The Influence of AI-Driven Learning Media on Football Motivation and Passing Ability

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Article Info

Abstract

This study aims to test the effectiveness of artificial intelligence (AI)-based learning media in improving students' soccer passing skills and learning motivation compared to conventional learning. The study used a quasi-experimental design with a pretest–posttest control group pattern on 60 FIK UNIMED students who were divided into experimental and control groups. The experimental group received AI-based learning with real-time feedback, personalized training, and gamification elements, while the control group used conventional methods. The research instruments included a passing skills test and a learning motivation scale. Data analysis used ANCOVA/t-test and Pearson correlation. The results showed that the experimental group had a significant increase in passing skills and learning motivation compared to the control group ($p < 0.01$) with a medium–large effect size. There was a positive relationship between increased motivation and improved passing skills. AI-based learning media effectively improved psychomotor and affective learning outcomes as well as skill retention.

INTRODUCTION

Developments in information technology and artificial intelligence (AI) have brought significant changes to the field of education, including physical education and sports. AI-based learning media offer adaptive features, real-time feedback, and performance analysis that are difficult to achieve with conventional methods. In the context of learning sports techniques, particularly passing in soccer, the application of AI has the potential to accelerate the learning process, improve movement accuracy, and personalize training to suit each student's needs.

Passing is a fundamental skill that determines success in soccer (Endriani et al., 2024; Muhammad Reza Destya et al., 2025; Silwan et al., 2025; Supriadi et al., 2023). Mastering passing techniques encompasses technical aspects (foot placement, power, and direction), tactical aspects (timing and positioning), and psychological aspects such as motivation and self-confidence. However, many schools face challenges: limited practice time, high teacher-student ratios, and varying abilities among students that make it difficult to provide optimal individual feedback (Alparis, 2024; Anshari Bausad et al., 2024; Barry Drust, 2023; Brackenridge et al., 2020; Hadinata et al., 2023; Liao & Fu, 2025; Primasoni et al., 2023; Simbolon & Makorohim, 2025; Supriadi & Mesnan, 2022). These conditions risk reducing the effectiveness of passing technique instruction and hindering the development of students' potential.

Previous research on motor skills instruction has shown that rapid, concrete feedback improves motor retention and learning motivation. AI-driven learning media can provide immediate visual and quantitative feedback, such as analysis of ball trajectory, foot angle, and passing speed, allowing students to make more focused corrections. Furthermore, gamification and personalization elements in AI-based applications can increase student engagement and intrinsic motivation to practice more frequently and consistently (Arlinwibowo et al., 2023).

However, empirical evidence regarding the direct impact of AI learning media on motivation and technical passing skills at the school level remains limited, particularly in the context of physical education in Indonesia (Ketut et al., 2021; Supianto, 2023). Some studies focus on the technical aspects of tools or prototype development without quantitatively measuring changes in students' learning motivation or practical skills. This lack of contextual data makes it difficult for teachers and policymakers to decide on widespread adoption of the technology.

Contextual empirical evidence in Indonesian schools regarding the effectiveness of artificial intelligence (AI)-based learning media for improving soccer passing skills remains limited and fragmented (Rahayu, 2023; Suciati et al., 2023). Most previous studies have focused on the technical feasibility of prototypes (e.g., accuracy of foot angle and ball trajectory detection) without

comprehensively examining the pedagogical impact on students' learning motivation and simultaneously improving their practical skills, with small sample sizes and minimal control groups. Pedagogical research suggests that real-time feedback and gamification can increase motivation and practice frequency, but rarely integrates AI specifically for the soccer context; while qualitative studies report user enthusiasm coupled with concerns regarding teacher training, costs, and infrastructure readiness. Research gaps are also evident in the limited study of short-term effects and (long-term) skill retention and the causal relationship between motivational changes and improved technical performance. There are also limited controlled experimental studies comparing AI media with conventional instruction in classroom/extracurricular settings. Addressing this gap, this study offers novelty through a holistic approach with a controlled experimental design in the Indonesian school context to simultaneously test the effect of AI-driven learning media on motivation and passing ability, combining objective performance metrics (video analysis), validated psychological measures, and system usage logs; while assessing implementation aspects (teacher acceptance, training needs, affordability, curriculum adaptation) and integrating real-time feedback features, personalized performance-based practice, and gamification to strengthen intrinsic motivation and skill retention (Astagisa et al., 2022; Beygmohammadloo et al.,

2024; Putri et al., 2023; Rahmani et al., 2024; Suwadi, 2023; Yahya et al., 2023).

Based on these conditions, research is needed to test the effectiveness of AI-based learning media in improving student motivation and passing ability. Such research is expected to provide empirical evidence regarding the contribution of AI to the process of learning sports skills, patterns of change in learning motivation, and implications for learning practices for physical education teachers. The research findings can also inform recommendations for developing more effective and affordable learning media for use in schools.

Taking into account the practical relevance and the gap in literature in the field, this study focuses on measuring the effect of using AI-driven learning media on students' learning motivation and technical passing skills in soccer, as well as analyzing the relationship between changes in motivation and improvements in these technical skills.

METHODS

This study uses a design **quasi-experimental** with a pattern pretest–posttest control group design (Sugiyono, 2023). This design aims to test the effect of using Artificial Intelligence (AI)-based learning media on students' soccer passing skills and learning motivation.

The experimental group received treatment using AI-based media, while the control group received conventional instruction through teacher demonstrations, drills, and direct

feedback. Both groups received equivalent learning objectives, materials, and learning duration.

Participants

The research participants were FIK UNIMED students in the football learning course selected using the technique. **Purposive sampling** based on class availability and approval. Two classes with relatively equal characteristics were designated as the experimental group and the control group. The inclusion criteria in this study included: (1) Students actively participating in Physical Education, Sports, and Health (PJOK) learning. (2) Never having used AI-based soccer learning media before.

Sampling Procedures

Before conducting the research, the researcher obtained approval from the students in determining the research sample, for the experimental group there were 30 people and for the experimental group there were 30 people. The experimental group participated in soccer passing skills learning using AI-based learning media which had the following features: (1) real-time feedback *(real*-time feedback). (2) Personalization of student performance-based exercises, (3) Gamification elements to increase learning engagement. The control group received conventional learning consisting of material explanations, demonstrations of techniques by the teacher, repetitive exercises (drills) and direct feedback.

Research Instruments

The instruments used in this study can be seen in Table 1 as follows:

Table 1. Research Instruments

No	Instrument	Measured Variables	Indicators/Aspects	Instrument's Shape
1	Football Passing Skills Test	Passing Skills	(1) Accuracy of passing to the target (2) Position of the supporting foot (3) Foot contact with the ball (4) Direction of kick (5) Kick power	Target-based practice tests and engineering assessment rubrics (supported by video analysis)
2	Learning Motivation Scale	Motivation to learn	(1) Intrinsic motivation (2) Extrinsic motivation (3) Involvement	Closed questionnaire (Likert 1–5)
3	System Usage Log (Experimental Group)	Involvement in the use of AI media	(1) Frequency of use (2) Duration of use (3) Number of training sessions	System log
4	Teacher Recruitment Checklist	Evaluation of media implementation	(1) Usability (2) Feasibility (3) Integration in learning	Checklist/rating scale sheet

Validity and Reliability

The validity of the content in the passing skills assessment rubric is determined through expert *judgment by* physical education experts and soccer coaches. Inter-rater reliability was analyzed using **Intraclass Correlation Coefficient (ICC)** or **Cohen's Kappa**.

The content validity of the research instrument was tested through expert assessment using the Content Validity Index (CVI). Three experts, consisting of a physical education expert and a soccer coach, were asked to assess the relevance of each instrument indicator using a four-point scale (1 = irrelevant to 4 = very relevant). The assessment results showed that all indicators in the passing skills assessment rubric had an I-CVI value of 1.00, indicating that all experts considered the indicators relevant. The Scale Content Validity Index (S-CVI) value obtained was 0.94, thus it can be concluded that the instrument has very good content validity and is suitable for use in research.

Instrument Validation Procedure

The instrument validation process was conducted through several systematic stages to ensure that the instruments used in this study possessed adequate levels of validity and reliability.

The first stage involved the **development of the initial draft of the instruments**. At this stage, the researcher designed the preliminary version of the instruments, which consisted of a **soccer passing skill assessment rubric** and a **learning motivation scale**. The development of these instruments was based on a comprehensive literature review, fundamental soccer skill indicators, and relevant theories of learning motivation.

The second stage was **expert judgment**. The draft instruments were then evaluated by several experts with expertise in **physical education and soccer coaching**. The experts were asked to assess the instruments based on several aspects, including the alignment of indicators with the research objectives, the clarity of the assessment indicator descriptions, the relevance of each item to the measured construct, and the feasibility of using the instruments within the learning context.

The third stage involved **scoring and feedback from the experts**. The experts provided ratings for each instrument item using a specific rating scale and also offered comments and suggestions for improvement to enhance the quality of the instruments.

The fourth stage was **instrument revision**. The researcher revised the instruments based on the experts' feedback to improve the clarity, relevance, and suitability of the assessment indicators in accordance with the measurement objectives.

The fifth stage consisted of a **pilot study**. The revised instruments were tested on a small group of students to ensure the clarity of the items and the feasibility of the instruments before being implemented in the main study.

Furthermore, **inter-rater reliability** for the soccer passing skill assessment rubric was analyzed using the **Intraclass Correlation Coefficient (ICC) or Cohen's Kappa** to determine the level of agreement between raters. Meanwhile, the **internal consistency** of the learning motivation scale was analyzed using **Cronbach's Alpha coefficient**, with a reliability criterion of ≥ 0.70.

Procedures

The research began with a preparation stage which included school

permission, parental approval, instrument validity and testing, and determining the experimental and control classes.

In the pretest phase, both groups took a soccer passing skills test and completed a learning motivation scale to determine the students' initial abilities. The experimental group received learning using AI-based media that provided real-time feedback, personalized training, and gamification elements. Meanwhile, the control group underwent conventional learning through teacher demonstrations and drills. The material, objectives, and learning duration were identical for both groups.

After the intervention, both groups took a posttest using the same instrument as the pretest. An optional follow-up test was administered 2–4 weeks later to measure skill retention. Additionally, teachers completed an acceptance checklist to evaluate the feasibility and effectiveness of the learning media implementation.

Design or Data Analysis

Data were analyzed using descriptive and inferential statistics. Normality and homogeneity tests were performed before hypothesis testing.

Differences between groups were analyzed using **Analysis of Covariance (ANCOVA)** with posttest scores as the dependent variable and pretest scores as the covariate, or using *independent-samples t-test* to the gain score.

Effect sizes are reported in the form **Cohen's d** or **partial eta squared (η^2)** The relationship between changes in learning motivation and improvements in passing skills was analyzed using Pearson correlation or regression analysis. The significance level was set at $\alpha = 0.05$.

RESULT

The results showed that students' passing ability and learning motivation in the experimental and control groups were at equivalent levels before the intervention. After the intervention, the group using AI-based learning media showed a significantly higher increase in passing ability than the control group ($p < 0.05$) with a medium-high effect size.

Furthermore, learning motivation scores in the experimental group increased significantly compared to the control group. Correlation analysis showed a significant positive relationship between increased motivation and improved passing ability. These findings indicate that AI-based learning media not only impacts psychomotor aspects but also strengthens students' affective aspects in physical education learning.

Table 2. Descriptive Statistics of Pretest-Posttest Passing Ability

Group	N	Pretest (Mean ± SD)	Posttest (Mean ± SD)	Gain Score
Experiment (AI)	30	10.45 ± 1.82	16.78± 1.65	6.33
Control (Conventional)	30	10.27 ±1.76	13.92±1.88	3.65

The descriptive statistics showed that both groups had relatively similar passing ability at the pretest stage. The experimental group obtained a mean score

of **10.45 (SD = 1.82)**, while the control group had a mean score of **10.27 (SD = 1.76)**. After the intervention, the experimental group demonstrated a substantial improvement with a posttest mean score of **16.78 (SD = 1.65)**, whereas the control group showed a smaller increase with a posttest mean score of **13.92 (SD = 1.88)**. The gain score indicated that the experimental group (**6.33**) improved more than the control group (**3.65**).

Table 3. Descriptive Statistics of Pretest-Posttest Learning Motivation

Group	N	Pretest (Mean ± SD)	Posttest (Mean ± SD)	Gain Score
Experiment (AI)	30	10.45 ± 1.82	16.78± 1.65	6.33
Control (Conventional)	30	10.27 ±1.76	13.92±1.88	3.65

The descriptive statistics indicate that the learning motivation levels of both groups were relatively similar at the pretest stage. The experimental group obtained a mean score of **3.12 (SD = 0.41)**, while the control group had a mean score of **3.15 (SD = 0.39)**. After the intervention, the experimental group showed a notable increase in learning motivation with a posttest mean score of **4.08 (SD = 0.36)**. In contrast, the control group experienced a smaller improvement with a posttest mean score of **3.55 (SD = 0.44)**.

The gain score analysis revealed that the experimental group achieved a higher improvement (**0.96**) compared to the control group (**0.40**), indicating that the intervention contributed to a greater increase in students' learning motivation.

Table 4. Inferential Test Results (Independent Sampel t-test on Gain Score)

Variable	Group	N	Mean Gain	SD	T	p-value
Passing Ability	Experimental	30	6.33	1.42	7.21	<0.001
	Control	30	3.65	1.37		
Learning Motivation	Experimental	30	0.96	0.28	6.14	<0.001
	Control	30	0.40	0.31		

The results revealed a significant difference in **passing ability improvement** between the two groups. The experimental group demonstrated a higher gain score (**M = 6.33, SD = 1.42**) compared to the control group (**M = 3.65, SD = 1.37**), with **t(58) = 7.21, p < 0.001**.

Similarly, the analysis of **learning motivation** indicated that the experimental group showed a greater increase (**M = 0.96, SD = 0.28**) than the control group (**M = 0.40, SD = 0.31**), with **t(58) = 6.14, p < 0.001**.

These findings suggest that the **AI-based learning intervention significantly improved both students' soccer passing ability and learning motivation compared to conventional learning methods**.

Table 5. Effect Size and Practical Significance (Cohen's d)

Variable	Mean Gain (Experimental)	Mean Gain (Control)	Cohen's d	Interpretation

Passing Ability	6.33	3.65	1.61	Large Effect
Learning Motivation	0.96	0.40	1.33	Large Effect

To examine the practical significance of the intervention, **Cohen's d effect size** was calculated based on the gain scores of the experimental and control groups. The results indicated a **large effect** of the intervention on both variables. For **passing ability**, the calculated effect size was **d = 1.61**, indicating a large practical effect of the AI-based learning media on improving students' soccer passing skills. Similarly, for **learning motivation**, the effect size was **d = 1.33**, which also falls into the **large effect category**. These findings suggest that the **AI-based learning intervention not only produced statistically significant improvements but also demonstrated substantial practical significance in enhancing students' performance and motivation**.

The following bar graph compares the pretest and posttest passing ability between groups and compares the pretest and posttest Learning Motivation between groups.
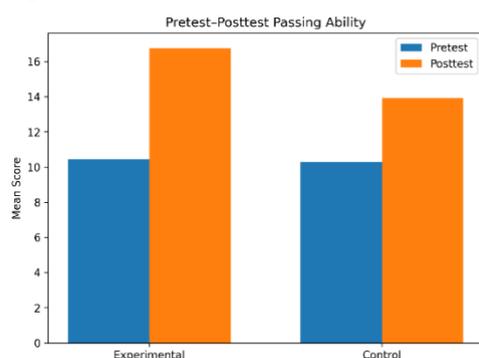

Fig 1. Comparison of Pretest & Posttest Passing Ability Between Groups

Figure 1 illustrates the comparison of the mean scores of soccer passing ability between the experimental and control groups in the pretest and posttest phases. Both groups showed relatively similar mean scores at the pretest stage. However, after the intervention, the experimental group demonstrated a substantially higher improvement compared to the control group. This result indicates that the AI-based learning media contributed to a greater enhancement of students' passing skills.
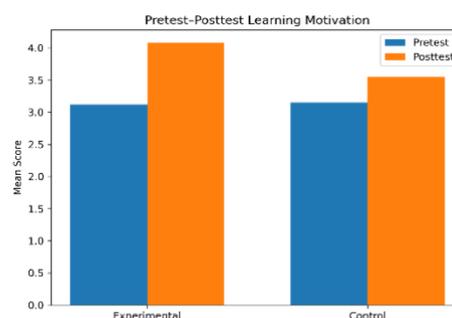

Fig 2. Changes in Learning Motivation from Pretest to Posttest

Figure 2 presents the comparison of students' learning motivation scores between the experimental and control groups before and after the intervention. The results show that both groups had comparable motivation levels during the pretest stage. After the implementation of the intervention, the experimental group experienced a more significant increase in learning motivation than the control group, suggesting that the AI-based learning approach effectively enhanced students' motivation during the learning process.

DISCUSSION

The results of the study showed that the use of artificial intelligence (AI)-based learning media had a significant impact on improving students' passing ability and learning motivation compared to conventional learning. The greater improvement in the experimental group indicates that the integration of real-time

feedback and visualization of movement performance can accelerate the process of technique correction and deepen students' understanding of the basic biomechanical principles of passing. These findings reinforce the view that interactive technology-based learning can improve the quality of training through augmented *feedback that* is specific, timely, and oriented towards key errors that often occur in passing technique.

The findings of increased learning motivation in the experimental group align with the principles of technology-based learning, which emphasize interactivity, personalization, and immersive learning experiences. The personalized performance-based training features and gamification elements contributed to increased intrinsic motivation for consistent practice. Theoretically, this can be explained through the framework self-determination, where support for the needs of autonomy (choice of practice level), competence (progress feedback), and relatedness (goal-based challenges) encourages higher learning engagement. This engagement, in turn, impacts the quality of motor practice and skill outcomes.

The positive relationship between increased learning motivation and improved passing ability indicates that affective and psychomotor aspects reinforce each other in the context of physical education learning. More motivated students tend to practice more frequently, focus more on feedback, and be more open to technique correction, resulting in greater performance improvements. These findings underscore the importance of designing learning media that are not only technically accurate but also pedagogically engaging, as motivation acts as a mediator that strengthens the effectiveness of AI-based interventions.

Retention test results showed that the experimental group maintained better passing performance than the control group. This indicates that AI-based learning not only improves short-term performance but also contributes to motor skill consolidation. Visual feedback and performance recordings allow for this. *error-based learning* more meaningful, thus facilitating the formation of more stable motor representations in motor memory. Thus, AI technology has the potential to support continuous learning and the transfer of skills to more authentic game situations.

From an implementation perspective, these findings have practical implications for physical education teachers and school administrators. AI-based learning media can serve as *co-teacher* which helps provide individualized feedback in classes with a high teacher-student ratio. However, successful implementation depends heavily on teacher readiness, infrastructure availability, and simple and affordable technology training design. Therefore, technology adoption needs to be accompanied by teacher mentoring strategies and curriculum integration to ensure AI use is not sporadic, but rather planned and sustainable.

This study has limitations, including the relatively short duration of the intervention and the limited sample size to a single school level/environment, so generalization of the findings should be done with caution. Furthermore, while AI-based video analysis provides objective feedback, variations in device quality and field conditions may impact motion detection accuracy. Further research is recommended to test long-term effectiveness across different educational levels, compare variations in AI feature design (e.g., level of personalization), and examine the impact on more complex gaming skills in a real-world context.

CONCLUSION

This study concluded that the use of artificial intelligence (AI)-based learning media was proven more effective than conventional learning in improving students' soccer passing skills and learning motivation. The AI-based intervention provided real-time feedback, personalized training, and gamification elements that encouraged learning engagement and accelerated technique correction, resulting in more significant performance improvements. Furthermore, there was a positive correlation between increased learning motivation and improved passing skills, demonstrating the close relationship between affective and psychomotor aspects of physical education learning.

AI-based learning also demonstrated superiority in maintaining learning gains on short-term retention tests, indicating a sustained impact on motor skill consolidation. Practically, these findings recommend the integration of AI-based learning media as an innovative alternative to improve the quality of soccer learning in schools. Further research is recommended to test effectiveness on a broader scale, with longer intervention durations, and with a variety of AI features to strengthen generalizability and sustainability of implementation.

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