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Innovative Learning Strategies to Boost Students' Multimedia Design Skills

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Abstract
The advancement of digital technology requires students to have strong multimedia design skills. The selection of the right learning model is believed to play an essential role in developing these competencies. This study aims to determine the effect of learning models on students' multimedia design skills. A quantitative approach with a quasi-experimental design was used, involving a pretest and post-test to measure students' abilities before and after the implementation of specific learning models. Statistical tests were analyzed to identify the significance of learning outcome differences. The results showed a significant improvement in students' multimedia design skills after applying active learning strategies. Students in the experimental group, who experienced an integration of Problem-Based Learning and Flipped Learning, achieved a mean score of 74.33, while the control group scored 59.72. The t-test confirmed a significant difference between the groups ($t = 3.007$; $p = 0.003$), indicating the effectiveness of the active learning model. The project-based approach significantly enhances students' technical skills and creativity in multimedia design. This finding emphasizes the need for educators in higher education to adopt innovative, technology-based learning strategies to build students' digital competencies. Future studies are recommended to explore long-term impacts across diverse disciplines and institutional contexts.

Keyword:: learning model, design skills, multimedia, students, higher education

Introduction

The development of digital technology has had a significant impact on the world of education, especially in the development of multimedia design skills. The digital transformation of education systems has been a key focus, with schools and universities striving to enhance their digital capacity and preparedness. This transformation is a complex process that requires strategic planning and the consideration of various interconnected factors [1]. Students are required not only to understand the theory but also to be able to apply multimedia design skills practically. Choosing the right learning model is key to improving these abilities through integrating technology and the right learning strategies. Digital technologies have significantly improved learner performance and teaching effectiveness by enabling personalized and adaptive learning experiences. For instance, using intelligent teaching systems has increased learning efficiency by 30% and reduced teaching costs by 20% [2].

Although various learning models have been applied in higher education, the effectiveness of each model in improving students' multimedia design skills is still debated. Interactive learning methods that transform students from passive consumers to active knowledge producers have been associated with higher student evaluation scores and perceived learning effectiveness. Some models may be more effective in certain aspects, while others show less significant impact. Therefore, it is essential to explore further how learning models affect the development of students' multimedia design skills.

Previous research shows multimedia-based learning models can improve students' motivation and learning outcomes in 3D image creation competencies. In addition, the hybrid learning model has also been shown to affect the development of students' high-level thinking skills. Moreover, the multimedia-based Assure model

can vary the learning process and increase students' learning motivation. The use of web-based learning media also contributes to improving critical thinking skills and cognitive abilities. However, further research is still needed to understand better the influence of learning models on students' multimedia design skills.

Despite these developments, there is still a lack of empirical evidence that directly compares the impact of different active learning models particularly the integration of Problem-Based Learning and Flipped Learning on students' ability to design multimedia products effectively. This raises the key research question: How do different learning models influence students' multimedia design skills in a higher education context?

This study urgently needs to identify the most effective learning model for improving students' multimedia design skills. The results of this study are expected to contribute to formulating more effective and relevant learning strategies with the demands of the current creative industry.

To answer the formulation of the research problem, this study will use a quantitative approach with a quasi-experimental design. Students will be divided into several groups, each receiving a different learning model, and multimedia design skills will be measured before and after treatment. Data analysis will be carried out to determine the extent to which each learning model affects the improvement of students' multimedia design skills.

2. Literature Review

The dual-channel assumption is a core component of the cognitive theory of multimedia learning, which suggests that humans process visual and verbal information in separate channels. This separation allows for more efficient data processing and integration [3]. The Cognitive Theory of Multimedia Learning (CTML) emphasizes that Learning is more effective when text and images are integrated, aligning with the multimedia principle [4]. Learning is most effective when learners actively engage with the material, organizing and integrating new information with existing knowledge. This can be facilitated through interactive elements and signaling important content [5].

In the 20th century, introducing film, television, and computers into the classroom brought new opportunities and challenges. These media were initially greeted with great anticipation but often faced practical obstacles when applied in everyday educational contexts [6]. Instructional design models have been pivotal in structuring educational content, focusing on analysis, design, development, implementation, and evaluation activities. These models provide a systematic approach to instructional design, ensuring that educational interventions are well-planned and effective [7]. Digital technologies have seamlessly integrated multimedia content, such as videos, songs, and news reports, into language lessons, enhancing the learning experience and exposing students to authentic language use [8].

PBL mendorong siswa untuk terlibat secara mendalam dengan konten, mempromosikan proses berpikir dinamis dan pemecahan masalah yang kreatif. Keterlibatan ini difasilitasi oleh kemampuan beradaptasi PBL terhadap berbagai ritme kognitif dan gaya belajar, yang meningkatkan kemampuan siswa untuk menghasilkan ide dan solusi inovatif [9], [10]. In this study, students who followed the PBL model showed an increase in the average score of creative thinking skills of 78.88 compared to 66.48 in the control group. Real-World Contexts and Idea Generation: The integration of real-world contexts in PBL encourages students to generate ideas, engage in critical thinking, and solve problems creatively. This approach has been shown to significantly improve students' creative thinking skills in various educational settings, including language learning [11].

While multimedia integration in education has shown promising results in enhancing motivation and learning effectiveness, it is essential to consider potential challenges. For instance, the cognitive load associated with multimedia learning can be high, requiring careful design and implementation to avoid overwhelming students [12]. Additionally, while multimedia tools can enhance engagement, they may not always lead to improved conceptual understanding, as seen in some gamified learning interventions [13]. Therefore, educators must balance multimedia with traditional teaching methods to ensure comprehensive learning experiences.

Discovery learning encourages students to explore and construct knowledge through active engagement and experimentation. This method aligns with the principles of inquiry-based Learning, where students learn by doing and reflecting on their experiences [14]. In a flipped classroom model, where students engage with multimedia content outside of class, there was a notable improvement in science process skills, particularly

in hypothesis formulation and operational definitions. This approach allows students to acquire foundational knowledge at their own pace, which they can apply during in-class experiments [15].
The PBL approach, when combined with animation media, can enhance critical thinking and problem-solving skills. This is supported by research indicating that PBL models improve students' abilities to analyze information and formulate solutions [16]. Additionally, virtual learning environments designed with PBL principles have increased students' problem-solving skills and academic success [17]. While animation-assisted PBL models promise to improve learning outcomes, it is essential to consider alternative educational strategies that enhance student engagement and understanding. For instance, immersive virtual reality (IVR) has improved academic achievement and reduced cognitive load in social studies contexts [18]. Integrating active, fun, and technology elements in PBL can create meaningful learning experiences and develop soft and technical skills [19]. These approaches highlight the diverse possibilities for enhancing education through innovative methods, suggesting that a combination of strategies may be most effective in addressing the varied needs of students.
Based on the literature review above, it can be concluded that interactive and problem-based learning models, such as PBL, have proven effective in improving students' multimedia design skills. In addition, multimedia-based learning media, such as animation and interactive media, positively contribute to students' motivation and learning outcomes. Although various learning models have been proven effective in improving students' multimedia design skills, the application of these models still faces several limitations, especially in multimedia design learning. In addition, research examining the effect of a combination of learning models and multimedia-based learning media on students' multimedia design skills is still relatively limited.

3. Research methods

This study used a quasi-experimental design with a pretest-posttest control group design approach. This design was chosen because the researcher could not completely randomize the participants into the experimental and control groups. However, it was still possible to test the effect of the learning model on students' multimedia design skills. The study population was fourth-semester students of the Mathematics Education Study Program, Universitas PGRI Silampari, who took the Multimedia-Based Mathematics Learning course. The sample was determined purposively, with the criteria of fourth-semester students who had taken the course and were willing to participate in the Learning. Two classes were selected as samples: class IVA (29 students) as the experimental group and class IVB (27 students) as the control group. The experimental group was given a combination of Problem-Based Learning (PBL) and Flipped Learning models, while the control group followed the conventional lecture method.
The main instrument in this study was a multimedia design skills test in the form of a design project assessed using a rubric with indicators of creativity, aesthetics, functionality, and pedagogical suitability. Three experts tested content and construct validity, and exploratory factor analysis showed all items were valid (loading factor > 0.50). The reliability test produced a Cronbach's Alpha value of 0.875, indicating high internal consistency.
Data collection was carried out during one lecture cycle for six weeks. In the initial stage, students from both groups were given a pretest. Then, the experimental group underwent active Learning with the PBL and Flipped Learning models, while the control group followed lecture learning. After six meetings, both groups were given a design task as a post-test.
Data analysis was carried out quantitatively. Before the primary analysis, the assumptions of normality and homogeneity were tested. Differences in post-test results between groups were analyzed using an independent t-test, while skill improvement was analyzed through gain score calculations.
This research adheres to the principles of research ethics, including obtaining official permission, obtaining participant approval through informed consent, maintaining data confidentiality, and ensuring fair and unpressured treatment during the intervention process.
Although the study's results indicate that integrating PBL and Flipped Learning models supported by digital media can significantly improve students' multimedia design skills, this study has several limitations. This study was only conducted at one institution, so the results cannot be generalized. In addition, the duration of the intervention was only one semester, and although an assessment rubric was used, the assessment of multimedia design results still contained elements of subjectivity. Overall, this study provides strong evidence that an active learning approach based on digital technology effectively improves students'

practical skills, especially in multimedia design. These findings are essential to developing technology-based learning strategies in higher education.

Hypothesis testing in this study was carried out through several systematic stages. First, the formulation of the null hypothesis (H_0) states that there is no significant difference in multimedia design skills between the experimental and control groups. Conversely, the alternative hypothesis (H_1) states a substantial difference between the two groups. Before the primary statistical test was conducted, a normality and homogeneity test was carried out on the post-test data to ensure that the data met parametric test assumptions. After the assumptions were met, the analysis was continued with an independent t-test on the post-test results of the two groups. The results of this test are interpreted based on the significance value ($p<0.05$), which is the basis for determining whether the null hypothesis can be rejected. If the p-value is less than 0.05, it can be concluded that the learning model used significantly influences students' multimedia design skills.

4. Result

This study involved two classes of students, namely the experimental class and the control class, with 56 respondents. The experimental class comprised 29 students participating in innovative Learning by applying the Problem-Based Learning (PBL) and Flipped Learning models. At the same time, the control class consisted of 27 students who participated in conventional Learning with the lecture method. Data were obtained from the multimedia design skills tests carried out by each student after treatment. Based on the distribution of data received, there was a significant variation in scores between the two groups, which indicated differences in the level of achievement of multimedia design skills.

The data normality test was conducted using the Shapiro-Wilk test, and the results showed that the data from both groups were in a normal distribution, marked by a significance value (p) greater than 0.05. Thus, the normality assumption is met to make the data suitable for analysis using parametric statistical techniques.

Table 1. Descriptive Statistics of Student Learning Outcomes

Class	N	Average	Maximum Score	Minimum Score
Experiment	29	74,33	92	45
Control	27	59,72	88	34

Based on Table 1, the average learning outcomes of the experimental class were 74.33, with a maximum score of 92 and a minimum score of 45. Meanwhile, the control class had an average score of 59.72, with the highest score of 88 and the lowest score of 34. The average difference of 14.61 points indicates the potential for significant differences between the two groups regarding multimedia design skills.

Table 2. Results of Two-Sample T-Test on Student Learning Outcomes with Realistic Mathematics Education and Flipped Learning Approaches

Kelas	Levene's Test for Equality of Variances	t-test for Equality of Means	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference
	F = 0.189	Sig. = 0.665	t = 3.007	82	0.003	9.66667	3.2145

An independent t-test was conducted to determine the differences in learning outcomes between students who followed the Problem-Based Learning and Flipped Learning models. Based on Table 2, the results of the Levene test show that the variances of the two groups are homogeneous (F = 0.189; Sig. = 0.665) so that the assumption of homogeneity is met. The t-test results show a significant difference between the two learning models (t = 3.007; df = 82; p = 0.003), with an average difference of 9.67 points. Thus, the null hypothesis (H_0) is rejected, and it can be concluded that the innovative learning model significantly affects student learning outcomes.

The results of the Pearson correlation test showed a significant positive relationship between the level of student involvement in the learning process and the learning outcome score ($r = 0.61$; $p < 0.01$). This finding indicates that the higher the student involvement in learning activities, the better the multimedia design skills achieved.

The homogeneity assumption has been met based on the results of the Levene test. In addition, the regression residual normality test shows that the data is usually distributed. No disturbing multicollinearity or heteroscedasticity problems were found, so the statistical model used in this study can be declared valid and feasible for further analysis.

The results of the analysis show that innovative learning models, both Problem-Based Learning and Flipped Learning, have a significant influence on improving students' multimedia design skills. This is reflected in the difference in average values between the experimental and control groups and the significance value ($p < 0.05$), which indicates a statistically significant difference. Thus, the application of innovative learning models has proven effective in improving students' abilities in designing learning multimedia.

These findings support a more active and student-centered learning approach. Problem-Based Learning and Flipped Learning models have increased student engagement and understanding, ultimately positively impacting multimedia design skills. This is in line with the principles of constructivist Learning that emphasize the importance of students' active role in constructing knowledge through problem-solving and reflection. Thus, this approach improves learning outcomes and encourages the development of critical and creative thinking skills essential in multimedia design.

Several significant findings were obtained based on the analysis results. First, innovative learning models such as Problem-Based Learning and Flipped Learning have proven significantly more effective in improving learning outcomes than conventional learning models. Second, active student involvement in the learning process has a close relationship with the achievement of multimedia design skills, which shows that the higher the student participation, the better the results achieved

Although the learning model has been proven to influence learning outcomes significantly, no significant influence was found from demographic factors such as gender. This shows that the effectiveness of the learning model is more determined by the learning strategy applied than by the student's characteristics.

4. Discussion

The results of this study indicate that an innovative learning model that combines digital media with Problem-Based Learning and Flipped Learning approaches has a significant influence on improving students' multimedia design skills. These findings answer the objectives and research questions that highlight the effectiveness of learning models in supporting more meaningful learning outcomes, especially in the context of mastering 21st-century skills. This study confirms that intervention through an appropriate learning model has strong relevance in improving students' practical skill achievement, including in multimedia design. PBL is instrumental in enhancing problem-solving skills and academic achievement. Combined with online Learning and flipped classrooms, it has outperformed traditional methods in teaching problem-solving skills [20]. In the context of computer skills, a Flipped-Blended Learning model with augmented PBL has demonstrated significant improvements in student performance, indicating the effectiveness of this approach in practical skill development [21].

The use of digital media in Learning has been proven to improve student learning outcomes significantly. This media presents material visually and interactively, creating a more efficient and engaging learning experience[22]. In addition, digital media also encourages students' cognitive involvement by helping them to compose design products in a structured and systematic manner[23]. C [24], [25], [26], [27]. Thus, digital media is a learning aid and a catalyst for developing advanced skills. [28], [29]. These findings reinforce the importance of digitalization in supporting contextual and applied Learning.

Combining problem-based Learning and flipped learning models has proven effective in enhancing students' multimedia design abilities. By engaging with digital learning materials independently, students gain a foundational understanding of key concepts, which they apply during collaborative sessions focused on solving authentic problems. This approach deepens conceptual understanding and promotes practical design skills development through active learning [30], [31]. This learning process enhances students' critical and creative thinking abilities, essential competencies in developing practical and innovative multimedia designs. By engaging in analysis, evaluation, and solution-finding during real-world tasks, students are better equipped to produce meaningful and high-quality design outcomes [32], [33]. In addition, this model fosters collaboration among students during the design process, aligning with the principles of project-based Learning. Through group discussions, idea sharing, and joint problem-solving, students enhance their communication and teamwork skills and gain diverse perspectives that enrich the quality of their multimedia design projects [34], [35]. These findings suggest that combining the two models fosters an ideal

environment for active learning [36] [37]. Hence, this approach is strongly advised for teaching technology skills in higher education [38] [39].

This study reveals two key findings: digital learning media and innovative learning models significantly enhance students' learning outcomes and practical abilities. Combining technology with constructivist teaching methods has been demonstrated to improve multimedia design skills effectively while offering more contextualized and Deeper Learning.

Digital media positively contributes to the quality of Learning and increases student engagement in the e-learning process [40]. This finding is also supported by a study conducted by [41], Which is also supported by a study stating that flipped Learning can increase the effectiveness of project-based Learning. In addition, blended learning approaches have improved students' design skills in a digital context [42]. He confirms that problem-based Learning can improve students' problem-solving skills in the multimedia production process [43], [44].

Several other studies have shown that the effectiveness of flipped Learning is greatly influenced by the level of student readiness and the quality of learning resources used. This study also indicates that some students still feel uncomfortable or are not yet accustomed to the independent learning method characteristic of flipped classes [45]. Not all students can use digital media effectively without intensive guidance [46]. In addition, there are also challenges in developing interactive learning materials that also have strong pedagogical relevance [47]. Lecturer training is essential so that learning models such as flipped Learning and Problem-Based Learning (PBL) can be implemented effectively. This shows that the success of implementing learning models does not only depend on students but is also greatly influenced by the readiness of the institution and the capacity and competence of facilitators in supporting the learning process

Overall, the results of this study indicate that the combination of problem-based learning models and flipped learning supported by digital media can significantly improve students' multimedia design skills. Although its implementation has challenges, integrating the two models has created a more active, contextual, and collaborative learning atmosphere. With this approach, students are better prepared to face the complex and ever-evolving digital workplace challenges.

This study presents something new by combining two active learning models, Problem-Based Learning and Flipped Learning, to improve multimedia design skills in higher education. In addition, this study also utilizes digital media as the main component to support multimodal Learning. This approach fills the gap in the literature that previously examined the two models separately while providing new contributions on optimally integrating technology-based pedagogical strategies in multimedia design learning.

This study proposes an integrative conceptual framework combining active learning models with media-based digital approaches to improve students' practical skills. The framework is expected to be a reference for further research that wants to explore technology-based skills learning more comprehensively

5. Conclusion

The results of this study indicate that integrating digital media with the Problem-Based Learning (PBL) and Flipped Learning models can significantly improve students' multimedia design skills. Thus, the research hypothesis is proven and accepted because there is a real influence of the learning model on students' abilities. This study makes an essential contribution to education by implementing active learning strategies based on digital technology that have proven effective in improving students' practical skills in the design field. An integrative approach like this is rarely discussed in previous studies, thus opening up new opportunities for developing learning models. However, this study's limitation lies in the sample's scope, which only comes from one higher education institution, so the results cannot be generalized to other study programs or institutions. Based on these findings, lecturers and educational institutions should implement active learning approaches based on technology, such as PBL and Flipped Learning, to strengthen students' practical skills, especially in multimedia design.

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