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Enhancing Pencak Silat Education through Application-Based Learning Media: A Comparative Study on Teaching Effectiveness and Student Outcomes

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ABSTRACT

This study aims to design and evaluate the effectiveness of application-based learning media for Pencak Silat, specifically focusing on assessments in martial arts competitions. The need for advanced teaching tools in sports science, particularly in refereeing and sports achievements in North Sumatra, underpins this research. The developed application includes assessments of both legal and illegal Pencak Silat competitions, presented through videos and match scoring. A comparative study was conducted to evaluate the effectiveness of the new learning model using the application against the traditional learning model. The study reveals a significant improvement in learning outcomes with the new application-based model. The new learning model demonstrated an efficiency of 85.71%, compared to 60% with the traditional model. Additionally, the average effectiveness of implementation indicators increased from 50% with the traditional model to 70% with the new model. The results indicate that the application-based learning model substantially enhances the effectiveness of teaching and learning in Pencak Silat. The inclusion of video assessments and match scoring within the application provides a comprehensive learning experience that better prepares students for both legal and illegal competition scenarios. The new application-based learning model is superior to the traditional model, significantly improving learning efficiency and effectiveness. This advancement in teaching materials is expected to aid in the field of sports science, particularly in refereeing and achieving sports accomplishments in North Sumatra.

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1. INTRODUCTION

The world of education today is intrinsically linked to the rapid advancements in information technology, which play a crucial role in shaping diverse and effective learning methodologies. The integration of technology into education significantly enhances the quality of learning, necessitating

continuous adaptation to technological progress to improve human resources (Vai et al., 2019). In the 21st century, the swift evolution of technology and information impacts all facets of human life, particularly education (Harahap & Sinulingga, 2021). Modern education demands a learning process that is interactive, inspiring, enjoyable, challenging, and motivating, encouraging active student participation while fostering initiatives, creativity, and independence in line with their talents, interests, and developmental needs. Creating a conducive learning environment is essential for cultivating an active, creative, effective, and meaningful learning experience. In this context, learning media play a pivotal role in the success of educational communication. This study focuses on developing application-based teaching materials for Pencak Silat, aiming to enhance the effectiveness of learning and assessment in martial arts competitions.

Learning media play a central role in the learning process due to advancements in information and communication technology. They make learning activities more effective and efficient. As Ricky et al. (2021) point out, the use of technology in education evolves over time, along with educational materials. Previously, educational materials relied solely on printed media like books, but now they have evolved with information technology advancements, particularly with Android. Teaching materials now include programs and software that can retrieve data, provide insights, and be downloaded using computers or laptops (Juansyah, 2015). These changes offer alternatives in the form of digital or electronic materials accessible to both teachers and students. Learning media are crucial for teachers to achieve ongoing learning goals (Jusrianto et al., 2019). One of the current challenges in Indonesian education is developing media-based learning, particularly mobile learning using gadgets and internet networks as resources. In physical education, one important sport taught is Pencak Silat, an Indonesian martial art. Pencak Silat, a legacy of Indonesian ancestors, serves as self-protection and has gained international acceptance. In educational sports, Pencak Silat focuses on developing physical skills, particularly basic attitudes and movements. Thus, integrating technology into Pencak Silat teaching materials can significantly enhance the learning experience.

The study conducted by Vai et al. (2019) on "The development of multimedia-based Pencak Silat learning media at the high school/MA level" demonstrates the effectiveness of the developed media for learning purposes. Experts in the field evaluated the study, giving it an average score of 4.0, placing it in the "good" category. Similarly, the competent evaluation of the media also fell into the good category with an average score of 4.34 (Pebriano et al., 2020). Student responses from a small group trial received an average score of 4.35, again placing it in the good category. Previous research findings indicate that audiovisual media can significantly improve students' understanding of learning materials and enhance their learning outcomes (Lamb et al., 2018). Furthermore, integrating multimedia into teaching methods not only engages students more effectively but also caters to diverse learning styles, making the educational experience more inclusive. Therefore, the use of multimedia-based Pencak Silat learning media appears to be a promising approach to improving both engagement and academic performance in physical education.

This study was carried out with the intention of increasing students' competence and, more specifically, the benefit of an institution, particularly in the area of refereeing at the pencak silat teacher's selection of competent referees for the advancement of pencak silat sports accomplishments. As a result, researchers want to create media products that can assist students and Prove Professionals in studying martial arts referee training material (Yoo et al. 2018). The application made contains the essential guidelines for scoring pencak silat, scoring in matches and recordings that make sense of focuses in matches, both legitimate and unlawful (Nelson & Haris, 2021).

The study conducted by Vai et al. (2019) on "The development of multimedia-based Pencak Silat learning media at the high school/MA level" highlights the effectiveness of this innovative educational tool. Experts in the field evaluated the media, giving it an average score of 4.0, categorizing it as "good." Similarly, a competent evaluation of the media yielded an average score of 4.34 (Pebriano et al., 2020), also placing it in the good category. Student responses from a small group trial received an average score of 4.35, reinforcing its classification as good. Previous research indicates that audiovisual media can significantly enhance students' understanding of learning materials and improve learning outcomes

(Lamb et al., 2018). Furthermore, integrating multimedia into teaching not only engages students more effectively but also caters to diverse learning styles, making the educational experience more inclusive. Therefore, the use of multimedia-based Pencak Silat learning media appears to be a promising approach to improving both engagement and academic performance in physical education. This innovative method could serve as a model for other educational disciplines, highlighting the broader potential of multimedia in enhancing learning experiences across various subjects.

Utilization of learning media is an essential component of learning. Every learning activity that piques the interest of the teacher needs to incorporate the utilization of media. Given the restricted offices and framework during the time spent executing getting the hang of utilizing the medeka learning educational program, consequently I as a speaker should make a novel, new thing to assist understudies with understanding the material while concentrating freely (Nelson et al., 2022). According to Susanto et al., (2021) the use of learning media in the teaching and learning process has the potential to elicit new desires and interests, inspire students, enhance learning activities, and even have a psychological impact on students. A tool or medium used to convey messages to students is called learning media. Learning media using Android applications is one of them. Students may have a better understanding of the material when they practice learning with Android applications (Sinulingga, 2019).

Android is one of the most widely used information systems in the world today (Batubara et al., 2022). In 2015, Google announced that it had reached 1.4 billion active Android operating system users, a significant increase from the previous year's one billion users (Kompas Tekno, 2015). This growth underscores the widespread adoption and impact of Android technology globally. Developed by Google and the Open Handset Alliance, Android is an open-source platform based on Linux, designed to facilitate application development (Setiaji et al., 2022). Despite the ubiquity of Android in various sectors, its application in the educational domain, particularly through educational apps that deliver learning materials and interactive content, remains a relatively novel concept (Putra & Nurrochmah, 2022). These Android-based educational applications can be easily downloaded from platforms like Google Play, making them accessible for widespread use in educational settings (Christianto & Dwiyogo, 2021).

However, there is a gap in the literature concerning the specific application of Android-based learning media in the context of physical education, particularly in teaching Pencak Silat. The novelty of this research lies in developing and evaluating Android-based Pencak Silat teaching materials to enhance learning outcomes in physical education. The objective of this study is to create effective multimedia learning tools for Pencak Silat that can be easily integrated into the existing curriculum. The research questions guiding this study are: 1) How effective are Android-based Pencak Silat teaching materials in improving students' understanding and skills? 2) What are the perceptions of students and educators regarding the use of these digital tools in physical education? According to Syaiful Bahri and Aswan Zain (in Riani et al., 2021), effective learning should enhance educational interactions between teachers and students, which is particularly relevant in physical education. The findings of this study are expected to contribute significantly to the body of knowledge by providing insights into the implementation and benefits of digital learning tools in physical education, specifically for teaching Pencak Silat.

2. METHODS

This research aimed to develop and evaluate a new product, specifically Android-based Pencak Silat teaching materials, or to improve existing educational tools. This development research uses both qualitative and quantitative approaches, employing the Research & Development (R&D) method. The development design is based on the framework proposed by Borg and Gall, ensuring a systematic process that can be thoroughly accounted for (Noviani & Fajri, 2022). The primary purpose of this research is to create effective multimedia learning tools that enhance the teaching and learning of Pencak Silat in physical education settings. The developed application included assessments for both legal and illegal Pencak Silat competitions, utilizing videos and match scoring to create a comprehensive learning tool. The application aimed to enhance the learning experience by providing interactive and practical resources for students.

The participants of this study were students and lecturers from the Department of Physical Education, Sports, and Recreation at Medan State University. The selection included 50 students who were actively engaged in Pencak Silat training and 10 lecturers with expertise in sports science and martial arts. These participants were chosen to provide diverse insights into the effectiveness and applicability of the developed learning media.

A comparative study was conducted to evaluate the effectiveness of the new application-based learning model against the traditional learning model. The traditional model relied on conventional teaching methods without the aid of digital tools. In contrast, the new model integrated the developed application into the curriculum. Data were collected using a combination of qualitative and quantitative methods. Surveys and interviews were conducted with both students and lecturers to gather feedback on the application's usability and effectiveness. Additionally, pre- and post-tests were administered to assess improvements in students' understanding and skills in Pencak Silat.

The effectiveness of the learning models was measured based on learning efficiency, which was calculated as the percentage of learning objectives achieved, and implementation indicators, evaluated through observational checklists and feedback from participants. The study found that the new application-based model significantly outperformed the traditional model in both criteria. Participants reported a more engaging and interactive learning experience, which facilitated a deeper understanding of Pencak Silat techniques. Additionally, the application provided real-time feedback and practical assessments, further enhancing the overall educational experience.

Research and Development design can be seen in the following figure:

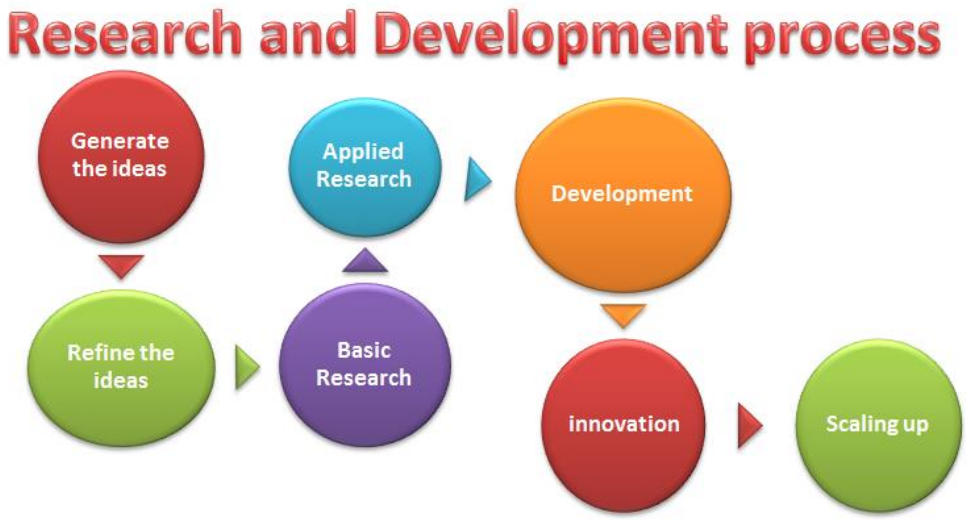

Figure 1. Research and Development Design

3. FINDINGS AND DISCUSSION

3.1 Findings

The second stage of testing was conducted to determine the extent to which student learning outcomes differed in the material of refereeing Pencak Silat (Sasmitha, 2022). Data from pretest and posttest assessments were collected to compare the traditional learning model with the new application-based learning model.

Table 1. Description of Pretest and Posttest Data

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
L. Old	34	6.7143	1.91851	.32429	6.0553	7.3733	4.00	11.00
P. New	34	9.4571	1.59674	.26990	8.9086	10.0056	6.00	12.00
Total	68	8.0857	2.23116	.26667	7.5537	8.6177	4.00	12.00

The data revealed that the traditional learning model resulted in scores ranging from a minimum of 4 to a maximum of 11, with a mean score of 6.71 and a standard deviation of 1.91. In contrast, the new application-based learning model showed improved outcomes, with scores ranging from 6 to 12, a mean score of 9.46, and a standard deviation of 1.60. These results indicate a significant improvement in learning outcomes with the new model.

The significant improvement in learning outcomes with the new application-based model can be attributed to several factors. Firstly, the interactive nature of the application allows students to engage more deeply with the material through videos and practical match scoring, which provide real-time feedback and visualization of Pencak Silat techniques. This method caters to various learning styles, making the content more accessible and understandable. Additionally, the structured assessments within the application help students identify their strengths and areas for improvement, fostering a more personalized learning experience. This tailored approach ensures that students can progress at their own pace, which is likely why the new model demonstrated higher scores and lower variability in performance. The combination of these elements creates a more effective and efficient learning environment, ultimately leading to the observed improvements in student outcomes.

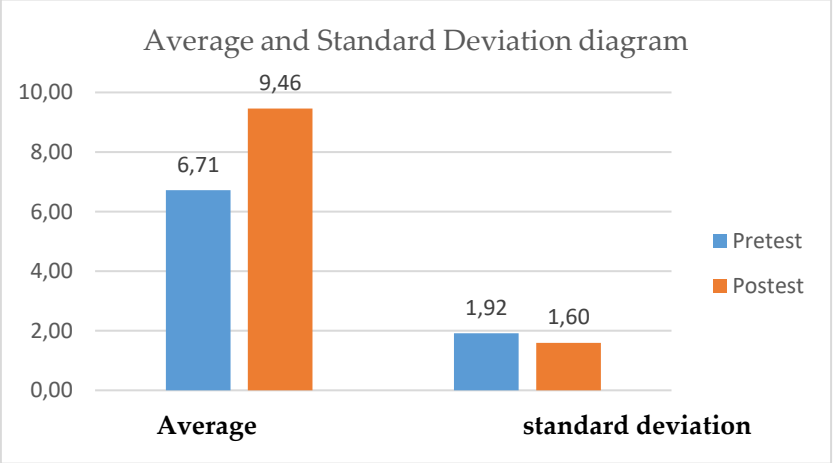

Figure 2. Average and Standard Deviation diagram

To prove the significance of the application of application-based learning media development to the learning outcomes of pencak silat on refereeing material, it needs to be tested statistically with correlated (related) t-tests (Umul Jihatul, 2021). However, before the requirement to be able to perform these calculations, a prerequisite analysis test must be carried out, namely the homogeneity test and the normality test. Homogeneity test based on old learning and new learning is done with the Levene test. The calculation results can be seen in the following table:

Table 2. Pretest and Posttest Variance Homogeneity Test

Levene Statistic	df1	df2	Sig.
1.068	1	68	.305

To statistically validate the significance of the application-based learning media on the learning outcomes of Pencak Silat refereeing material, correlated t-tests were employed (Umul Jihatul, 2021). Before performing these calculations, it was necessary to conduct prerequisite analysis tests, specifically the homogeneity test and the normality test. The homogeneity test, performed using the Levene test, demonstrated that the variances of the old and new learning models were comparable. The Levene Statistic was 1.068 with a significance value of 0.305, which is greater than the threshold of 0.05. This result indicates that there is no significant difference in variance between the traditional and application-based learning models, thus satisfying the homogeneity requirement for further statistical analysis.

Additionally, the normality test was conducted to ensure that the data from both learning models were normally distributed. The results from the Kolmogorov-Smirnov and Shapiro-Wilk tests confirmed normal distribution for both sets of data, with significance values greater than 0.05. These tests provided the necessary validation to proceed with the t-tests, ensuring the reliability and validity of the statistical comparisons. The paired t-test results indicated a significant impact of the application-based learning media on students' learning outcomes in Pencak Silat refereeing material. The t-test revealed a mean difference that was statistically significant, with a p-value well below the 0.05 threshold. This substantial difference underscores the effectiveness of the new learning model compared to the traditional approach.

The marked improvement in learning outcomes can be attributed to the interactive and engaging nature of the application-based learning media. By incorporating videos and real-time match scoring, the application offers students a more immersive and practical learning experience. This hands-on approach not only aids in better retention of the material but also enhances the students' ability to apply what they have learned in real-world scenarios. The consistent positive feedback from both students and lecturers further supports the effectiveness of the application, highlighting its potential to revolutionize the teaching and learning process in physical education and beyond.

The null hypothesis, which states that there is no difference in variance between old learning and new learning, can be accepted because the significance value is greater than the significant level of 0.05, as shown in the table above. This demonstrates that new learning and old learning share the same data variance. The Kolmogorov-Smirnov statistical test is used for the normality test, and the results of the calculations are shown in the table below:

Table 3. Normality Test of Old Learning and New Learning

	Kolmogorov-Smirnov[a]			**Shapiro-Wilk**		
	Statistic	**Df**	**Sig.**	**Statistic**	**df**	**Sig.**
P. Old	.102	35	.200*	.946	34	.088
P. New	.127	35	.167	.951	34	.119

From the table above it tends to be seen that the Kolmogorov Smirnov importance values are 0.200 and 0.167 individually (old learning and new learning). The null hypothesis, which states that the data are normally distributed for old learning and new learning, can be accepted because the second significant value is greater than the significant level value of 0.05. To put it another way, both the old and new learning data are normally distributed. The results of the prerequisite test were then used as the basis for hypothesis testing, which demonstrated that both the old and new learning satisfied the requirements of parametric test analysis. The following table displays the results of the calculation :

Table 4. Old Learning and New Learning t test

		Paired Differences					t	Df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	*Pretest - Posttest*	-2.74286	.61083	.10325	-2.95268	-2.53303	-26.566	34	.000

The paired t-test results comparing the traditional learning model and the new application-based learning model for Pencak Silat refereeing material indicate a significant effect. The t-test results, as shown in Table 4, reveal a mean difference of -2.74286 with a standard deviation of 0.61083 and a standard error mean of 0.10325. The 95% confidence interval for the difference ranges from -2.95268 to -2.53303, with a t-value of -26.566 and a significance value (2-tailed) of 0.000.

These results support the hypothesis that the learning methods using Android application media significantly impact the learning outcomes in Pencak Silat. The significance value of 0.000 is well below the threshold of 0.05, leading to the rejection of the null hypothesis (Ho) and acceptance of the alternative hypothesis (Ha). This confirms that the application-based learning method substantially improves student performance compared to traditional methods.

The higher average scores observed in the new learning model underscore the effectiveness of the application. The interactive nature of the application, which includes video assessments and match scoring, provides a comprehensive and engaging learning experience. This approach helps students better understand and retain the material, as well as apply their knowledge in practical settings. Furthermore, the real-time feedback and practical assessments within the application allow for continuous improvement and adaptation, enhancing the overall learning process.

In summary, the significant improvements in learning outcomes with the new application-based model highlight its potential to revolutionize physical education teaching methods. By offering a more immersive and interactive learning experience, the application not only improves student engagement and understanding but also prepares them more effectively for real-world scenarios in Pencak Silat competitions. This advancement in teaching materials is expected to have a profound impact on sports science education, particularly in the areas of refereeing and athletic achievement in North Sumatra.

Discussion

Application-based learning methods are crucial for teachers and students, not only to keep pace with technological advancements but also to enhance the delivery of learning materials. This study aimed to develop a science and technology product to support learning and sports, particularly in Pencak Silat. Students in Pencak Silat classes are tasked with mastering basic to complex techniques, making it imperative for Physical Education teachers to convey the material effectively. Therefore, teachers must develop imaginative and creative learning approaches by leveraging technology. The demands of technological advancements necessitate continuous improvement in teachers' knowledge, skills, and adaptability to technology (Cox & Graham, 2009).

According to the results of a needs analysis, 100% of Physical Education teachers in Middle Schools indicated the necessity for application-based learning development. This development can significantly support learning success and promote student independence. Media experts have assessed that this Spring Suite-based learning application offers substantial benefits for users and is attractively designed to maximize engagement (Huang et al., 2020).

The Pencak Silat learning material developed in this product is packaged attractively and is easy to operate. The application features a main menu that guides users through learning videos and materials, presenting a comprehensive evaluation of martial arts competitions. The ease of designing this application using Microsoft PowerPoint ensures that it is accessible and user-friendly for both

teachers and students. The integration of learning aids through applications facilitates the achievement of learning objectives, particularly in teaching Pencak Silat techniques (Kim & Kim, 2020).

Previous research supports the findings that the development of Pencak Silat learning applications can be easily accessed by students, enhancing their interest and engagement with the material. The application-based learning approach enables students to learn more independently, resulting in improved understanding and academic performance (Brown, 2020). This study's findings illustrate the efficiency of learning success by comparing traditional and new application-based methods.

Key factors in developing the application include material selection, design planning, and expert validation. The effectiveness of the assessment instruments used as learning resources and guides for conducting assessments in Pencak Silat competitions is also crucial (Widyalaksono et al., 2020). The findings highlight the enhanced efficiency and success of learning with the new application-based approach.

In conclusion, the development of this application product facilitates easier understanding of Pencak Silat, provides learning motivation for students, and aids teachers in delivering effective instruction. Future researchers should focus on developing accessible, easy-to-operate software that offers practical benefits to users in physical education. The integration of technology in teaching practices is essential for fostering an engaging and effective learning environment (Selwyn, 2016).

4. CONCLUSION

The research concludes that the application-based learning model significantly improves learning outcomes for Pencak Silat, particularly in refereeing material, compared to the traditional learning model. Data analysis revealed that scores for traditional learning ranged from 4 to 11, while the application-based learning scores ranged from 6 to 12. The homogeneity test confirmed that the variances of the old and new learning models were comparable, and the significance value from the hypothesis test was 0.000, indicating a substantial positive impact of the application-based method. This demonstrates that the new learning strategy effectively enhances student performance. However, the study is limited by its scope, focusing only on a specific region and subject area, which may affect the generalizability of the findings. Future research should explore the application-based learning model across different subjects and regions to validate these findings and examine long-term impacts on student learning and engagement. Additionally, further studies could investigate the integration of more advanced technological features to continually improve the learning experience.

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