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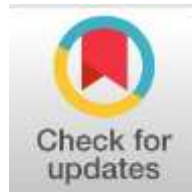
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Multimedia-Assisted Project-Based Learning for Vocational English Writing Proficiency: Pembelajaran Berbasis Proyek Berbantuan Multimedia untuk Meningkatkan Kemampuan Menulis Bahasa Inggris Siswa Sekolah Menengah Kejuruan

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Abstract

General Background: Innovative instructional strategies that foster engaging, interactive, and dynamic learning environments are essential for improving global educational standards and language proficiency. **Specific Background:** Vocational high school students in Indonesia, particularly in Langsa, frequently struggle with productive English skills, specifically demonstrating difficulties in grammatical construction, vocabulary range, and coherent text development. **Knowledge Gap:** Despite the acknowledged potential of technology integration, empirical evidence regarding the application of multimedia-assisted Project-Based Learning (PjBL) models to address specific writing proficiency challenges in Indonesian vocational settings remains insufficient. **Aims:** This study aimed to develop and validate a multimedia-assisted PjBL model integrating text, images, audio, and video to improve the English writing skills of tenth-grade vocational students. **Results:** Following the ADDIE development framework, the experimental group achieved a significantly higher post-test mean score (82.7) compared to the control group (76.3), with an independent-samples t-test confirming high statistical significance ($p < 0.001$). **Novelty:** This research uniquely operationalizes Mayer's Cognitive Theory of Multimedia Learning within a PjBL framework to provide a structured, student-centered approach that optimizes cognitive processing and writing output. **Implications:** The multimedia-assisted PjBL model serves as an innovative, effective instructional framework for educators to boost English writing achievement, provided schools ensure adequate technological infrastructure and teacher preparedness for its implementation.

Highlights

- The multimedia-assisted Project-Based Learning model achieved high feasibility and validity scores from subject-matter and instructional design experts.
- Integrating diverse multimedia elements into student-centered projects significantly promotes coherent idea organization and grammatical accuracy.
- Implementation of technology-supported instruction results in higher learning completion rates compared to conventional PowerPoint-based teaching methods.

Keywords

Project-Based Learning; Multimedia; Writing Skills; Instructional Development; Vocational Education

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INTRODUCTION

Education is a long-term investment in human resources. UNESCO [1] emphasizes the need to improve the curriculum, improve the quality of teaching staff, and provide adequate facilities and infrastructure. Because of this, raising the quality of education is a key strategy for building a learning atmosphere that is engaging, enjoyable, creative, dynamic, and highly interactive [2]. Indonesia continues to treat education as a major national focus, a commitment clearly shown by the government's policy to put at least 20% of both national and local budgets directly into the education sector [3]. However, even with this strong financial backing, the Indonesian education system still struggles with a variety of hurdles that hold back the overall quality of teaching and learning.

The 2023 Programme for International Student Assessment (PISA) results placed Indonesia at 68th out of the 81 participating nations. This ranking highlights how much Indonesian students are still struggling to master the core skills evaluated by the PISA framework. More broadly, these scores point to ongoing issues with the overall quality of education in the country, especially in fundamental areas like reading, math, and science. This condition is certainly concerning, considering that Indonesia has abundant human resources. Ideally, quality education should be able to enhance the potential of these human resources; however, in reality, these outcomes have not met expectations [4]. To better understand students' English language proficiency, more specific empirical evidence is required. Sun et al. [5] found that EFL learners often lack sufficient opportunities to practice language skills in authentic communicative settings. The authors also observed that integrating technology into language learning contributed to improvements in learners' fluency and encouraged more active use of the target language.

According to the English Proficiency Index (EPI) published by EF Education First, Indonesia is consistently categorized at a low level of English proficiency. This indicates that students still face considerable challenges in mastering English, particularly in productive skills such as writing. English is one of the subjects taught in formal education in Indonesia, often positioned as a compulsory or local content subject. However, Dewanti [6] analyses of the implementation of the English curriculum reveal several weaknesses that require serious attention, especially in improving students' writing skills. Improving English learning outcomes requires instructional strategies that actively involve students in meaningful learning experiences. Research by Kokotsaki et al. [7] highlights the role of authentic learning in promoting student engagement, while Mayer's Cognitive Theory of Multimedia Learning [8] explains how the integration of text, images, audio, and other multimedia elements can support cognitive processing and improve learning effectiveness.

The 2024 EF English Proficiency Index (EF EPI) reports that Indonesia ranked 80th among 116 countries, with a score of 468, placing it in the Low Proficiency category [9]. The report also highlights a noticeable gap in English skills across different regions. Java took the top spot with a score of 492, while Maluku sat at the very bottom with just 402. Beyond location, demographics played a role too. People between the ages of 26 and 30 earned the highest scores, and men edged out women by a small margin. Ultimately, these results make it clear that boosting overall English proficiency is still a major hurdle for the Indonesian education system.

. These results indicate that although English is taught as a compulsory subject in schools, the overall level of English proficiency still needs to be improved through more effective learning approaches that are relevant to students' needs.

English language education encompasses four main skills: listening, reading, writing, and speaking. For English subjects in schools, the expected competencies include: Listening, namely the ability to understand instructions, information, and simple stories delivered orally in the context of the classroom, school, and the surrounding environment; Speaking, namely the ability to express meaning orally in simple interpersonal and transactional discourse, including instructions and information within the same context; Reading, namely the ability to read aloud and understand the meaning of instructions, information, short functional texts, and simple descriptive texts with pictures in a written context; and Writing, namely the ability to write words, phrases, and short functional texts with correct spelling and punctuation.

Based on initial interviews with English teachers at SMKN 1 Langsa it was discovered that the writing skills of tenth-grade students were still at a basic level. According to the English teacher, many students still scored below the minimum competency criteria (KKM) of 75, based on the observation data 73% of students—namely 22 out of 30 students still have scores below the minimum criteria. This was evident in the large number of students who still had difficulty constructing sentences grammatically, limited vocabulary, and were unable to develop ideas into coherent text. Helping students become better writers really comes down to using teaching methods that draw them into meaningful, hands-on experiences [10]. In the world of English language education, Project-Based Learning (PjBL) has gained a lot of traction for exactly this reason. It pushes students to build their skills and knowledge by tackling genuine, real-world projects [11].

What makes PjBL stand out is that it doesn't just fixate on the final grade or product. Instead, it values teamwork, curiosity, and self-reflection every step of the way. This kind of learning environment not only sharpens their writing but also naturally builds up their creativity, drive, and critical thinking skills [12].

The challenges highlighted in this study ultimately brought us to two core research questions. First, is the multimedia-based Project-Based Learning (PjBL) model genuinely valid when it comes to improving the English writing skills of vocational high school students? Second, does this model actually work in boosting their overall writing performance?

Driven by these questions, our research centers on creating, building, and putting to the test a multimedia learning model that is firmly rooted in the PjBL approach.

METHOD

The development of the multimedia-based learning model followed the ADDIE framework proposed by Sudjana [13]. This framework was selected because its five iterative phases analysis, design, development, implementation, and evaluation provide a systematic procedure for designing, refining, and evaluating instructional products.. This study focuses on research and development (R&D), which includes validity and effectiveness testing. In the validity testing stage, validation was conducted by subject-matter experts and design experts using a Likert scale scoring system ranging from 1 to 5 to determine the level of validity of the developed model. Furthermore, Rachma [14] stated that the ADDIE model provides a systematic and flexible approach to designing, developing, and evaluating effective and efficient learning media. Therefore, this study adopted the ADDIE model, which consists of five stages, each with its own specific steps.

1. Analysis: This stage will analyze student needs.
2. Design: This stage will involve the researcher designing a model to solve the problems identified in the analysis stage. (Product Creation)
3. Development: This includes the stages of creation, revision, feasibility testing, practicality, and development of a finished product for implementation.
4. Implementation: This stage will involve the product being implemented on research subjects. (Product testing was conducted to determine its effectiveness.)
5. Evaluation: This stage will involve evaluating the product, assessing the objectives of its creation and determining whether the goal of improving student skills has been achieved.

At its core, this study is all about designing and building a multimedia-driven Project-Based Learning (PjBL) model tailored to boost the English writing skills of students at SMKN Langsa.

To make this happen, the final model blends traditional writing lessons with a rich mix of multimedia elements such as text, images, audio, and video. Ultimately, this combination is designed to shift away from standard lessons and create a learning experience that is much more interactive and genuinely engaging for the students.

Participants in this study were tenth-grade students enrolled at a vocational high school in Langsa. The participants were divided into two groups: 26 students in the experimental class and 25 students in the control class. The sampling technique used was purposive sampling based on existing classroom groupings determined by the school. The experimental class received instruction using the multimedia-based Project Based Learning (PjBL) model, while the control class received conventional instruction using PowerPoint-based learning.

The instruments employed in this study consisted of test items, interview guidelines, observation sheets, and documentation of the product implementation. This study was carried out over a four-month period, consisting of four stages: analysis (first month), design and product development (second month), validation and product trials (third month), and evaluation of results (fourth month)

To examine the effectiveness of the developed model, post-tests were administered in both the control and experimental classes to determine the effectiveness of the multimedia-based PjBL learning model using Recount Text material. Meidiantary [15] stated that a writing test can be used to measure students' English writing skills. Furthermore, the data generated from these tests were analyzed to determine the effectiveness of the developed model. Before conducting the effectiveness test using an independent sample t-test, several assumptions had to be met, namely normality and homogeneity tests. Lubis et al. [16] explained that the normality test aims to determine whether the data are normally distributed, whereas the homogeneity test is used to determine whether the variances of two or more groups are equal. Once both requirements are fulfilled, an independent sample t-test can be performed on the research data. Permission was obtained from the school, informed consent was secured from parents or guardians, and participants were assured of confidentiality and their right to withdraw from the study at any time.

RESULT AND DISCUSSION

A.Result

The research model used is the ADDIE model which consists of 5 stages (Analysis, Design, Development, Implementation, Evaluation), from the implementation and evaluation stage, the effectiveness of the Multimedia Project Based Learning Model to Improve Students' English Writing Skills can be measured. The effectiveness of this learning model will be determined through the ADDIE stages, specifically at the implementation phase. After the implementation is carried out, its effectiveness will be tested through pre-tests and post-tests in the class where the developed model is applied. The results of each every stage in the ADDIE model will be described as follows:

1) Analysis

Table 1. Results of Needs Analysis Questionnaire by Students

No.	Aspect	Mean	Percentage	Criteria
1	Needs and Interest	4.77	95.33%	Highly Needed
2	Benefits	4.75	94.96%	Highly Needed
3	Effectiveness and Practicality	4.72	94.44%	Highly Needed
4	Students' Learning Independence	4.79	95.89%	Highly Needed
	Average	4.76	99.15%	Highly Needed

Overall, the results of the students' needs analysis indicate a very high demand for interactive multimedia-based learning media integrated with the Project Based Learning (PjBL) model to support a more effective and engaging English learning process, as well as to enhance students' independence and writing skills.

When we looked at the needs analysis, it became obvious that there is a strong demand for teaching tools that combine multimedia with the Project-Based Learning (PjBL) approach for English writing classes at SMK Negeri 1 Langsa. Feedback from both teachers and students pointed out that this kind of setup could really transform the classroom environment. They felt it would naturally draw students into the lessons, spark their creativity, and help them take charge of their own learning as they work through the writing process. By putting this multimedia-supported PjBL model into practice, students get a genuine chance to explore and build their English writing skills in a way that actually connects with them. The hands-on projects, along with the continuous back-and-forth between classmates and teachers, ultimately make the whole learning experience much more meaningful.

The results of this needs analysis produced several supporting components needed in the development of learning media, namely: (1) material components in the form of Recount Text material presented contextually and systematically according to the characteristics of vocational school students; (2) media components in the form of the use of interactive multimedia that includes text, images, audio, and video as a single interactive multimedia unit; (3) learning model components in the form of Project Based Learning (PjBL) stages integrated in the learning media; (4) evaluation components in the form of exercises, quizzes, and writing skills assessment rubrics; and (5) technical components in the form of media platforms that are easy for students to access and use. These components are then used as the basis for designing and developing learning media at the design stage.

2) Design and Development

After obtaining data from the teacher and student needs analysis, which indicated a significant need for interactive multimedia-based learning media, the next step was to design and develop the learning media according to the Project-Based Learning (PjBL) model. The developed media will also undergo a feasibility test by media experts and content experts, as well as a trial on students.

The developed learning media products were then validated by subject matter experts, media experts, and design experts to assess their feasibility. The feasibility test (validation) of the learning media involved two media experts, two instructional design experts, and two learning material expert. The average validation score provided by the material experts was 90.4%, indicating that the developed product was highly feasible, with each expert providing an assessment using an instrument provided by the researcher. Each expert's suggestions and input served as input for improving the developed learning media to ensure it was suitable for use.

Assessment Score by Material Experts

Table 2. Scores of Evaluation Results by Material Expert

No.	Aspect	Mean	Percentage	Criteria
1	Clarity and Learning Objectives	4.50	90%	Very Feasible
2	Relevance and Up-to-dateness of Material	4.42	88.4%	Very Feasible
3	Language Comprehensibility and Illustrations	4.50	90%	Very Feasible
4	Time Effectiveness and Usage Instructions	4.75	95%	Very Feasible
5	Quality of Test Items and Evaluation	4.46	89.2%	Very Feasible
	Average	4.52	90.4%	Very Feasible

From the results of the validation test by the learning material experts above, it can be concluded that the developed learning product or media is highly feasible and can be tested on students. As shown in the table, based on the five assessment aspects evaluated by the material expert, the average percentage score was 90.4%, indicating that the developed model is valid in terms of content.

Assessment Score by Media Expert

Table 3. Scores of Evaluation Results by Media Expert

No.	Aspect	Mean	Percentage	Criteria
1	Media Design and Appearance	4.40	88%	Very Feasible
2	Audio and Narration	4.25	85%	Very Feasible
3	Multimedia Quality and Display Speed	4.50	90%	Very Feasible
	Average	4.38	87.7%	Very Feasible

Based on the results of the media expert validation, the developed learning model is considered highly valid and categorized

as very feasible, as indicated by an average percentage score of 87.7%. From the validity test results above, it can be concluded that the product of this development research is highly feasible and can proceed to the next stage, namely testing it on students.

3) Implementation and Evaluation

After obtaining the needs analysis assessment data, creating a design for English learning media using the PjBL learning model, developing learning media products, the next stage is to implement the learning media products by conducting field trials.

After the multimedia-based PjBL learning model for English was introduced to the experimental class, the next step was to measure learning outcomes (post-test) in both the experimental and control classes using the attached test. The learning outcomes obtained were as follows :

1. Learning outcomes of students who used the multimedia-based PjBL learning model

The results of the study in the experimental class showed that the lowest score for students was 73, while the highest score was 93. The average (mean) score obtained was 82.7, with a standard deviation of 5.42, indicating that the distribution of students' scores was in the low or homogeneous category.

Meanwhile, the mode value in this data is not single; it appears at several scores, namely 80, 83.3, and 86.7. This condition is known as multimodal data, which is a situation where there is more than one value that appears most frequently in a distribution. Thus, it can be concluded that the tendency of student scores is not concentrated in a single score, but rather spread across several dominant scores. The following presents descriptive data from a class taught using the multimedia-based PjBL learning model, also known as the experimental class.

Table 4. *Frequency Distribution of Post-Test Results For Experimental Class*

Number	Interval	Class Edge	Frequency	Relative Frequency
1	73-76	72,5-76,5	1	3,85%
2	77-80	76,5-80,5	11	42,31%
3	81-84	80,5-84,5	7	26,92%
4	85-88	84,5-88,5	5	19,23%
5	89-92	88,5-92,5	0	0%
6	93-96	92,5-96,5	2	7,69%
total			26	100%

2. Learning outcomes of students using conventional learning media

The results of the study in the control class showed that the lowest student score was 66 and the highest score was 83. The mean was 76.3, with a mode of 73.3 and a standard deviation of 5.1. The following is descriptive data from the class that was taught without the multimedia-based PjBL learning model, but instead used Power-Point.

Table 5. *Frequency Distribution of Post-Test Experimental For Control Class*

Number	Interval	Class Edge	Frequency	Relative Frequency
1	66-69	65,5-69,5	1	4%
2	70-74	69,5-74,5	9	36%
3	75-79	75,5-79,5	7	28%
4	80-84	79,5-84,5	8	32%
total			25	100%

3. Data Analysis Requirements Testing

Several requirements must be met before conducting an independent sample t-test, namely the normality test and the homogeneity test. The normality test is conducted to evaluate the distribution of the analyzed data. The following table provides information regarding significance, which is a measure of the level of confidence in determining whether data is normally distributed or not.

Table 6. *Results of the Control Normality Post Test Experimental For Control Class*

		Pretest Control	Posttest Control
N		25	25
Normal Parameters ^{a,b}	Mean	45.504	76.264
	Std. Deviation	6.0907	4.0056

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Most Extreme Differences	Absolute	0.170	0.170
	Positive	0.150	0.170
	Negative	-0.170	-0.150
Test Statistic		0.170	0.170
Asymp. Sig. (2-tailed)		.061 ^c	.059 ^c

Based on the results of the Kolmogorov–Smirnov normality test for the control class, a 2-tailed significance value (Asymp. Sig.) of 0.061 was obtained for the pretest data and 0.059 for the posttest data, with a sample size of 25 students. Both significance values are greater than 0.05, indicating that the data are normally distributed.

Table 7. Experimental Normality Test Results for Experimental Class

		Pretest Control	Posttest Control
N		26	26
Normal Parameters ^{a,b}	Mean	46.73	82.550
	Std. Deviation	7.035	4.7538
Most Extreme Differences	Absolute	0.164	0.168
	Positive	0.164	0.168
	Negative	-0.102	-0.142
Test Statistic		0.164	0.168
Asymp. Sig. (2-tailed)		.071 ^c	.057 ^c

The results of the Kolmogorov–Smirnov normality test in the experimental class showed a significance value (Asymp. Sig. 2-tailed) of 0.071 for the pretest data and 0.057 for the posttest data, with a sample size of 26 students. The significance value for both measurements was greater than 0.05, so it can be concluded that the pretest and posttest data in the experimental class were normally distributed. Therefore, the data in the experimental class met the assumption of normality and were suitable for analysis using parametric statistical tests.

A. Hypothesis Testing

After the normality and homogeneity requirements were met, the hypothesis was tested using an independent sample t-test to determine the difference in learning outcomes between two unpaired groups, namely the experimental class and the control class. This test is a parametric statistic, requiring normally distributed data. The hypotheses in this study are as follows:

H1: There is a significant difference in learning outcomes between classes taught using the multimedia-based Project Based Learning model and classes taught without the multimedia-based Project Based Learning model.

H0: There is no significant difference in learning outcomes between classes taught using the multimedia-based Project Based Learning model and classes taught without the multimedia-based Project Based Learning model.

1.) Paired Sample T-Test

a. Experimental Class

Hypothesis

H₀: There is no difference in the average pretest and posttest scores in the experimental class.

H₁: There is a difference in the average pretest and posttest scores in the experimental class.

B. Basis for Decision Making

If Sig. (2-tailed) < 0.05 → H₀ is rejected, H₁ is accepted.

If Sig. (2-tailed) > 0.05 → H₀ is accepted, H₁ is rejected.

The test results show a significance value (2-tailed) of < 0.001 (< 0.05). Thus, H₀ is rejected and H₁ is accepted. This indicates that there is a significant difference between the pretest and posttest scores in the experimental class. Therefore, the implementation of the multimedia-based PjBL model has an impact on improving students' writing skills. Both the experimental and control groups showed improvement in students' writing ability. However, the experimental group demonstrated a greater increase compared to the control group, with a higher gain score.

b. Control Class

Hypothesis

H₀: There is no difference in the average pretest and posttest scores in the control class.

H₁: There is a difference in the average pretest and posttest scores in the control class.

Basis for Decision Making

If Sig. (2-tailed) < 0.05 → H_0 is rejected. H_1 is accepted.

If Sig. (2-tailed) > 0.05 → H_0 is accepted. H_1 is rejected.

The test results showed a significance value (2-tailed) of <0.001 (<0.05). Thus, H_0 was rejected and H_1 was accepted. This indicates that there was a significant difference between the pretest and posttest scores in the control class. These results indicate an increase in students' writing skills after learning using conventional methods.

C.Independent Samples t-test

The results of the independent sample t-test showed a significance value (2-tailed) of 0.000, which is less than 0.05. Therefore, H_0 is rejected and H_1 is accepted, indicating a significant difference in learning outcomes between classes using the multimedia-based Project Based Learning (PjBL) model and classes not using the multimedia-based Project Based Learning (PjBL) model.

Table 8. Independent Sample Test

		t-test for Equality of Means					
		df	Sig. to (2-tailed)	Std. Error Difference	Mean Difference	95% Confidence Interval of the Difference	
						Lower	Upper
Hasil Belajar Siswa	Equal variances assumed	49	0,000	6,2860	6,2860	3,8074	8,7646
	Equal variances not assumed	48,184	0,000	6,2860	6,2860	3,8147	8,7573

The developed product was validated by experts and categorized as highly feasible for use in learning. Both the experimental and control groups showed significant improvement; however, the experimental group achieved significantly higher post-test scores than the control group (mean difference = 6.286, $t = 5.097$, $df = 49$, $p < 0.001$, $d = 1.24$). These findings confirm the effectiveness of the multimedia-based Project Based Learning (PjBL) model in improving students' learning outcomes. The effect size analysis using Cohen's d yielded a value of 1.24, which indicates a large effect according to Cohen's interpretation standards. This finding demonstrates that the multimedia-based PjBL model not only produced statistically significant results but also had substantial practical significance in improving students' English writing skills.

B.Discussion

Discussion of Product Feasibility Test Results for the Development of a Multimedia-Based PjBL Learning Model.

Based on the expert validation results, the product developed was a multimedia-based PjBL learning model. The results of the instrument submitted to the learning media experts yielded an average response rate of 87.7%, and the learning materials experts gave an average rating of 90.4%. If these scores are averaged, the results are: Average expert feasibility score: 88.01% With an overall average score of 89.01%, this learning media product demonstrates excellent quality across various aspects and is ready for implementation in a real-world learning environment.

Meanwhile, the learning media feasibility score, obtained from the field trial, was 94.9%. Student assessments differ from those of learning design experts due to differences in perspective, knowledge and skill levels, preferences, and context of use. With a final average score of 92%, it can be concluded that this learning media product meets excellent feasibility standards and is ready for implementation in the learning process. Based on the assessment guidelines and criteria according to these data indicate that the developed English learning media is highly suitable for use by students in English for 10th grade.

Discussion of the Results of the Effectiveness Test of Multimedia-Based PjBL Learning Model Development Product

Based on the results of the research data processing, there was a significant difference in English writing skills learning outcomes between students who studied using the multimedia-based Project-Based Learning (PjBL) model and those who studied using conventional learning. The results of the independent sample t-test showed a significance value of less than 0.05; therefore, H_0 was rejected and H_1 was accepted. This indicates that the implementation of the multimedia-based PjBL model had a significant impact on improving student learning outcomes.

These findings are consistent with previous studies highlighting the effectiveness of Project-Based Learning in writing instruction. Amalia and Thahar [17] found that multimedia-based PjBL significantly improved students' writing achievement by stimulating creativity and strengthening their understanding of writing concepts. Time and again, earlier research has shown that Project-Based Learning (PjBL) is highly effective at helping students become better English writers. For instance, Yuliana and Sahayu [18] discovered that PjBL didn't just sharpen writing skills it also got students much more invested in the learning process. Building on that idea, Handayani [19] showed that blending audio-visual tools with PjBL

gave a real boost to students' descriptive writing abilities.

Echoing these past findings, our own study saw very similar positive results. We noticed a clear improvement in the students' work; they became much better at putting their ideas together logically, choosing the right vocabulary, and writing recount texts with solid grammar.

These improvements should be understood as evidence of better writing performance rather than changes in broader psychological attributes.

These results are strongly supported by international research on Project-Based Learning and multimedia learning. For example, Kokotsaki et al. [7] highlighted that Project-Based Learning significantly improves students' engagement, collaboration, and academic achievement by providing authentic and meaningful learning experiences. Similarly, Schneider et al. [20] reported that digital learning environments can enhance students' motivation, engagement, and learning outcomes through the effective integration of technology and social interaction.

In addition, Laela [21] reported that PjBL combined with digital and multimedia tools significantly improves students' critical thinking skills and learning outcomes, as students are actively involved in problem-solving and project creation. This aligns with the findings of Syafiqri [22], who found that multimedia-supported learning environments significantly improve students' writing skills by facilitating better idea organization, language use, and creativity.

Moreover, Mayer [8], through the Cognitive Theory of Multimedia Learning, explained that students learn more effectively when information is presented through a combination of text, images, and audio, as it enhances cognitive processing and retention. This theoretical foundation supports the effectiveness of multimedia integration within the PjBL model in improving writing skills. Therefore, these studies provide a relevant foundation for conducting multimedia-based research.

In terms of learning completion based on the Minimum Completion Criteria (KKM), the experimental class performed better than the control class. Twenty-six students, or 86.11%, in the experimental class achieved a score above 75, while only 11.43% of students in the control class reached the KKM. This significant difference in learning completion further confirms the effectiveness of the multimedia-based PjBL model. These findings are consistent with previous studies indicating that technology-supported and student-centered learning approaches contribute positively to academic achievement and learning effectiveness, as reported by Schneider et al. [20].

Overall, the writing skills of students in the experimental class experienced a substantial improvement after the implementation of the multimedia-based Project-Based Learning (PjBL) model. Pretest results indicated that most students were in the low to moderate category, with scores ranging from 33 to 63, and the majority had not yet reached the Minimum Completion Criteria. After the treatment, posttest results showed a significant increase in both average scores and ability distribution, with student scores ranging from 73.3 to 93.3. The majority of students were categorized as good to excellent, and 86.11% achieved scores above the KKM. The combination of project-based learning and multimedia creates an interactive, student-centered learning environment that supports higher-order thinking skills and meaningful learning experiences. Therefore, it can be concluded that the multimedia-based PjBL model is an effective and innovative approach to improving students' English writing skills.

CONCLUSION

This study demonstrates that the multimedia-based Project-Based Learning (PjBL) model is an effective instructional approach for improving vocational high school students' English writing skills. Putting this into practice in the classroom showed that mixing multimedia tools with Project-Based Learning (PjBL) really drew students in, making them much more active participants from start to finish. Instead of just rushing to get a writing assignment done, the students actually engaged with the multimedia content, bounced ideas off their classmates, and fine-tuned their drafts through hands-on projects. All of this active involvement clearly paid off, showing up as better organized ideas, stronger vocabulary choices, and more accurate grammar in their final work.

The real worth of this model goes way beyond the statistical score differences between the two groups. Its true strength is how it sets up genuine, real-world learning scenarios where students have to step up and take charge of planning, creating, and sharing their writing projects. Experiences like these do more than just boost their grades; they keep the learners hooked and teach them how to work independently. This makes the model an especially great fit for vocational schools, where hands-on, practical learning is the main goal.

That being said, we do need to keep a few limitations in mind when looking at these results. For one, we only ran the study in a single vocational high school with a fairly small group of students, so we can't automatically assume these exact results would happen in every other school setting. On top of that, the whole timeframe was pretty short, which makes it tough to tell how the students' writing skills might develop over the long haul. It is also worth noting that the kind of tech equipment available can vary wildly from school to school, which would definitely impact how smoothly this model can be rolled out.

Even with those limitations, though, the results offer some very real takeaways for English teachers and vocational schools. Using a multimedia-based PjBL approach gives educators a fresh alternative that ties regular writing practice to real-life project work, all while keeping students engaged and boosting their digital skills. However, pulling this off successfully takes more than just a good lesson plan. It really relies on having reliable tech in the classroom and ensuring teachers feel

confident and ready to guide tech-supported lessons.

Future studies are recommended to involve larger and more diverse participants from different educational settings, extend the implementation period, and examine the effectiveness of multimedia-based PjBL in other English language skills such as speaking, reading, or listening.

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