Develop Website-Based Emomart Using PjBL to Enhance Routing Psychomotor Skills in Students

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Abstract. This study examines the influence of the website-based learning environment, Emomart, which is integrated with the Project Based Learning (PjBL) approach on improving students' psychomotor competence in routing configurations. This study adopts the Research and Development (RnD) development model with the ADDIE framework. Through the One Group Pretest-Posttest Design research design and quantitative data analysis, this study found strong empirical evidence that the learning intervention was able to significantly improve students' ability to configure the network. The validation results showed the level of conformity in a row, namely, 93% (very valid), 90% (very valid), 88% (very valid), and 77% (valid). The results of high validation of the research instrument and the support of statistical tests corroborate these findings. The statistical test showed that there was a statistically significant difference between the average score of pretest = 71.39 and posttest = 81.84. The results of the Paired-Sample T-test showed a significance value of 0.000 < 0.05 indicating a significant increase in students' psychomotor competence after the learning intervention. Thus, the empirical evidence supports the alternative hypothesis, so the null hypothesis is rejected. Therefore, it is concluded that project-based learning with the support of digital platforms can be an effective strategy in improving students' technical skills in the field of computer networks

Keywords: ADDIE; Project Based Learning; Psychomotorics; Routing Configuration; Website;

1. Introduction

The rapid development of technology has encouraged education systems to adopt technological devices to support the teaching and learning process. The use of technological devices has become a common habit that is difficult to separate from learning activities. With the aim of improving student learning competencies, learning media innovation can be done by using the E-module application. Learning media that follow technological developments are expected to optimize student potential in achieving higher competencies, in line with the demands of the digital era (Obidovna, 2024).

The implementation of learning media in the educational process makes a significant contribution to the cognitive development of students. Psychologically, learning media serves as a bridge to present abstract concepts into concrete representations that are easier to understand. Learning media allows the presentation of information through various modalities (visual, audio, kinesthetic), so that it can accommodate various learning styles of students. (Oyebola Olusola Ayeni *et al.*, 2024) This increases student engagement and strengthens long-term memory.

As one of the state vocational schools in Gresik, SMKN 1 Cerme has transformed into an innovative school by adopting an independent curriculum, a strategic step to improve the quality of education and prepare competent graduates in the global era. The Department of Computer Network Technology and Telecommunications is a department that is closely related to technology. In one of the vocational subjects, there is a Concentration 3 Concentration subject, Network Device Installation and Configuration, which is in the material about compiling network

infrastructure, both simulated and real. In addition to mastering the material, because vocational school students are required to be able to apply or practice, in addition to learning and understanding the material, students are expected to be able to practice directly on physical devices (Islami, Agni Zaus and Agni Zaus, 2024).

To improve students' learning competencies at SMKN 1 Cerme, this study aims to develop a digital learning platform (E-module) called Emomart. This platform integrates various interactive elements designed to encourage students' active engagement in the learning process. With the support of various desktop and mobile devices, Emomart has the potential to be an effective solution in addressing modern learning challenges.

Thus, the contribution of this research lies in the application of e-modules as learning media to improve students' abilities in the subject of Concentration 3: Network Device Installation and Configuration. Through e-modules, students can understand the material more flexibly, support independent learning, and improve their practical skills in installing and configuring network devices. In addition, the use of this e-module is expected to increase student engagement, accelerate concept understanding, and facilitate access to learning materials anytime and anywhere. Thus, this research contributes to the development of learning models that are more effective and adaptive to the needs of students in the digital era.

2. Methods

This research adopts the Research and Development (R&D) method with the main goal of designing, developing, and evaluating innovative products. Research and Development (R&D) is a research method used to produce new products and test their effectiveness. (Tejedor *et al.*, 2024) So in this research, by developing a product, namely website-based e-module learning media, it is a manifestation to produce a new product which can produce valid media and can be considered feasible to use. In Figure 1, the development of this learning media adopts the ADDIE framework, including the needs analysis stage, instructional design, material development, implementation, and evaluation.
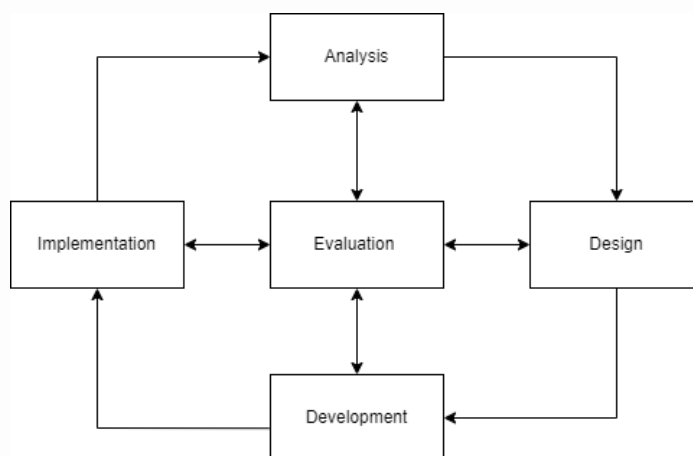

Figure 1 ADDIE stage

This study adopts a one-group pretest-posttest experimental design to test the effect of the application of website-based EMOMART (E-Module Smart) learning media on students' psychomotor competence in routing.

Table 1 Test design

Group	Action	Pre-test	Post-test
XI TKJ	X_1	Y_1	Y_2

Information:

X1 = Experimental Group, Treatment given using website-based EMOMART learning media

Y1 = Psychomotor Pre-test Results of Experimental Class

Y2 = Post-test results of psychomotor class Experiment with the number of students in class XI

TKJ totaling 30 students. The data analysis in this study includes testing the validity of research instruments and evaluating student competencies.

2.1 Validation Assessment Analysis

The validation sheet obtained from the collected validation data will then be converted into a percentage of the validity result from filling out the validation sheet:

$$Validation\ Presentation\ \% = \frac{score\ obtained}{maximum\ score} \times 100\% \qquad (1)$$

The results of the percentage calculation are categorized as follows:

Table 2 Validation Percentage Category

Presentase	Criteria
81% - 100%	Very valid
61% - 80%	Valid
41% - 60%	Quite Valid
21% - 40%	Invalid
0% - 20%	Very invalid

The data will be interpreted with quantitative techniques, so that the validation level of the website-based EMOMART (E-Module Smart) learning media with the PjBL learning model on the routing material can be seen.

2.2 Analysis of Student

Competency Results After the pretest and posttest, the calculation of the results of student competencies will be carried out. By using the formula for the results of students' psychomotor competencies as follows.

$$Value = \frac{total\ score}{maximum\ sxore} \times 100 \qquad (2)$$

a. Normality Test

To find out whether the data is normally distributed or not, a normality test is carried out. The Shapiro-Wilk normality test was used in this study because the number of samples was less than 100. With the following decision-making guidelines:

1. The value of Sig. < 0.05 is enough evidence to reject the hypothesis of H_0. So that H_0 is accepted with abnormally distributed data
2. The value of Sig. > 0.05 is not enough evidence to reject the hypothesis of H_0. So that H_1 receives normally distributed data

b. Hypothesis Test

Based on the results of the normality and homogeneity tests that show normal data distribution and homogeneous variance, the next analysis will use a paired-sample t-test. The statistical decisions in this test are based on:

1. If the significance value > 0.05, then there is not enough evidence to reject the H_0 hypothesis
2. If the significance value < 0.05, then H_0 hypothesis is rejected and H_1 is accapted

3. Results and Discussion

3.1. Media Development Results

The implementation of web-based learning media is designed and developed using the PHP programming language called Emomart which is tailored to learning needs. As well as using use case diagrams to model the interaction between users and systems (Figure 2).
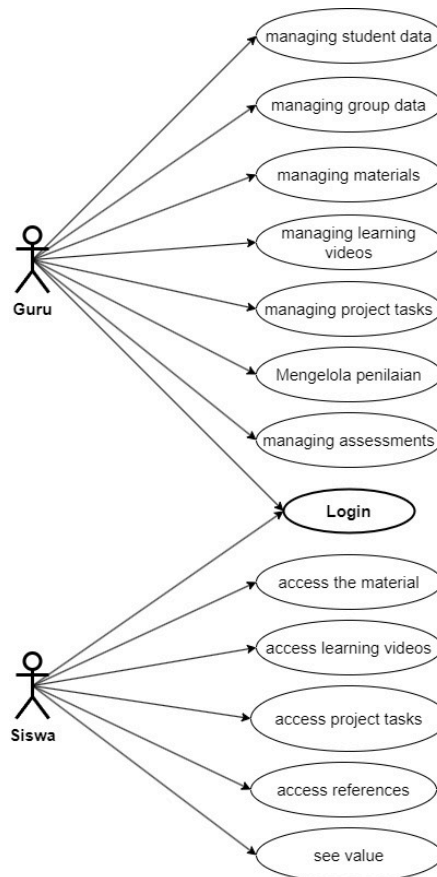

Figure 2 Use case diagram

The implementation of web-based learning media is designed and developed using the PHP programming language called Emomart which is tailored to learning needs. As well as using case diagrams to model the interaction between users and systems. Based on this design, as illustrated in Figures 3 to 7, the Emomart system was developed with the following access.
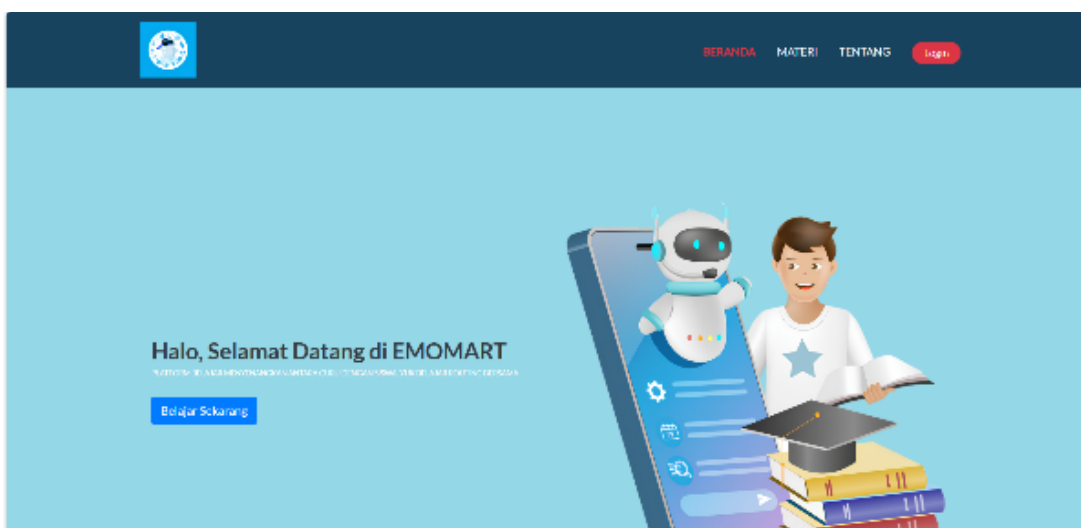
Figure 3 Start Page

3.1.1 Teacher

Teacher/admin accounts can only be accessed by the teacher himself/herself. After successfully logging in using the teacher's account, the teacher will be directed to the main page.
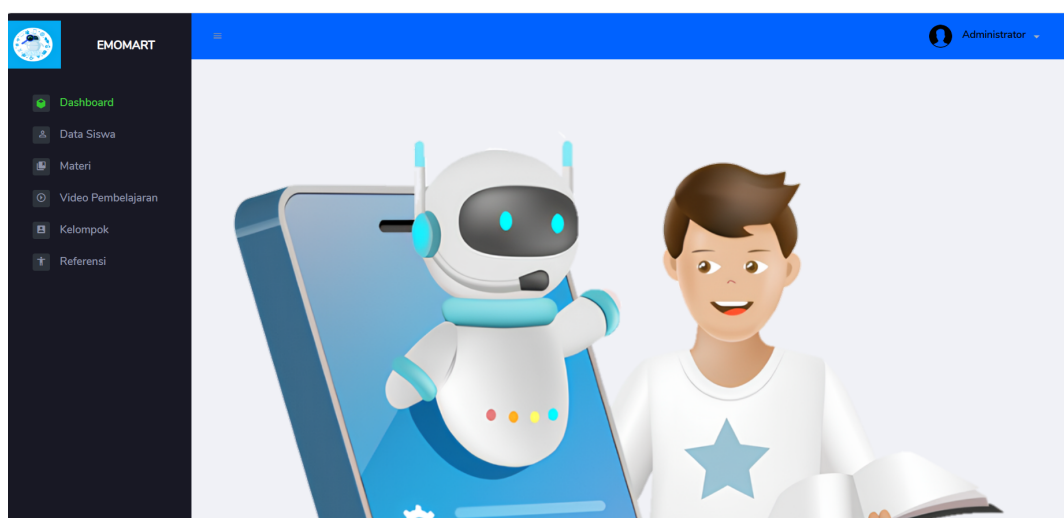

Figure 4 Module Teacher

In the teacher's page, there are features that support learning, as follows Figure 4. In a digital-based learning system, *the Student Data, Material, Learning Videos, Group,* and *References* modules are essential components that can be accessed by teachers to optimize the teaching process. The Student Data module allows teachers to view academic information and student characteristics, such as learning history, evaluation results, and learning preferences. This data can be used to analyze the individual needs of students, so that the learning strategies applied are more in accordance with their characteristics. Meanwhile, the Material module provides access to various teaching materials, such as presentations, articles, and e-books that support competency-based learning.

In addition, the Learning Videos module provides flexibility for teachers in providing multimedia content that can improve student understanding through visual and interactive demonstrations. The Group module facilitates the formation of discussion groups or projects,

allowing teachers to manage and monitor collaboration between students. Finally, the References module provides access to additional reference sources, such as academic journals and research databases, which can support the research-based learning process. With access to these modules, teachers can design more effective and personalized learning experiences, tailored to student needs and curriculum demands.

3.1.2 Student

After students successfully enter the application, they will be directed directly to the main page, for the main features of the student page, namely students can access learning materials or modules, learning videos, additional learning resources and tasks designed to facilitate the achievement of learning goals (Figure 5).
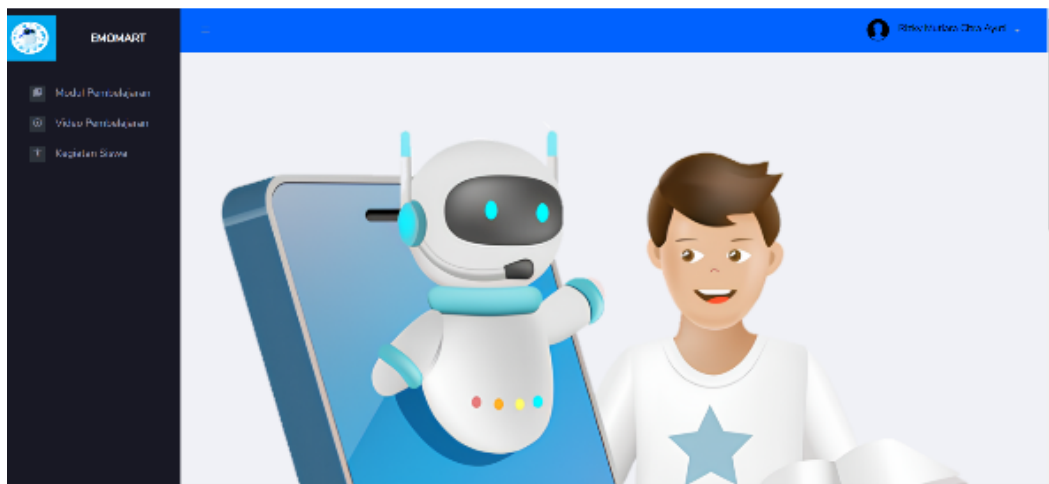

Figure 5 Student homepage

In the digital learning system, students are given access to various modules that support their learning process independently and interactively. The Learning Modules provide structured learning materials that include theory, exercises, and assessments to measure student understanding. This module is designed so that students can learn concepts according to predetermined stages, allowing flexibility in adjusting the learning rhythm of each individual.

In addition, the Learning Videos module provides access to audiovisual content that clarifies learning concepts through visual demonstrations and interactive explanations. This learning video can be used as the main learning resource and support for students in understanding more complex material. The Student Activity module allows students to access assignments, quizzes, and discussion activities designed to increase their engagement in the learning process. With these modules, students can develop a more independent understanding, interact with the material dynamically, and increase their involvement in academic activities.

The Student Activity feature serves as a crucial tool for assessing student performance through a structured series of tasks designed to evaluate academic competence. These assessments include multiple-choice quizzes and project-based assignments, ensuring a comprehensive measurement of students' cognitive (Figure 6). The multiple-choice quiz functions as an initial assessment to gauge students' cognitive abilities, allowing educators to determine their understanding of fundamental concepts before progressing to more advanced learning stages.

Beyond cognitive evaluation, project-based assessments focus on developing psychomotor skills, encouraging students to apply theoretical knowledge in practical scenarios. This approach ensures that students not only grasp theoretical concepts but also demonstrate their ability to implement them effectively. By integrating diverse assessment methods, the Student Activity

feature supports a balanced evaluation framework that aligns with competency-based learning, fostering both analytical thinking and hands-on proficiency.
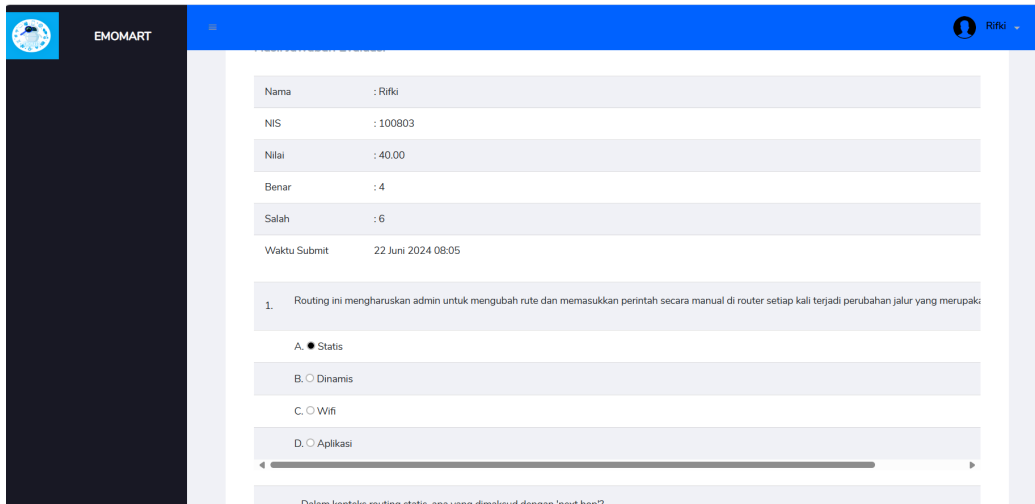

Figure 6 Cognitive Quiz
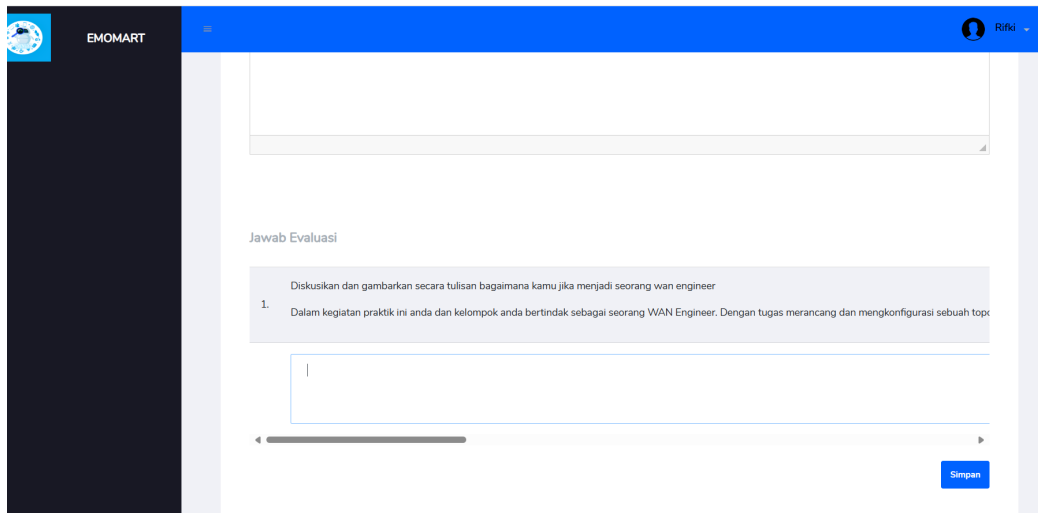
Discussion activities or as an evaluation of project work.

Figure 7 Discussion essay form

3.2. Validation Results

The validation process of learning tools (media, materials, instruments, lesson plans) has been carried out by expert validators (lecturers and teachers of SMKN 1 Cerme). The validation results show that the learning tools developed have met the validity criteria, as stated in Table 3.

Table 3 Validation results

Validation	Percentage	Information
Media	93%	Highly Valid
Materi	90%	Highly Valid

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Validation	Percentage	Information
RPP	88%	Highly Valid
Soal Prestest-Posttest	77%	Valid

3.3. Student Pyschomotor Test Results

3.3.1 Normality Test

Based on the results of the Shapiro-Wilk normality test using the SPSS application with a Sig. > value of 0.05, it can be concluded that the data is normally distributed. Following Figure 8 are the results of the normality test.

Tests of Normality

	Jenis Tes	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Hasil Belajar	Pre Test	.193	30	.006	.931	30	.053
	Post Test	.151	30	.077	.942	30	.104

a. Lilliefors Significance Correction

Figure 8 Normality test results

Shapiro-Wilk's analysis of posttest psychomotor values showed a significance value of 0.104 (p > 0.05). These results indicate that the data is normally distributed.

3.3.2 Hypothesis Test

After confirming that the research data is normally distributed, the next step is to conduct an inferential analysis using the Paired Sample T-Test. The results of this analysis are presented visually in Figure 27.

Paired Samples Test

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Pre Test - Post Test	-12.033	3.275	.598	-13.256	-10.811	-20.127	29	.000

Figure 9 Hypothesis test results

Based on Figure 9, the Paired Sample T-Test hypothesis test states that the Sig (2-tailed) value is 0.000 < 0.05, then H0 is rejected and H1 is accepted. These results indicate a statistically significant difference in mean between pretest and posttest scores.

3.4 Discussion

The findings of this study demonstrate that the implementation of the Emomart website-based learning platform with a Project-Based Learning (PjBL) model has significantly enhanced students' psychomotor competence in routing configuration. This is evidenced by the substantial increase in students' performance from the pre-test to the post-test, with an average score improvement from 71.39 to 81.84. The paired-sample t-test results indicate a significance value of 0.000 < 0.05, confirming that the learning intervention effectively enhances students' practical skills in configuring networks.

These results align with previous research, such as the study by Sari (2023) on website-based learning media for Informatics subjects using the PjBL model, which demonstrated a high

feasibility score of 87.2% for media validation and a significant improvement in students' competencies. Similarly, Prasetyo (2022) found that integrating web-based interactive learning media in project-based learning environments positively impacts students' psychomotor skills in web programming, with validity scores ranging from 0.75 ("Valid") to 0.93 ("Very Valid"). These findings collectively reinforce the effectiveness of web-based learning in developing technical skills, particularly in vocational education settings.

Beyond the statistical results, qualitative observations during the study suggest that students engaged more actively in hands-on activities and demonstrated improved problem-solving skills when using the Emomart platform. The interactive features, such as modular content, instructional videos, and real-time feedback, played a crucial role in facilitating self-directed learning and enhancing practical application.

However, this study has several limitations. Firstly, it focused solely on routing configuration as a technical skill, which may limit the generalizability of the findings to other technical competencies. Secondly, the sample size of 30 students, while sufficient for preliminary analysis, could be expanded in future research to improve the robustness of the conclusions. Additionally, this study did not explore long-term retention of psychomotor skills, which could be an important area for further investigation.

Future research could explore the integration of adaptive learning technologies, such as AI-driven assessments and real-time feedback mechanisms, to further enhance the personalization of learning experiences. Expanding this approach to other subjects within computer networking and vocational training could provide a more comprehensive understanding of the effectiveness of digital learning platforms in skill-based education.

4. Conclusions

Based on the results of this study, the implementation of the Emomart website-based learning platform has been proven effective in improving students' psychomotor competence in routing configuration. The paired t-test results indicate a significant improvement, with the psychomotor pretest score averaging 71.39 and the posttest score increasing to 81.84. The statistical analysis showed a significance value of $0.000 < 0.05$, confirming that the use of the Emomart platform positively impacts students' psychomotor skills.

However, this study has certain limitations, including its focus on a specific subject (routing configuration) and a limited sample size, which may affect the generalizability of the findings. Future research can explore the application of website-based learning in different technical subjects, incorporate larger and more diverse student groups, and investigate the long-term retention of psychomotor skills. Additionally, further studies could integrate adaptive learning features and AI-driven assessments to enhance personalized learning experiences.

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