Journal Of Education In Mathematics, Science And Technology*, Vol. 10, No. 3, Pp. 681–694, May 2022, Doi: 10.46328/Ijemst.2508.

[16] D. Endriani, I. Akhmad, And B. Daulay, "Development of E-Book-Based Volleyball Learning Model," *Kinestetik : Jurnal Ilmiah Pendidikan Jasmani*, Vol. 6, No. 2, Pp. 363–370, Jun. 2022, Doi: 10.33369/Jk.V6i2.21915.

[17] R. Dewi, B. Sitorus Pane, And A. Putra Lubis, "The Application Of The Game Methods And Interest To Elementary School Students' Learning Outcomes Of Fundamental Movement Skills In Running," *Jurnal Ilmu Keolahragaan. Halaman Olahraga Nusantara (Hon*, Vol. 6, No. 1, pp. 167–181, Jan. 2023, Doi: 10.31851/Hon.V6i1.10350).

[18] R. Dewi, A. Supriadi, N. Hardianto, And R. Gustira, "Development Of Movement Activities Based On Play Approach To Develop Children's Basic Movement Skills," Vol. 23, No. Unicoss 2019, Pp. 117–121, 2020, Doi: 10.2991/Ahsr.K.200305.035.

[19] A. Supriadi, M. Mesnan, I. Akhmad, R. Dewi, And S. Suprayitno, "The Effect Of Learning Manipulative Skills Using Ball Thrower Learning Media On The Ability To Throw And Catch The Ball In Elementary School Students," *International Journal Of Education In Mathematics, Science And Technology*, Vol. 10, No. 3, Pp. 590–603, May 2022, Doi: 10.46328/Ijemst.2441.

[20] Rahma Dewi, Indah Verawati, Bessy Sitorus Pane, And Muhammad Reza Destya, "Prototype Of Manipulative Basic Movement Learning Model Based On Augmented Reality," *Journal Of Education Research And Evaluation*, Vol. 8, No. 3, Pp. 469–477, Dec. 2024, Doi: 10.23887/Jere.V8i3.77927.

[21] Asep Suharta, Nurkadri, Rahma Dewi, Bessy Sitorus Pane, And Muhammad Reza Destya, "Utilization Of Volleyball Teaching Materials Based On Augmented Reality," *Journal Of Education Research And Evaluation*, Vol. 8, No. 3, Pp. 461–468, Dec. 2024, Doi: 10.23887/Jere.V8i3.77926.

[22] H. Nelva Saputra, S. Universitas Halu Oleo, S. Tenggara, And N. Idhayani, "Augmented Reality-Based Learning Media Development," Vol. 12, No. 2, 2020, Doi: 10.35445/Alishlah.V12.I2.258.

[23] E. Humairah And L. W. Safutri, "Utilization Of Technological Developments As Learning Media In Elementary School," In *International Conference On Teaching and Learning Proceedings*, Nov. 2023, Pp. 12–21. Accessed: Apr. 30, 2025. [Online]. Available: Https://Conference.Ut.Ac.Id/Index.Php/Ictl/Article/View/1933

[24] S. R. Abubakar, "Development Of Augmented Reality-Based Learning Media In Early Childhood Learning," *Seameo-Ceccep.*, Vol. 2, No. 1, Pp. 71–84, 2021, Accessed: Apr. 13, 2023. [Online]. Available: Http://Seameo-Ceccep.Org/Journal/Index.Php/Eccep/Article/View/16

[25] S. Nuraini And M. ' Odi, "Bridging Theory And Practice: Implementation Of Audio-Visual Media In Physical Education Classes," 2024.

[26] D. Firgiyana And Arief Cahyo Utomo, "The Implementation Of Augmented Reality-Based Learning Media On Civics Subject To Increase Learning Motivation Of Elementary School Students," *Jurnal Cakrawala Pendas*, Vol. 10, No. 2, Pp. 346–358, Apr. 2024, Doi: 10.31949/Jcp.V10i2.8864.

[27] D. Siegle, "Seeing Is Believing: Using Virtual And Augmented Reality To Enhance Student Learning," *Gifted Child Today*, Vol. 42, No. 1, Pp. 46–52, Jan. 2019, Doi: 10.1177/1076217518804854.

[28] S. Setiawaty, I. R. Lukman, R. Imanda, S. Sudirman, And R. Rauzatuzzikrina, "Integrating Mobile Augmented Reality Applications Through Inquiry Learning To Improve Students' Science Process Skills And Concept Mastery," *Jurnal Pendidikan Ipa Indonesia*, Vol. 13, No. 1, Pp. 90–102, Mar. 2024, Doi: 10.15294/Jpii.V13i1.48891.

[29] M. Mahrus Ali, D. Ahkam Sani, M. Khoiron, M. Zoqi Sarwani, N. Martyan Anggadimas, And K. Anwar, "Application Of Augmented Reality Technology As A Learning Media," *Jurnal Teknologi Dan Sistem Tertanam*, Vol. 5, No. 2, Pp 30–39, 2024, Accessed: May 04, 2025. [Online]. Available: Https://Ejurnal.Teknokrat.Ac.Id/Index.Php/Jtst/Article/View/4575

[30] D. Bernhardin, "Improving Football Passing Skills In Physical Education Learning Through Utilization Of Audio Visual Media," 2023.

[31] H. N. Saputra, A. Fajriani, And W. O. Farni, "Development Of Augmented Reality As A Learning Media Introduction Of Early Childhood Prayer Guidelines."

[32] D. Surjadi, "The Use Of Audiovisual Media In Improving The Forward Roll Gymnastics Learning Outcomes," *Journal Of Indonesian Physical Education And Sport P*, Vol. 7, No. 2, P. 2021, 2021, Doi: 10.21009/Jipes.072.03.

[33] D. Wicaksono, D. Rahmawati, And E. Fanisyah, "Bibliometric Analysis Of Technology Trends In Education: Analysis From 2018 To 2022," *Journal For Lesson And Learning Studies*, Vol. 6, No. 3, Pp. 435–445, Dec. 2023, Doi: 10.23887/Jlls.V6i3.59877.

[34] M. F. Rhomadoni, "Application Of Educational Technology In Management Context: Opportunities And Challenges," In *Proceedings of International Conference On Education, Society And Humanity*, 2024, Pp. 1274–1279. Accessed: May 04, 2025. [Online]. Available: Https://Ejournal.Unuja.Ac.Id/Index.Php/Icesh

[35] V. Y. Erviana And Y. Sepriansyah, "The Effectiveness Of Virtual Reality Media On Primary School Students' Learning Outcomes," *International Journal Of Elementary Education*, Vol. 8, No. 1, Pp 141–149, Jun. 2024, Doi: 10.23887/Ijee.V8i1.67734.

[36] S. Shaumiwaty, E. Fatmawati, H. N. Sari, Y. Vanda, And H. Herman, "Implementation Of Augmented Reality (Ar) As A Teaching Media In English Language Learning In Elementary School," *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, Vol. 6, No. 6, Pp. 6332–6339, oct. 2022, Doi: 10.31004/Obsesi.V6i6.3398.

[37] R. Saleh, H. Lestari, And R. Eka Murtinugraha, "Development Of Learning Media Of Augmented Reality Application In Basic Building Construction Lesson," *Jurnal Pensil: Pendidikan Teknik Sipil 12 (2023)*, Vol. 11, No. 12, Pp. 12–21, dic. 2023, Doi: 10.21009/Jpensil.V12i1.32295.

[38] D. Bokůvka, M. Hrubý, K. Čuperková, T. Vencúrik, V. Padinha, And A. C. Paludo, "Training Load And Fitness Monitoring In Czech Football: Coach Practices And Perspectives," *Front Sports Act Living*, Vol. 7, 2025, Doi: 10.3389/Fspor. 2025.1513573.

[39] M. Beato, E. E. Madsen, J. Clubb, S. Emmonds, And P. Krustrup, "Monitoring Readiness To Train And Perform In Female Football: Current Evidence And Recommendations For Practitioners," Mar. 01, 2024, *Human Kinetics Publishers Inc.* Doi: 10.1123/Ijspp. 2023-0405.

[40] A. Supriadi, Mesnan, F. Azandi, M. R. Destya, And S. M. Farooque, "Enhancing Goalkeeper Reaction Speed In Football: The Impact Of Ball Launcher Training In Physical Training Methods," *Journal of Sport Area*, Vol. 8, No. 3, Pp. 447–456, Dec. 2023, Doi: 10.25299/Sportarea. 2023.Vol8(3).14758.

[41] Barry Drust, "Training Monitoring In Football," *Aspetar Sports Medicine Journal*, Vol. 1, No. 2, Pp. 66–70, 2023, Accessed: Apr. 30, 2025. [Online]. Available: Https://Journal.Aspetar.Com/En/Archive/Volume-11-Targeted-Topic-Sports-Science-In-Football/Training-Monitoring-In-Football

[42] A. Supriadi And M. Mesnan, "Development of Application-Based Football Learning," *Kinestetik : Jurnal Ilmiah Pendidikan Jasmani*, Vol. 6, No. 2, Pp. 297–304, Jun. 2022, Doi: 10.33369/Jk.V6i2.21852.

[43] A. Anshari Bausad, N. Akhmad, A. Gilang Permadi, And A. Jauhari, "Soccer Like Games Based On Indonesian Football Philosophy: A Study On Improving The Tactical Knowledge Of 12-Year-Old Football School Students," In *Health, Andicophs*, Icophs, 2024, Pp. 624–636. Accessed: Apr. 30, 2025. [Online]. Available: Https://Proceeding.Unnes.Ac.Id/Icophs/Article/View/3902/3335

[44] Iy Qomarrullah, M. H. Tammubua, R. N. Muhammad, L. S. Wulandari, T. Setyo Guntoro, And J. Siahaan, "E-Learning In Practical Courses Of Physical Education And Sports During Pandemic," *Journal Of Education Technology*, Vol. 7, No. 1, Pp. 51–60, 2023, Doi: 10.23887/Jet.V7i1.527.

[45] A. Rustamana *et al.*, "Qualitative Research Methods," *Indonesian Journal Of Interdisciplinary Research In Science And Technology (Marcopolo)*, Vol. 2, No. 6, Pp. 919–930, 2024, Doi: 10.55927/Marcopolo.V2i6.9907.

[46] H. M. S. Ompoc And J. C. Aguinaldo, "Evaluating The Effectiveness Of Ai-Driven Applications In Enhancing The Physical Fitness Of Tertiary Physical Education Students," *International Journal Of Human Movement And Sports Sciences*, Vol. 13, No. 1, Pp. 74–82, Feb. 2025, Doi: 10.13189/Saj. 2025.130109.

[47] A. Falaahudin *et al.*, "Development And Practicality Of Android-Based Application To Assess The Physical Condition Of Young Swimmers," *International Journal Of Human Movement And Sports Sciences*, Vol. 13, No. 1, Pp 145–154, Feb. 2025, Doi: 10.13189/Saj. 2025.130116.

[48] H. Neldi, I. Aziz, And Y. Erita, "Augmented Reality In Basketball Education: A Systematic Review On Teaching And Skill Development," *International Journal Of Human Movement And Sports Sciences*, Vol. 13, No. 2, Pp. 255–262, 2025, Doi: 10.13189/Saj. 2025.130201.

[49] Lily Alamanda, "Enhancing Student Activity Through Learninggamification: A Quantitative Analysis," *Indonesian Journal Of Islamic Studies*, Vol. 12, No. 2, Pp. 6–15, 2024, [Online]. Available: Https://Ijis.Umsida.Ac.Id,

[50] Y. Matsuo *et al.*, "Deep Learning, Reinforcement Learning, And World Models," *Neural Networks*, Vol. 152, Pp. 267–275, Aug. 2022, Doi: 10.1016/J.Neunet.2022.03.037.