




The Effectiveness of AI-Based Learning Media (AI REG) in Improving Rhythmic Gymnastics Activities among Students

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Abstract

The development of Artificial Intelligence (AI) technology has influenced various fields of life, including the field of sports education. Currently, AI is beginning to be used to detect movement patterns, analyze performance, and provide real-time feedback to learners. Educators using AI can support learners in mastering the accuracy of complex movements in gymnastics through digital body movement visualization, particularly in sports education. The aim of this study is to develop AI-based learning media that can shape both learners and educators in rhythmic gymnastics activities. The research method used is an experiment with a one-group pretest-posttest design. The data collection technique uses test questions. The data analysis technique uses the paired sample t-test. The research results show that there is a significant difference in the average before and after learning using AI-based learning media. Students have better rhythmic gymnastics skills compared to before the learning. These results prove that AI-based learning media has a significant effect on rhythmic gymnastics skills. This research shows that the media used by educators, when easily implemented on students, will have a positive impact. AI-based learning media can effectively improve rhythmic gymnastics skills in students.

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Introduction

Advances in science and technology are increasingly driving innovation efforts in the use of technological innovations in the learning process. Teachers are required to keep pace with technological developments, including the ability to use technological tools to support the learning process (Fer & Karsak, 2023; Nurseto, 2018). Teachers should at least be able to use inexpensive and efficient tools, which, although simple and unpretentious, are essential in achieving desired teaching objectives. In addition to being able to use available tools, teachers are also required to develop skills in creating learning media for use when such media is not yet available. Teachers must possess sufficient knowledge and understanding of learning media (Arsyad, 2019).

Technological development Artificial Intelligence (AI) has impacted various areas of life, including the world of sports education (Wang et al., 2024). Currently, AI is starting to be used to detect movement patterns, analyze performance, and provide real-time feedback to students. Educators using AI can support students in learning the precision of complex movements in gymnastics with digital body movement visualizations in sports learning in particular (Liu et al., 2022). AI technology can also help educators evaluate, so that assessments are not only based on manual observation, which can lead to educator subjectivity (Song, 2024). Technology can help educators in verifying gymnastic movements performed by students, making AI one of the effective modern learning solutions for sports education (Cheng, 2022).

Learning media are tools used to convey learning material content that can stimulate students in participating in the learning process (Sanjaya, 2019). According to Yaumi, learning media are all forms of physical equipment designed in a planned manner to convey information and build interaction (Yaumi, 2018). Learning media is a message-carrying technology that can be used for learning purposes, learning media is a physical means to convey learning material. Learning media is a means of communication in print, visual and auditory forms, including hardware technology (Hamalik, 2015). Media is a tool that can be used as an intermediary that is useful for increasing effectiveness and efficiency in achieving goals. Learning media includes anything used by teachers to involve all five senses of sight, hearing, touch, smell, and taste when delivering their lessons. Learning media is an information carrier specifically designed to meet the objectives in a teaching and learning situation (Slameto, 2021).

Innovative sports learning must combine visual technology, interactive systems, and data-driven learning to make it more engaging for the younger generation (Hu et al., 2024). However, most educators still use conventional demonstration methods that make it difficult to accurately assess movement techniques. The lack of objective tools often makes it difficult for educators to provide individualized evaluations. Therefore, the application of AI in education is a relevant solution to improve the effectiveness of technology-based physical education, in particular (Zhang et al., 2023). AI technology can address this problem by recording, processing, and analyzing every movement using cameras and machine learning-based algorithms (machine learning) (Zhou et al., 2024). This system can provide automatic reports on student technique errors and progress over time. Thus, AI acts as a scientific tool that improves the accuracy, efficiency, and transparency of sports learning assessment.

Based on the results of observations conducted by researchers at Unimed and information obtained from FIK lecturers in March 2025, researchers observed that many students still do not understand rhythmic gymnastics techniques properly and correctly in learning rhythmic activities. While the competency demands of each material must be able to be carried out, so it is necessary to innovate supporting media in learning in the competency objectives of graduates, therefore researchers conducted research on PJKR students in the second semester of the 2025/2026 class on the development of media based on rhythmic gymnastics techniques. Artificial Intelligence(AI) in the rhythmic activity course for PJKR students in the second semester of the 2025/2026 academic year. According to the description, the researcher is very interested in conducting research with the title "Development of Rhythmic Gymnastics Learning Media Based on Artificial Intelligence (AI) For Students of the 2025/2026 Academic Year"

Method

This study uses research from Borg and Gall through 10 stages including: (1) Preliminary Study, (2) Research planning, (3) Initial product development, (4) Initial field trials (limited), (5) Revision of limited field test results, (6) Wider field tests, (7) Revision of field test results, (8) Feasibility test, (9) Revision of feasibility test results, (10) Dissemination and socialization of the final product (Rohmaini et al., 2020). The data analysis technique in this study uses a direct practical test to measure rhythmic gymnastics abilities in students. Data analysis in this study uses a paired sample t test with the help of SPSS V.26. Paired sample t-test is a testing method used to assess the effectiveness of treatment, characterized by the presence of differences in the average after treatment is given. To facilitate data analysis, this study used SPSS version 26 software. Guidelines for decision-making in testing paired sample t-test. Based on the significance value (Sig), the SPSS output results, the criteria for testing the hypothesis results are as follows:

1. If the Sign Value. $>$ (0.05) then H_a is rejected
2. If the Sign Value $<$ 0.05 then H_a is accepted

Results

Draft Development Process Model

Preliminary Study

Media is a tool used to facilitate the delivery of information to a wide audience. The learning process carried out by lecturers and students requires media that can help students easily receive and understand the material. Media facilitates lecturers in conveying material, both concrete and non-concrete. Learning using media can improve students' comprehension because the material presented is well-received. Media is essential for both online and offline learning. One goal of using learning media is to improve students' ability to graduate, namely by obtaining grades above the minimum set by lecturers.

The results of interviews with 3 lecturers in charge of rhythmic activity courses obtained information that there are still many students who do not understand rhythmic activity gymnastics techniques properly and correctly in learning rhythmic activities. This phenomenon indicates that students have not been able to understand rhythmic

gymnastics material. Learning media need to be developed so that students can receive and understand the material well. Researchers after knowing the field conditions experienced by the lecturers and students above, took the initiative to hold discussions with several lecturers, especially lecturers in charge of rhythmic activity courses, media expert lecturers, material expert lecturers, and expert lecturers in the curriculum section of the course. The discussion or known as FGD was conducted for 2 hours from the results of the discussion obtained several important notes to solve problems in online learning and offline learning. The results of the FGD can be seen in the following table.

Table 1. FGD Results

No	Notes
1	Lecturers and students need media that can be used for learning that is in accordance with modern technological developments.
2	This media can be studied at any time and is not boring.
3	Media can attract the millennial generation, especially the generation that likes gadgets.
4	Media can increase students' learning motivation

Based on the results of the Focus Group Discussion (FGD), this study plans to develop AI-based Rhythmic Gymnastics Learning Media for rhythmic gymnastics courses.

Draft Model

The planned model is then drafted to be used in the research. The draft model is a description of the model planning. Students have difficulty understanding the material presented by the lecturer. Students ultimately cannot receive the material given by the lecturer because the media used is not interesting for them. As a result, many students fail the competency assessment in rhythmic gymnastics. Lecturers need learning media that is interesting for students and makes it easier to convey material to them. The learning media that must be developed is flexible and easy for students to learn. Students who like gadgets can develop learning media that can be installed on the computer gadget so that students can study anytime and anywhere.

AI-Based Rhythmic Gymnastics Learning Media, hereinafter referred to as AI REG (Artificial Intelligence Research Eva Gymnastics), is a solution for lecturers and students to improve their ability to pass rhythmic gymnastics competency. This is because with the AI REG Learning Media, students can learn rhythmic gymnastics materials and movements at any time. Students not only learn in class but can also learn outside of class and outside of class hours. So far, researchers often have difficulty reading dozens of PDF journal pages manually to find one specific information. AI REG Learning Media uses a system that ends this manual process by providing smart search based on artificial intelligence. AI REG Learning Media Using the latest AI technology, RAG (Retrieval-Augmented Generation), which automatically dissects documents. Media Belajar AI REG is able to find the right paragraphs from a pile of PDFs and present a summary in seconds. With the integration of RAG and Pinecone Vector Database technology, the process of data analysis and extraction is now

revolutionary. Researchers can submit complex comparisons across various literature journals and immediately obtain comprehensive synthesis results without technical barriers. ChatGPT is usually designed to "always answer", risking falsifying citations. RAG forces pure AI to summarize only from the facts in our journal database. without limits to confidential documents. Allows us to analyze internal campus journal repositories or private documents without having to leak data to the wider internet. The media developed by Media Belajar AI REG when you first enter it will be greeted with the following image.

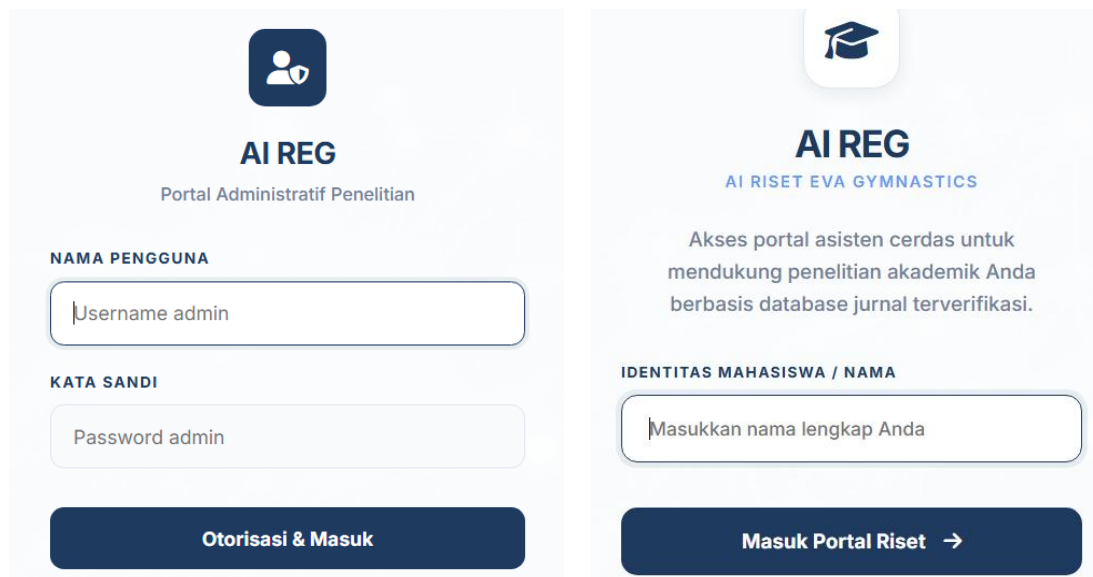


Figure 1. Media Front Page

Students who log into the AI REG Learning Media for rhythmic gymnastics can proceed by clicking the login menu. This will take them to the rhythmic gymnastics learning media application. When using the application, students simply need to enter their full name and they will be automatically logged in. After logging in, a page will appear where they can find the following information:

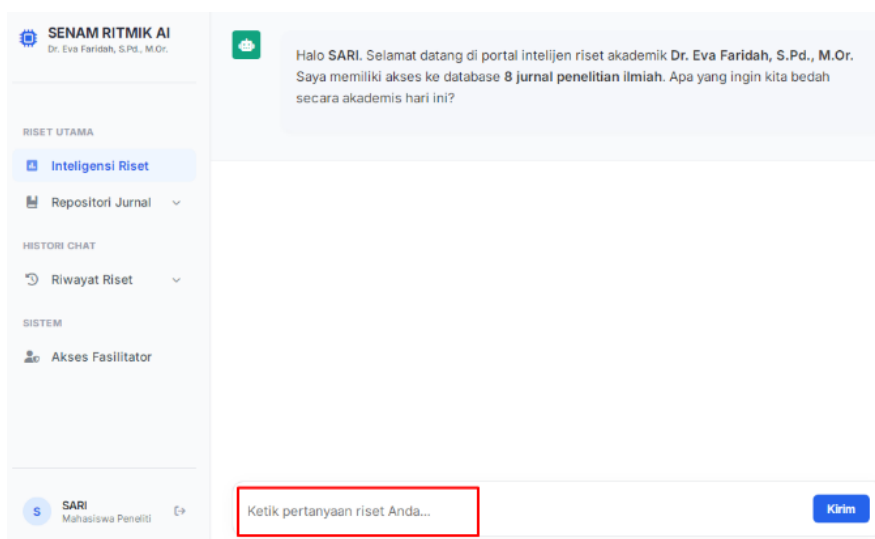


Figure 2. Main Media Home Page

The AI REG Learning Media developed displays theoretical materials related to rhythmic gymnastics. The materials presented include the history of rhythmic gymnastics, the principles of rhythmic gymnastics, basic rhythmic gymnastics movements, physical conditions in rhythmic gymnastics, rhythmic gymnastics learning media, and learning media. These materials are presented in text with an attractive display. In addition, the materials presented in the AI REG Rhythmic Gymnastics Learning Media application when used make the user feel like reading a physical book because they are followed by book-like movements. The display can be seen as follows:

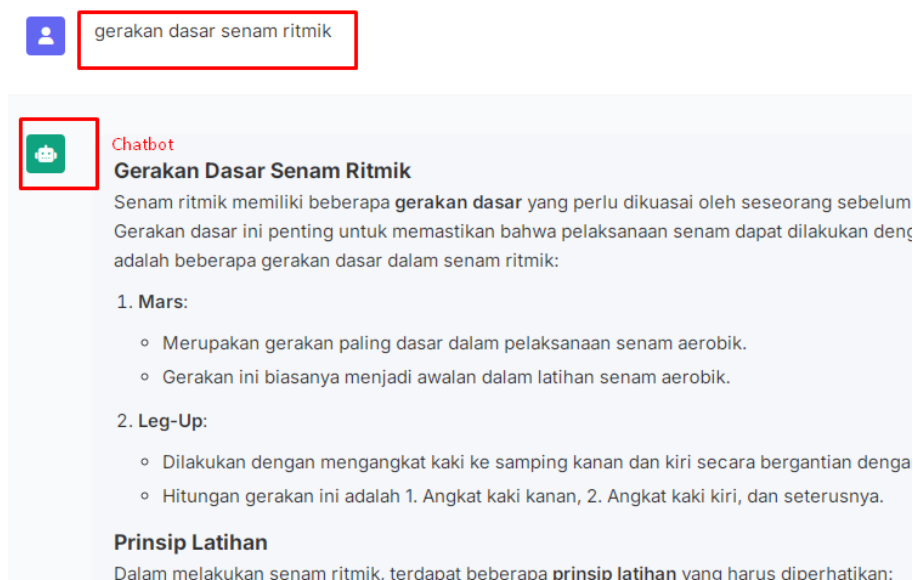


Figure 3. Rhythmic Gymnastics Material Display

The material presented specifically for the basic rhythmic gymnastics movement tutorial, in the AI REG Rhythmic Gymnastics Learning Media application, also presents motion videos on the material page. This means that the advantage of this digital gymnastics media is that in addition to presenting rhythmic gymnastics movement steps, it also presents movement videos on the same page. This condition makes it easy for application users to understand the movements to be followed or imitated. This is one of the differences between physical books and digital books, or what is known as digital gymnastics.

Data Analysis

Based on the results of the assessment of students' rhythmic activity abilities at the small and large class pretest stages, the following statistical descriptions were obtained.

Table 2. Description of Critical Thinking Skills

No	Level	Mean	Min	Max
1	Pretest	67.53	45	75
2	Positions	78.65	75	90

Based on the results of the study, it is known that the average pre-test score for students' rhythmic gymnastics abilities was 67.53. The lowest score obtained by students in the pre-test stage was 45, while the highest score was 75. In contrast to the results of rhythmic gymnastics abilities in the post-test stage, an average of 78.65 was obtained. The lowest score for critical thinking abilities for the post-test stage was 75 with the highest score being 90. Based on the results of the measurement of rhythmic gymnastics abilities, there was a difference in the average scores before and after. To prove a significant difference, a hypothesis test was conducted using a paired sample t-test. However, before conducting the paired sample t-test, the data were tested for normality and homogeneity first.

The normality test is used to test whether the standardized residual values in the regression model are normally distributed or not. The Kolmogorov-Smirnov test is used in the normality test, with a significance level of 0.05. The basis for making decisions from the normality test is to look at the probability value of *asympt.sig* (2-tailed) > 0.05, so it can be concluded that the data is normally distributed and vice versa if the probability value of *asympt.sig* (2-tailed) < 0.05, then the data is not normally distributed (Ghozali, 2018). Based on the results of the normality test using the Kolmogorov test, the following results were obtained:

Table 3. Normality Test

Tests of Normality						
	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest	.017	106	.231	.983	106	.211
Positions	.087	106	.210	.907	106	.070

a. Lilliefors Significance Correction

Based on the results of the normality test, the test results have a significant value of more than 0.05 ($p > 0.05$) so it can be concluded that the data in this study are normal. The data in this study are normally distributed. The homogeneity test is a statistical method to ensure that two or more data groups have the same or equivalent variance (diversity). This test is a requirement before conducting parametric analysis such as the Independent Sample T-Test and ANOVA, to ensure that the analysis results are not inconsistent. Data is said to be homogeneous if the significance value (*p*-value) is >0.05. The homogeneity test in this study was processed using SPSS V.26. The results of the homogeneity test can be described as follows:

Table 4. Homogeneity Test

Test of Homogeneity of Variances					
		Levene			
		Statistic	df1	df2	Sig.
Critical	Based on Mean	.848	1	58	.358
Thinking	Based on Median	.146	1	58	.702
Skills	Based on Median and with adjusted df	.146	1	56	.702
	Based on trimmed mean	.412	1	58	.522

The homogeneity test results show a significance value of 0.358. This probability value is greater than 0.05 ($p > 0.05$), so it can be concluded that the data is homogeneous. These results indicate that the data can be used for paired sample t-test analysis. The results of the paired sample t-test can be described as follows:

Table 5. Hypothesis Test Results

Stages	Mean	Difference	t count	p	Information
Pretest	67.53	11.12	16.337	0.013	Hypothesis Accepted
Posttest	78.65				

Source: Research Data Processing 2026

Based on the results of *paired sample t* test conducted the average difference in critical thinking skills before and after treatment was 11.12. The test results also obtained a t-value of 16.337 with a significant probability value of 0.013 ($p < 0.05$). These results indicate that the hypothesis is accepted, meaning that the learning strategy, *deep learning*, proven to be effective in improving students' critical thinking skills. The test results showed that there was a significant difference in the average critical thinking skills before and after the learning treatment with the learning strategy *deep learning*.

Discussion

Based on the research results, it is known that the developed model is effective for student learning in the rhythmic activity course. The AI-Based Rhythmic Activity Gymnastics Learning Media used is statistically proven to be able to improve the rhythmic gymnastics graduation competency in students. The AI REG rhythmic gymnastics learning media was tested using small and large classes. The results in both classes statistically showed a significant difference in the average rhythmic gymnastics abilities of students. Statistically, the hypothesis test results of the AI REG Rhythmic Activity Gymnastics Learning Media trial obtained a significant value of 0.000, which means that the model can significantly improve the rhythmic gymnastics graduation competency in students. The rhythmic gymnastics graduation competency in students, especially the basic movements that students had before being given learning using the AI REG Rhythmic Activity Gymnastics Learning Media, showed a significant increase.

The AI REG learning media is effective for use by lecturers. The results of the study indicate that the media was tested with three lecturers in rhythmic subjects. Based on the lecturers' responses, it shows that the developed model, namely the AI REG Rhythmic Activity Gymnastics Learning Media, helps lecturers in teaching. This media is effective for addressing these problems. In addition, this model can be used on other materials and is flexible in its use. The results of this study are in line with research by (Wang et al., 2024), (Liu et al., 2022), and (Cheng, 2022) which found that AI REG media is effective in improving student learning outcomes. AI REG media facilitates learning activities and makes the material studied easily understood by students.

Innovative sports learning must combine visual technology, interactive systems, and data-driven learning to be more engaging for the younger generation (Hu et al., 2024). The results of this study, which apply AI technology

in education, provide a relevant solution to improve the effectiveness of technology-based physical education, in particular. This research aligns with the opinion of Zhang et al. (2023), who explained that rapid technological developments require education to implement technology-based learning to engage and facilitate students' learning.

Learning media in education facilitates the teaching and learning process of students and teachers, which can increase student learning motivation, because teaching materials using learning media will attract more students' attention. The meaning of the teaching materials will be clearer so that students can understand it better and allow students to master the objectives of the teaching materials (Hamalik, 2015). Learning methods are more varied not only with verbal communication through the delivery of spoken words alone, and students do not feel bored in learning and also make teachers not run out of energy in delivering teaching materials because the implementation time in learning can be shortened, which means the length of learning time required can be shortened because most media only require a short time to deliver messages and lesson content in a sufficient amount but can be absorbed well by students (Sanjaya, 2019). The learning process does not only take place in the school environment but can take place anywhere and anytime needed, for example, students can learn using electronic media such as television, radio, laptops and other electronic media (Slameto, 2021).

Learning media is anything that can convey messages, can stimulate the thoughts, feelings, and desires of students so that it can encourage the creation of a learning process in students. The objectives of learning media are: Facilitating the teaching and learning process, Increasing the efficiency of teaching and learning, Maintaining relevance to learning objectives, and Helping students concentrate (Kustandi, 2019). The use of learning media in addition to making it easier for educators to convey material to students, the use of learning media helps to increase student motivation to learn more interactively and more actively in the classroom so that there is feedback for educators and students. The use of learning media is also very helpful in the effectiveness of the learning process during the teaching and learning process (Yaumi, 2018).

Conclusion

The results of the study indicate that the AI REG learning media is suitable for use in learning rhythmic gymnastics activities for students. The results of the trial on students obtained information that the AI REG learning media for rhythmic gymnastics activities for students can effectively improve rhythmic gymnastics abilities in students. Students find it easier and can do rhythmic gymnastics after participating in learning using the AI REG learning media. The average value of rhythmic gymnastics abilities in students has increased before and after AI REG learning. These results can be used by lecturers to be able to use the AI REG learning media when they want to increase rhythmic gymnastics activities in students in the future.

Statements and Declarations

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During the preparation of this article, the authors did not use ChatGPT.

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