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Development of E-Module based on Heyzine Flipbook to Increase Student Motivation and Learning Outcomes in Learning Letters

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Abstract

This study examines the effect of using Heyzine Flipbooks on students' motivation and learning outcomes in learning letter text for grade VII students at SMP Negeri 2 Padamara. With a quantitative experimental approach, two groups were analyzed: the control group (class 7A) using conventional learning methods, and the experimental group (class 7D) using Heyzine Flipbooks as an interactive learning tool. The purpose of this study was to examine the effect on the use of Heyzine Flipbooks on student motivation and learning outcomes. The research method used in this study is to use a quantitative method approach with experimental methods. Pretest and post-test data were collected to measure students' motivation and learning outcomes. The results showed a significant increase in motivation and learning achievement in the experimental group compared to the control group. The use of Heyzine Flipbooks, which integrates multimedia elements such as videos, images, and animations, provides a more interesting and interactive learning experience. It allows students to better understand the subject matter and participate more actively in the learning process. This study concludes that Heyzine Flipbooks is an effective digital tool to improve students' motivation and learning outcomes, especially on materials that require complex understanding such as letter texts.

Keywords: Digital Learning Media; Heyzine Flipbooks; Learning Motivation; Learning Letter Texts; Learning Outcomes.

INTRODUCTION

Education is a fundamental element in developing quality human resources. Among the various subjects taught in schools, Bahasa Indonesia plays an important role in shaping students' language skills, critical thinking, and writing skills. One of the materials taught in Bahasa Indonesia is letter text, which is often considered difficult and boring by students ([Heung & Yim, 2024](#)). This is a challenge for teachers to find learning methods and media that can improve students' motivation and learning outcomes ([Pan et al., 2024](#); [Su et al., 2024](#)).

Along with the development of technology, various innovations in learning media have begun to be used to create a more interactive and enjoyable learning

experience ([Habedank et al., 2024](#)). One of the promising media is Heyzine Flipbooks, a web-based platform that allows the creation of digital learning materials in the form of flipbooks ([Zunaidah et al., 2024](#)). Heyzine Flipbooks offers various interactive features such as page animations, videos, images, graphics, and audio, which can increase the appeal of learning materials for students ([Kamza et al., 2023](#)). With its multimedia elements, Heyzine Flipbooks provides a more interesting learning experience and is close to the experience of reading a physical book, which can stimulate students' interest in learning ([Manzil et al., 2022](#); [Putra et al., 2023](#)).

Several previous studies have shown that the use of digital media in learning can increase students' learning motivation, interactive media such as Heyzine Flipbooks can make learning materials more dynamic and flexible, so that students are more motivated to learn ([Fitriyah & Sahda, 2023](#)). Motivation is one of the key factors in the success of the learning process. Motivated students tend to be more actively involved in learning, so they can achieve better learning outcomes ([R. Sari et al., 2023](#)).

In addition to increasing motivation, the use of digital media can also have a positive impact on learning outcomes. According to research flipbook-based digital modules equipped with interactive elements can improve students' understanding of the material being taught. In the context of learning letter texts, the use of Heyzine Flipbooks is expected to help students understand the material more effectively, in a more visual and interactive way. This is in line with the constructivist approach, where students learn better when they can build their own knowledge through rich and contextual experiences ([Adiatma & Thana, 2022](#)).

At SMP Negeri 2 Padamara, students' motivation in learning letter texts is often low. Students feel that this learning is monotonous and less interesting, so they are less actively involved. As one of the favorite schools in the Purbalingga area, SMP Negeri 2 Padamara wants to improve the quality of learning by adopting technological innovation. Therefore, this study aims to test the effect of using Heyzine Flipbooks on student motivation and learning outcomes in learning letter texts in class VII of SMP Negeri 2 Padamara.

The use of technology in education, especially digital learning media, is growing along with the increasing need to create interactive and effective learning experiences ([Mulyono & Elly, 2023](#); [Putra et al., 2023](#)). One of the innovative media that can be used is Heyzine Flipbooks, a web-based platform that allows teachers and students to access learning materials with multimedia elements, such as videos, images, and animations ([Aryasahab & Suryadi, 2024](#); [Zunaidah et al., 2024](#)). This media is believed to be able to increase student motivation and learning outcomes, especially in the context of learning Indonesian ([Nurlina & Wardianto, 2022](#); [Solikhah & Nurlina, 2024](#); [Windiyaningrum et al., 2023](#)).

Class VII of SMP Negeri 2 Padamara often faces challenges in motivating students to learn letter texts, which are often considered boring. With this background, this study attempts to examine the effect of using Heyzine Flipbooks on students' motivation and learning outcomes in learning letter texts at SMP Negeri 2 Padamara. This study aims to measure the effect of implementing Heyzine

Flipbooks on students' motivation and learning outcomes in learning letters in class VII of SMP Negeri 2 Padamara.

Based on the background that has been described, this study tries to answer several main questions related to the use of Heyzine Flipbooks in learning. One of the main problems to be solved is whether the use of Heyzine Flipbooks can improve students' learning motivation in learning letter texts in class VII of SMP Negeri 2 Padamara. Learning motivation is an important aspect that influences students' involvement in the learning process and the learning outcomes they achieve. In addition, this study also tries to see whether there is a significant difference between the learning outcomes of students who use Heyzine Flipbooks and those who use conventional methods. Thus, the two main questions that are the focus are: how does the use of Heyzine Flipbooks affect students' learning motivation, and whether there is a significant difference in learning outcomes between groups of students who use Heyzine Flipbooks and groups who do not use the media. This problem formulation will be the basis of this entire study, with the aim of finding out to what extent the use of digital technology such as Heyzine Flipbooks can affect students' learning processes, both in terms of motivation and learning outcomes.

The purpose of this study was to explore the effect of using Heyzine Flipbooks on students' motivation and learning outcomes. Specifically, this study aims to determine whether the use of interactive learning media such as Heyzine Flipbooks can improve students' learning motivation in learning letter texts, which have so far been considered monotonous and difficult to understand. In addition, this study also aims to compare learning outcomes between students who use Heyzine Flipbooks and students who use functional learning methods. It is hoped that through the use of this interactive media, students will be more interested in following the lesson, so that their learning outcomes will also increase. The ultimate goal is to evaluate the effectiveness of Heyzine Flipbooks as a learning aid in the classroom. With these objectives, this study is expected to contribute to our understanding of the effectiveness of digital learning media in the context of junior high school education, especially in the subject of Indonesian Language.

This research is expected to provide theoretical and practical benefits that can have an impact on the world of education, especially in the use of technology as a learning medium. Theoretically, this research will enrich scientific studies on the influence of interactive digital media on student motivation and learning outcomes, and provide new insights into how technology can be used to improve the quality of learning in schools. Practically, this research will be beneficial for various parties. For teachers, the results of this study can be a reference in choosing the right learning media to increase student engagement in class. For students, the use of Heyzine Flipbooks is expected to provide a more enjoyable and interactive learning experience, so that their learning motivation increases and their learning outcomes are better. In addition, for schools, this research can be a reference for considering the application of digital technology in the curriculum, which is in line with current technological developments.

METHODS

This research uses a quantitative method approach with experimental methods. Quantitative research is a research approach that using data in the form of numbers and exact science to answer the research hypothesis (Setiyaningsih et al., 2024). Research hypothesis. Quantitative research from the beginning was carried out systematically and systematically, data in the form of numbers, data collection with instruments, and emphasizes statistical data analysis (M. Sari et al., 2022). data collection with instruments, and emphasizes statistical data analysis. Every Each data is described with statistical numbers that can be measured and tested empirically (Abraham & Supriyati, 2022). The following are the steps of the research method on figure 1:

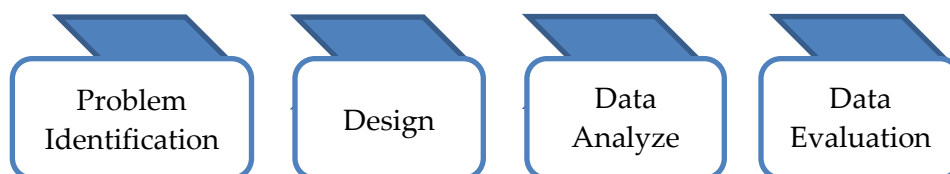


Figure 1. Research Stages (Sinambela & Sarton, 2021)

Based on Figure 1, regarding the stages of research, first regarding the identification of problems, including formulating problems, and formulating problems. then the design stage, which includes preparing research analysis in the form of variables to be used, next is conducting experiments and analyzing data and drawing conclusions and implications. The last stage, namely the evaluation stage, is used to provide an evaluation of the research conducted.

RESULT AND DISCUSSION

Pretest and Post-test Results for Class 7A

The post-test data of class 7A shows that out of 32 students, the average score obtained was 67.56 with the lowest score of 43 and the highest score of 83. From the frequency distribution of student learning outcomes, most students were in the range of 57-63 points (34.38%) followed by the range of 64-70 points (25%).

The following table summarizes the post-test results of class 7A students on Table 1:

Table 1. Summarize Post Test

Data Description	Class 7A
Number of students	32
Total score	2162
Average	67.56
Lowest Value	43
The highest score	83
Standard Deviation	9,10

The frequency distribution of learning outcomes of class 7A students is presented in the following on table 2:

Table 2. Distribution of learning outcomes

Interval Class	f	f(%)
43-49	1	3.13%
50-56	1	3.13%
67-63	11	34.38%
64-70	8	25.00%
71-77	7	22.00%
78-84	4	12.50%

Pretest and Posttest Results of class 7D

For class 7D, which used Heyzine Flipbooks, the average post-test score obtained by students was 74.59 with the lowest score of 57 and the highest score of 90. Most students were in the range of 75-80 points (28.13%), followed by the range of 69-74 points (18.75%).

The post-test results for class 7D are presented in the following on table 3:

Table 3. posttest and posttest 7D

Data Description	Class 7D
Number of students	32
Total score	2387
Average	74.59
Lowest Value	57
The highest score	90
Standard Deviation	9.55

The frequency distribution of learning outcomes of class 7D students is shown as follows on table 4:

Table 4. Distribution of Learning Outcomes 7D

Interval Class	f	f(%)
57-62	4	12.5%
63-68	5	15.63%
69-74	6	18.75%
75-80	9	28.13%
81-86	3	9.38%
87-92	5	15.63%

Comparison of Learning Outcomes of Classes 7A and 7D

There is a significant difference between the learning outcomes of class 7A and 7D after the implementation of Heyzine Flipbooks. The average post-test score of students in class 7D is higher (74.59) compared to class 7A (67.56). The highest score in class 7D is also greater than that of class 7A, and the variation in scores in class 7D is greater, indicating a significant increase after the use of digital learning media. The following table shows a comparison of learning outcomes between the two classes on table 5:

Table 5. Comparison of learning outcomes

Data Description	Class 7A	Class 7D
Average	67.56	74.59
Lowest Value	43	57
The highest score	83	90
Standard Deviation	9,10	9.55

The diagram below illustrates the comparison of the percentage of learning outcomes of students in classes 7A and 7D:

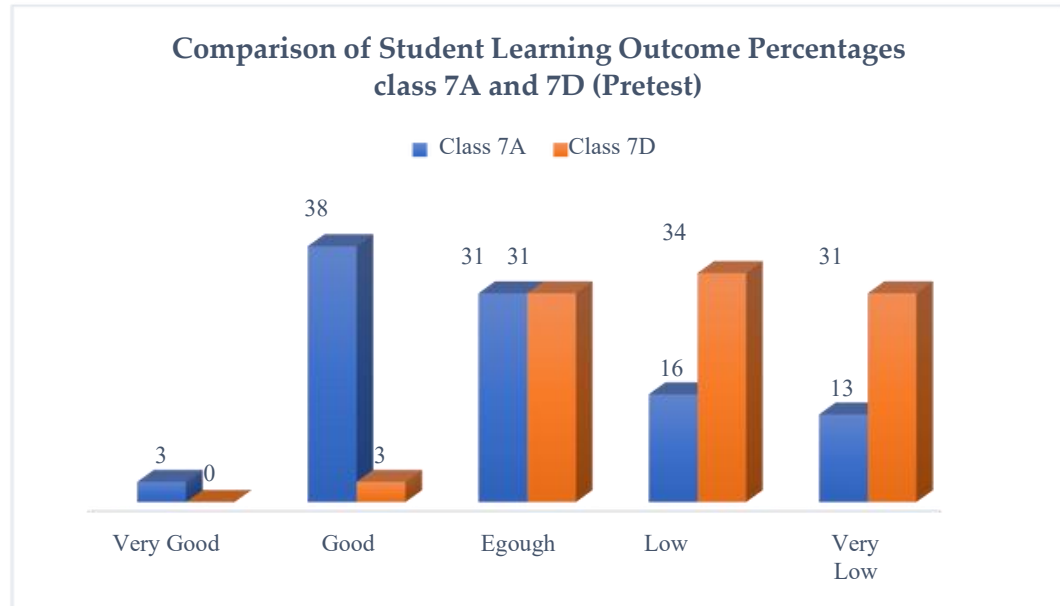


Figure 2. Comparison of Percentage Of Student Learning

In general, the pretest scores of class 7A are better than those of class 7D. both in terms of average scores and percentages. However, the variation in scores in class 7D is greater, indicating a more significant difference in ability among students. Furthermore, the researcher will provide treatment according to the objectives of this study, namely using Heyzine Flipbooks as a learning medium in which class 7D is the treatment class.

Based on the results of the learning motivation questionnaire, student motivation in class 7D who used Heyzine Flipbooks experienced a significant increase compared to class 7A. Before the intervention, the average motivation score of students in class 7D was 71.22, while after using Heyzine Flipbooks, the average score increased to 80.31. In contrast, the control class that did not use Heyzine Flipbooks only experienced a smaller increase, from 67.56 to 74.59.

Motivation Analysis: One of the reasons why Heyzine Flipbooks can increase student motivation is because of its interactive and visually appealing nature. According to the cognitive learning motivation theory (Emda, 2018), students tend to be more motivated when the material is presented dynamically and involves more senses, such as visual and audio. Heyzine Flipbooks is able to meet this need by providing page animations that resemble physical books, as well as adding multimedia elements such as videos and images.

The use of digital media such as Heyzine Flipbooks provides a richer learning experience, increases student engagement, and stimulates greater interest in learning, in accordance with research by (Kamza et al., 2023; Khasanah et al., 2024) which found that the use of interactive media can increase student engagement in the learning process.

The following table illustrates a comparison of motivation between the two classes:

Table 6. Comparison motivation

Motivation Category	Class 7A (%)	Class 7D (%)
Very high	0%	0%
Tall	3%	66%
Currently	63%	34%
Enough	34%	0%

As seen in the table, the majority of students in class 7D are in the high motivation category (66%), while in class 7A, only 3% of students reach the high motivation level. This difference indicates that interactive digital media significantly affects students' learning enthusiasm.

In addition to increasing motivation, student learning outcomes also experienced a significant increase after using Heyzine Flipbooks. Based on the post-test results, the average score in the experimental class (7D) was 74.59, while in the control class (7A) it was 67.56. The increase in learning outcomes in this experimental class shows that Heyzine Flipbooks is able to provide a significant positive impact on student understanding in learning letter texts.

Learning Outcome Analysis: According to constructivism theory (Vygotsky), students learn better when they can construct their own knowledge through interactive and contextual experiences. Heyzine Flipbooks allow students to explore the material independently, strengthening critical thinking skills and understanding concepts more deeply. The multimedia elements added in flipbooks also help visualize difficult concepts and enrich the learning experience for students. Comparison of the pretest and post-test results in both classes shows that students in the experimental class experienced more significant improvements compared to the control class, as seen in the following on table 7:

Table 7. Improvements Compared

Data Description	Class 7A (Pretest)	Class 7A (Post-test)	Class 7D (Pretest)	Class 7D (Post-test)
Average	61.97	67.56	51.34	74.59
Lowest Value	33	43	23	57
The highest score	80	83	73	90

The significant improvement in class 7D (experimental) strengthens the hypothesis that the use of Heyzine Flipbooks has a positive effect on student learning outcomes. The average score of students in the experimental class increased from 51.34 (pretest) to 74.59 (post-test), while in the control class the average increase was only from 61.97 to 67.56.

The Mann-Whitney U Test used to compare the two groups showed a significance value of 0.006 (<0.05), which means there is a significant difference between the control and experimental groups in terms of learning outcomes. This shows that Heyzine Flipbooks is able to improve learning outcomes significantly.

The increase in student motivation in the experimental class can be explained by several factors. Heyzine Flipbooks provides a more interactive learning experience, allowing students to engage directly with the subject matter. In the context of cognitive learning motivation theory ([Matsuzaki et al., 2021](#)), interesting media can increase students' curiosity and encourage them to be more active in learning.

The use of interactive media, such as Heyzine Flipbooks, can reduce the boredom that students often feel in conventional learning. This is in line with the findings of ([Baumgartner et al., 2021](#); [Hikmah et al., 2021](#); [Sumayana et al., 2021](#)) research which shows that the use of interactive media can increase student engagement and motivation in learning.

Significant learning outcomes in the experimental class indicate that Heyzine Flipbooks are effective in improving students' understanding of the material. According to constructivism theory (Vygotsky), learning that involves active interaction and exploration can help students build deeper knowledge. With the multimedia features available on Heyzine, students can access information from various perspectives, which supports a more comprehensive learning process.

Comparison of pretest and posttest results showed that students in the experimental class experienced a greater increase in understanding the material. The use of Heyzine Flipbooks that allows students to study independently is also in line with the principle of self-regulated learning, where students can manage their time and how they study. This allows students to deepen their understanding of the material, which contributes to improved learning outcomes.

Based on the research results, the use of Heyzine Flipbooks can be implied as one of the alternatives of innovative and effective learning media. This media not only attracts students' attention, but also provides easy access to interactive learning materials. By using Heyzine Flipbooks, teachers can create a more dynamic and enjoyable learning atmosphere, thus helping students to be more motivated in learning.

The use of digital media such as Heyzine Flipbooks is also in line with the demands of the modern education curriculum that emphasizes the integration of technology in the learning process. In today's digital era, it is important for students to have good digital literacy skills. Therefore, the application of digital learning media in the context of learning in schools is a must to prepare students to face future challenges.

Although the results of the study show that Heyzine Flipbooks provide significant benefits, there are some challenges that need to be considered. One of them is the accessibility of technology among students. Not all students may have devices or a stable internet connection, which can hinder the maximum use of digital media. Therefore, schools need to provide infrastructure that supports the use of technology in learning.

Suggestions for further research include conducting a larger study to evaluate the impact of using Heyzine Flipbooks in a variety of learning contexts and other subjects. Longitudinal research could also be conducted to evaluate the long-term impact of using digital learning media on student motivation and learning outcomes.

CONCLUSION

Based on the results of the research that has been conducted, it can be concluded that the use of Heyzine Flipbooks has a significant positive impact on student learning motivation and learning outcomes in learning letter texts in class VII of SMP Negeri 2 Padamara. This study shows a significant increase in student learning motivation after using Heyzine Flipbooks, with the majority of students in the high motivation category. In addition, student learning outcomes in the experimental class (class 7D) that used Heyzine Flipbooks were also better than those in the control class (class 7A) that did not use the media. Post-test data showed a significant increase in average scores in the experimental class, which reflected a better understanding of the subject matter. Thus, it can be concluded that Heyzine Flipbooks is an effective learning medium to improve student motivation and learning outcomes, especially in learning letter texts.

This study provides significant implications in the field of education, especially related to the application of digital technology in the learning process. One of the main implications of this study is that Heyzine Flipbooks can be used as an alternative effective learning media in improving student learning motivation and learning outcomes. Teachers can utilize Heyzine Flipbooks as an innovative learning strategy that makes learning materials more interesting, interactive, and in accordance with student needs, especially in learning letter texts. By providing multimedia elements such as videos, images, and animations, Flipbooks are able to present a more dynamic learning experience. In addition, this study opens up opportunities for further research related to the effectiveness of Heyzine Flipbooks in the context of other subjects or at different levels of education. These findings can also help schools to develop policies that encourage the use of digital technology in the curriculum to improve the overall quality of learning.

Thus, this research is expected to provide a positive contribution to the development of learning at SMP Negeri 2 Padamara and become a reference for broader learning innovation in the educational environment.

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Development of SCaGI website as career information guidance media to improve students' career maturity in senior high school in Boalemo District

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Abstract

This study aims to develop the SCaGI website as a career information guidance medium to improve the career maturity of senior high school students in Boalemo District, Gorontalo Province. The research was conducted using the ADDIE development model, which includes the stages of analysis, design, development, implementation, and evaluation. A total of 120 Grade XII students from four high schools were involved, with 18 students identified as having low career maturity. Data collection techniques included interviews, questionnaires, and a career maturity scale. Validation was carried out by material and media experts, and effectiveness testing used a one-group pretest-posttest experimental design. The SCaGI website was evaluated as highly feasible by material experts (97.72%) and media experts (95.45%), and was considered highly practical by guidance and counseling teachers (94.73%). The implementation of the SCaGI website demonstrated significant improvement in students' career maturity, with an average N-Gain score of 0.76 (76.91%), indicating high effectiveness. These findings suggest that the SCaGI website is a valuable tool for providing accessible and engaging career information, supporting students in making more informed and independent career decisions. This study contributes to digital innovation in guidance and counseling practices and opens opportunities for broader implementation in diverse educational settings.

Keywords: Career Guidance; Career Information Media; Career Maturity; High School Students; Scagi Website.

INTRODUCTION

Career orientation is an essential aspect of high school education as it prepares students to make informed decisions about their future. Effective career guidance provides students with exposure to various occupations, helps build relevant skills, and supports informed career decision-making (Uleanya, et al., 2020). This process contributes significantly to students' self-awareness, motivation, and goal setting, which are critical in facing the transition from school to the world of work. Career education also functions as a preventive strategy to reduce indecision and future unemployment among young people (Super, 1980).

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However, many students still face confusion in choosing a career path, especially when they lack structured exposure to career development processes ([Puebla, 2022](#)). In the absence of clear guidance, students often rely on parental expectations, peer influence, or social trends rather than their competencies. Such external pressures may lead to career mismatches and lower motivation ([Nyamwange, 2016](#)). According to [Patton & Lokan \(2001\)](#), insufficient career guidance at the high school level can result in students entering higher education or the workforce without clear direction or readiness.

Career maturity is a key component in the career decision-making process, reflecting an individual's readiness to make realistic and appropriate career choices based on their developmental stage. According to Super's life-span theory, high school students—particularly those in Grade XII—are expected to complete tasks such as developing a realistic self-concept, exploring career options, and planning post-secondary pathways ([González, 2008](#); [Sharf, 2014](#)). These developmental tasks are critical in ensuring students transition smoothly into higher education or employment that aligns with their personal values, interests, and abilities. Students with higher levels of career maturity tend to make more confident and autonomous decisions regarding their futures ([Patton & Lokan, 2001](#)).

However, findings from a preliminary survey conducted in four senior high schools in Boalemo District, Gorontalo Province, revealed concerning patterns. Of the students surveyed, only 10% demonstrated high levels of career maturity, while the majority (75%) fell within the moderate category, and 15% were in the low category. These results indicate that most students lack optimal readiness for making informed career decisions. Traditional guidance methods such as lectures and general group sessions may not effectively address the diverse needs and backgrounds of students. Therefore, innovative, engaging, and individualized career guidance strategies are needed to better support students in navigating their career development.

Previous studies have shown that digital media, particularly web-based platforms, can significantly enhance the effectiveness of guidance and counseling services in schools. Web-based systems offer advantages such as continuous access, multimedia content delivery, and user interactivity, which support students in understanding complex career information ([Rosalin et al., 2018](#)). [Alhadi et al. \(2016\)](#) also emphasize that the use of digital media provides counselors with creative ways to deliver material and personalize the experience according to students' needs. This is especially relevant in the context of Generation Z students who are highly familiar with internet-based technologies and mobile platforms.

Online career information tools have also been found to increase student engagement, understanding, and self-reflection regarding career planning ([Beidoğlu et al., 2015](#)). When career materials are presented in digital formats—such as videos, interactive quizzes, or virtual consultations—students are more likely to process the information actively and relate it to their personal aspirations. In addition, [Sarmila, et all \(2022\)](#) demonstrated that website-based career platforms improve decision-making skills by offering structured pathways to explore job types, academic programs, and future options. The integration of digital platforms

into counseling services thus allows for greater flexibility, accessibility, and interactive learning, especially in areas where traditional resources are limited. Several models, such as SIGI-PLUS, DISCOVER, and cyber-counseling platforms, have been developed to support students' career planning through the use of computer-assisted guidance tools (Peterson et al., 1994). These tools were designed to assist students in identifying their interests, exploring occupations, and planning educational pathways. In international contexts, especially in developed countries, such systems have been integrated into school curricula to provide structured, data-driven support for career development (Howieson & Semple, 2013). In Indonesia, digital innovations such as cyber-counseling websites are beginning to gain ground, enabling virtual communication between students and school counselors and offering features like self-assessment tools, digital consultation rooms, and career video content (Prabawa et al., 2018).

Despite their potential, these models often fail to address the unique challenges faced by students in rural or under-resourced regions. Limited internet access, lack of localized content, and insufficient technological infrastructure can render many of these tools ineffective in such environments (Beidoğlu et al., 2015). Furthermore, guidance services in Indonesian high schools are still largely delivered through conventional means, such as classroom lectures or brief one-on-one counseling sessions, which may not fully engage students or accommodate diverse learning styles (Khatulistiwa et al., 2024). These limitations highlight the need for contextualized, culturally relevant, and easily accessible guidance media that can bridge the gap between available resources and student needs.

Based on these considerations, there remains a significant gap in the availability of accessible, interactive, and contextually relevant career guidance media in Indonesian high schools, particularly in rural districts such as Boalemo. While existing tools offer general guidance features, they often fail to reflect the specific needs, language, and socio-cultural context of local students. This study responds to that gap by aiming to develop the SCAGI website (Student Career Guidance Information) as a digital career guidance platform specifically tailored to the local educational setting. The SCAGI website is designed to be user-friendly, mobile-accessible, and equipped with rich multimedia content to support students' career exploration processes.

The primary objective of this study is to improve students' career maturity by providing relevant, engaging, and easily accessible career information. By integrating educational content with interactive features and online consultation services, SCAGI offers a more dynamic alternative to conventional guidance methods. This research contributes to the field of educational innovation by presenting a development model that aligns with the principles of digital transformation in schools. Furthermore, it provides a scalable framework that could be adopted in other regions facing similar resource constraints, thereby offering both theoretical significance and practical value in enhancing digital-based career services (Hooley & Staunton, 2020). Question words, particularly: what, why, which, who, where, when, and how.

METHODS

Research Design

This study employed a Research and Development (R&D) approach using the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) as its framework (Branch, 2009). This design was chosen because it allows systematic development and testing of educational products through iterative phases. It was considered appropriate for this study, as the aim was to create and evaluate the effectiveness of the SCaGI website as a digital medium for career guidance.

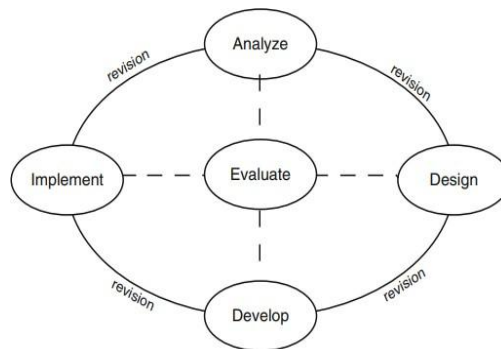


Figure 1. The ADDIE concept (Branch, 2024)

Participants and Sampling

The participants were 120 Grade XII students from four senior high schools in Boalemo District, Gorontalo Province. Each school contributed 30 students, selected through simple random sampling. Prior to implementation, a career maturity pretest was administered to all participants. Based on the results, 18 students with low career maturity levels were identified to receive the intervention during the implementation phase of the study.

Group Assignment

This study used a one-group pretest-posttest design, meaning there was no control group or random group assignment. All 18 students identified with low career maturity formed a single experimental group. They participated in the intervention sessions where the SCaGI website was implemented as a career information guidance tool. Each student accessed the website individually under the supervision of guidance and counseling teachers.

Instruments and Tools

Several instruments were used to collect data:

1. Interview guidelines were used during the analysis stage to explore student and teacher needs.
2. Validation rubrics were developed to assess the feasibility of the product, completed by two media experts and two material experts.
3. A Career Maturity Scale adapted from Sharf (2014) was used to measure students' career maturity. The scale consisted of Likert-type items (0–4) covering six indicators: career planning, information seeking, decision-making, understanding of job references, job preference, and ability to make decisions.

The instruments were validated by experts and showed high feasibility: 97.72% by material experts and 95.45% by media experts. The practicality score given by guidance and counseling teachers was 94.73%, indicating high reliability and appropriateness.

Data Collection

Data collection followed the five stages of the ADDIE model:

1. Analysis: Conducted via interviews with 8 guidance and counseling teachers across 4 schools to identify student needs and existing guidance practices.
2. Design: Developed a storyboard and feature plan for the SCaGI website based on the analysis.
3. Development: Constructed the prototype website and conducted validation with expert reviewers.
4. Implementation: Field-tested the SCaGI website on 18 students with low career maturity through two sessions in one week.
5. Evaluation: Conducted a pretest and posttest using the Career Maturity Scale to assess changes in students' career maturity levels.

Data Analysis

Data were analyzed using descriptive and inferential statistical methods. Validation and practicality data were analyzed using percentage scores from expert rubrics. Pretest and posttest data were analyzed using N-Gain Score to determine the effectiveness of the SCaGI website. The N-Gain Score was calculated using the formula:

$$\text{N-Gain} = \frac{(\text{Posttest Score} - \text{Pretest Score})}{(100 - \text{Pretest Score})}$$

The results showed an average N-Gain Score of 0.76 (76.91%), indicating that the intervention had a high level of effectiveness. In addition, the Wilcoxon Signed-Rank Test was employed to compare the differences between pretest and posttest scores, as the data did not meet the assumptions of normal distribution. This non-parametric test is suitable for analyzing paired data in small samples ([Field, 2013](#)).

RESULT AND DISCUSSION

Result

Based on the initial analysis stage of this development process, Grade XII high school students in Boalemo Regency demonstrated varying levels of career maturity. These results are illustrated in Figure 1.

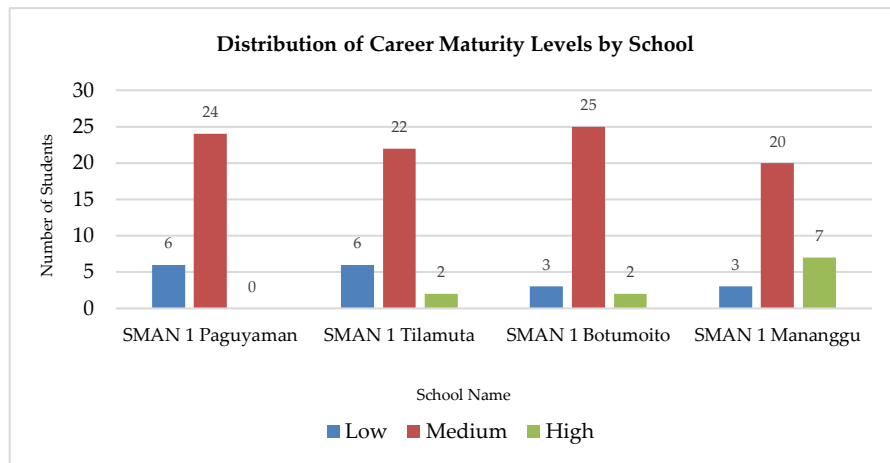


Figure 1: Distribution of Students' Career Maturity Levels Across Four High Schools

The individual percentage scores for each student were obtained from the pretest results, as presented in Table 2.

Table 2. Pre-test results

Number	Students	School	Score	Category
1.	DWH	SMA Negeri 1 Paguyaman	57,77%	Low
2.	SBP	SMA Negeri 1 Paguyaman	56,66%	Low
3.	FA	SMA Negeri 1 Paguyaman	55,55%	Low
4.	DAA	SMA Negeri 1 Paguyaman	53,88%	Low
5.	MTK	SMA Negeri 1 Paguyaman	56,11%	Low
6.	SMA	SMA Negeri 1 Paguyaman	58,33%	Low
7.	MRE	SMA Negeri 1 Tilamuta	58,88%	Low
8.	RLM	SMA Negeri 1 Tilamuta	59,44%	Low
9.	ARNP	SMA Negeri 1 Tilamuta	58,88%	Low
10.	FMM	SMA Negeri 1 Tilamuta	59,44%	Low
11.	ARA	SMA Negeri 1 Tilamuta	57,77%	Low
12.	AM	SMA Negeri 1 Tilamuta	56,66%	Low
13.	AKA	SMA Negeri 1 Botumoito	55%	Low
14.	SN	SMA Negeri 1 Botumoito	58,88%	Low
15.	ANW	SMA Negeri 1 Botumoito	59,44%	Low
16.	TCS	SMA Negeri 1 Mananggu	58,33%	Low
17.	LK	SMA Negeri 1 Mananggu	59,44%	Low
18.	NLTB	SMA Negeri 1 Mananggu	57,22%	Low

Based on table 2, three factors of each student's career-related problems were identified. The results of this identification are described in Figure 2.

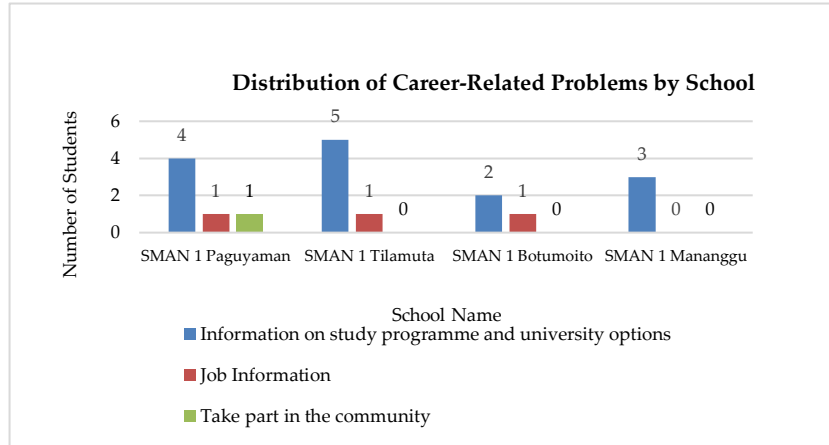


Figure 2. Identification of students' career-related problems by School

Based on the diagram above, a total of 18 students from the four participating schools were identified as having low levels of career maturity. The second and third stages of the research and development process involved the design and development of the product based on field data. The outcomes of these stages are illustrated in Figures 3 and 4.

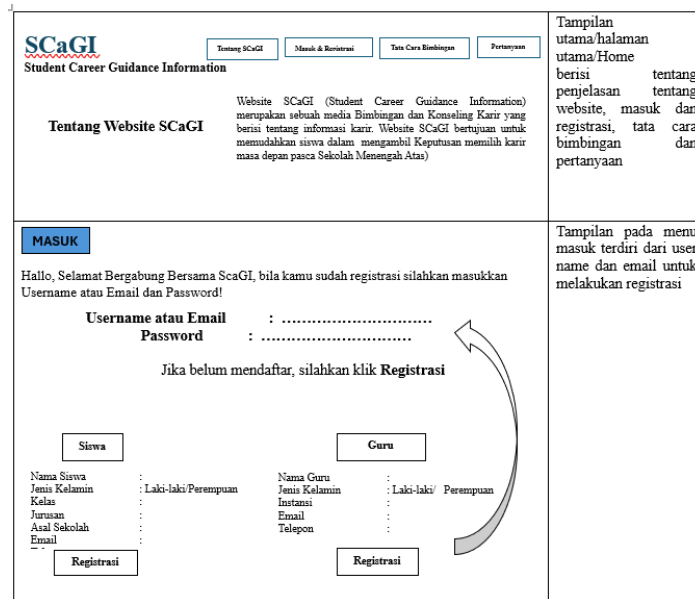


Figure 3. Initial prototype design of SCaGI website

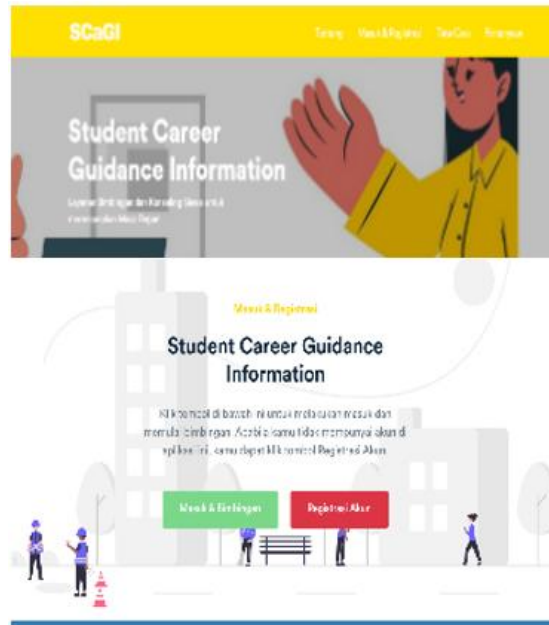


Figure 4. Final interface of the developed SCaGI website

The resulting product is the SCaGI (Student Career Guidance Information) website, developed as a digital career information guidance medium. The website contains information related to study program choices, universities in Indonesia, job options, and post-school activities. All content has been adapted to align with the major selection system used in Indonesian senior high schools. The website presents information through videos on university choices, types of occupations, and community engagement options. Each video is supplemented with explanatory descriptions to enhance students' understanding, particularly regarding university-related information. A notable feature of the SCaGI website is its online guidance system, which facilitates direct communication between students and guidance and counseling teachers. This feature aims to make it easier for students to consult on career-related matters without the need for face-to-face meetings.

Both media and material experts evaluated the development of the SCaGI website. The material expert validation resulted in a score of 97.72%, categorized as "very feasible", based on indicators such as usefulness, feasibility, and accuracy. Meanwhile, media expert validation resulted in a score of 95.45%, also categorized as "very feasible", based on criteria such as content quality, clarity and convenience, information richness, relevance, accuracy, user experience, structure and presentation, design and layout, visual appearance, interactivity, user engagement, interactive functions, and monitoring and response capabilities.

The next stage involved implementing the SCaGI website in a field trial. Students identified as having a low level of career maturity received the intervention in the form of access to the SCaGI website and its guidance media. The intervention was conducted twice within one week, delivered alternately across schools. The final stage was evaluation, in which the effectiveness of the intervention was assessed using posttest data, as presented in Table 3.

Table 3. Posttest Results

Numb	Students	School	Score	Category
1.	DWH	SMA Negeri 1 Paguyaman	91,66%	High
2.	SBP	SMA Negeri 1 Paguyaman	89,44%	High
3.	FA	SMA Negeri 1 Paguyaman	88,33%	High
4.	DAA	SMA Negeri 1 Paguyaman	90%	Medium
5.	MTK	SMA Negeri 1 Paguyaman	91,11%	High
6.	SMA	SMA Negeri 1 Paguyaman	89,44%	High
7.	MRE	SMA Negeri 1 Tilamuta	92,77%	High
8.	RLM	SMA Negeri 1 Tilamuta	91,66%	High
9.	ARNP	SMA Negeri 1 Tilamuta	92,22%	High
10.	FMM	SMA Negeri 1 Tilamuta	88,88%	High
11.	ARA	SMA Negeri 1 Tilamuta	93,88%	High
12.	AM	SMA Negeri 1 Tilamuta	91,11%	Medium
13.	AKA	SMA Negeri 1 Botumoito	90%	High
14.	SN	SMA Negeri 1 Botumoito	90,55%	High
15.	ANW	SMA Negeri 1 Botumoito	88,33%	High
16.	TCS	SMA Negeri 1 Mananggu	88,88%	High
17.	LK	SMA Negeri 1 Mananggu	92,22%	High
18.	NLTB	SMA Negeri 1 Mananggu	89,44%	Medium

After the posttest, an N-Gain Score analysis was conducted to evaluate the effectiveness of using the SCAI website as a career information medium in enhancing students' career maturity. The results of the N-Gain analysis are presented in Table 4.

Table 4. N-Gain Score Results

Numb	Students	Score		N-Gain Score	N-Gain Scor (%)
		Prestest	Posttest		
1	DWH	57,77%	91,66%	0,79	79.07
2	SBP	56,66%	89,44%	0,75	75.00
3	FA	55,55%	88,33%	0,73	73.33
4	DAA	53,88%	90%	0,79	78.72
5	MTK	56,11%	91,11%	0,80	79.55
6	SMA	58,33%	89,44%	0,74	73.81
7	MRE	58,88%	92,77%	0,81	80.95
8	RLM	59,44%	91,66%	0,78	78.05
9	ARNP	58,88%	92,22%	0,81	80.95
10	FMM	59,44%	88,88%	0,71	70.73
11	ARA	57,77%	93,88%	0,84	83.72
12	AM	56,66%	91,11%	0,80	79.55
13	AKA	55%	90%	0,78	77.78
14	SN	58,88%	90,55%	0,76	76.19
15	ANW	59,44%	88,33%	0,71	70.73
16	TCS	58,33%	88,88%	0,71	71.43
17	LK	59,44%	92,22%	0,80	80.49
18	NLTB	57,22%	89,44%	0,74	74.42
Rata-rata Skor				0,76	76,91

The N-Gain Score analysis presented in the table indicates an improvement of 76.91%, which falls into the “high” effectiveness category. This result suggests that the use of the SCaGI website as a career information medium in guidance and counseling services is effective in enhancing students' career maturity.

Discussion

The findings of this study demonstrate that the SCaGI website significantly improved students' career maturity. This is supported by the N-Gain Score analysis, which shows an average score of 0.76 (76.91%), indicating high effectiveness, and by the Wilcoxon Signed-Rank Test ($Z = -3.731$; $p < 0.001$), which confirms a statistically significant difference between students' pretest and posttest scores. These results suggest that SCaGI is a viable career information medium that can enhance students' readiness in making career-related decisions.

This result aligns with findings from previous research. For instance, [Rosalin et al. \(2018\)](#) emphasized the flexibility of websites in delivering career information, while [Alhadi et al. \(2016\)](#) noted increased student interest due to digital media use in counseling. [Beidoğlu et al. \(2015\)](#) also highlighted the significance of digital tools in enhancing guidance services. Compared to earlier models like SIGI-PLUS ([Peterson et al., 1994](#)) or cyber-counseling systems ([Prabawa et al., 2018](#)), SCaGI offers greater contextual relevance by integrating with the Indonesian school system. This contextual adaptation strengthens SCaGI's position as a more effective solution. Supporting this, [Watts \(2002\)](#) also noted the increasing centrality of ICT in modern career development. Furthermore, studies by [Astuti et al. \(2022\)](#) and [Bimrose et al. \(2015\)](#) reinforce the present findings, particularly in terms of student engagement and access equity. A recent meta-analysis also reported that technology-enhanced career guidance in schools yields a moderate to high effect size ($g \approx 0.42$) in improving students' career skills and attitudes [Sharapova et al. \(2023\)](#), supporting the effectiveness observed in this study.

The effectiveness of SCaGI may be explained by several design features. First, it provides tailored content aligned with senior high school majors, engaging multimedia elements, and interactive features such as online consultation, career videos, and personal planning tools. These allow students to explore career paths at their own pace and revisit material when needed. [Gati & Asulin-Peretz \(2011\)](#) found that students prefer internet-based counseling for its flexibility and low-pressure environment—characteristics that SCaGI embraces effectively. Similarly, [Hidayat et al. \(2022\)](#) found that mobile-based career counseling apps in Indonesia improved students' clarity in choosing academic majors, confirming the importance of accessible, context-aware digital media in career decision support.

The implications of this study are significant for both practice and policy. [Ainscow \(2020\)](#) emphasized that digital technologies in career guidance help bridge equity gaps. SCaGI embodies this principle by providing scalable, culturally relevant guidance to underserved areas. It aligns with Indonesia's national career guidance framework, [Kemendikbud \(2014\)](#), and the broader goals of Education 5.0, which emphasize accessibility, personalization, and digital innovation. As such, SCaGI can serve as a replicable model for other regions with similar needs.

Despite its contributions, this study has limitations. The sample size was relatively small and focused only on one region (Boalemo District), which may limit the generalizability of the findings. Additionally, the study assessed only short-term outcomes without tracking long-term decision-making. Future research should apply SCaGI across diverse school settings and examine its longitudinal impact. Comparative studies using control groups or mixed methods could provide deeper insight into how digital interventions influence students' career development. As [Copeland et al. \(2011\)](#) noted, effective systems must support both students and counselors, a goal SCaGI attempts to address through its asynchronous yet guided approach.

CONCLUSION

This study aimed to develop and evaluate the effectiveness of the SCaGI website as a digital medium for delivering career information guidance to senior high school students. The main findings indicate that the SCaGI website significantly improved students' career maturity, as shown by a high N-Gain Score of 0.76 (76.91%) and a statistically significant result in the Wilcoxon Signed-Rank Test ($Z = -3.731$; $p < 0.001$). These results demonstrate the website's effectiveness in enhancing students' readiness for career decision-making.

The implications of this study are substantial for the field of guidance and counseling. SCaGI offers a practical, accessible, and engaging platform for providing career-related information, especially in schools with limited counseling services. Its integration of multimedia content and online consultation features represents a scalable model that supports the national framework for career guidance and aligns with the digital transformation in education. However, the study has certain limitations. It was conducted with a small sample of 18 students in a single district, which may limit the generalizability of the findings. The research also focused on short-term outcomes without assessing long-term effects on students' actual career choices.

Future research is recommended to extend the implementation of SCaGI to other regions and use larger, more diverse samples. Comparative studies using experimental designs or longitudinal approaches would also provide deeper insights into the sustained impact of digital guidance tools on students' career development. In conclusion, this research contributes to the advancement of educational innovation by presenting an effective, technology-based career guidance model tailored to local needs. The SCaGI website serves as a promising tool to support students' career maturity and can be adopted as a strategic solution in modern counseling practices.

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Revolutionising Education: The Role of SCT-Based E-Modules in Fostering Creative Thinking

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Abstract

Creative thinking is crucial for students in addressing educational and daily challenges. It enables them to analyze problems and generate innovative solutions. The SCT-based e-module supports this development by allowing students to manage learning independently, thereby enhancing comprehension and creative thinking. This study employs a Research and Development (R&D) approach, utilizing the 4D model: Define, Design, Develop, and Disseminate. The aim is to create a valid, practical, and effective SCT-based e-module on buffer solutions. Conducted at SMAN 1 Martapura, the study involved five students in individual trials, 10 in small group trials, and 35 in limited trials. Data analysis showed: (1) Validity reached 84.89%, categorized as highly valid; (2) Practicality was confirmed by student responses (83% in individual trials, 83.5% in small groups) and teacher responses (92.5%), indicating high practicality; (3) Effectiveness was measured through students' creative thinking N-gain scores, which averaged 0.54, signifying moderate effectiveness. These results confirm the SCT-based e-module as an effective tool for fostering students' creative thinking.

Keywords: 4D; Creative Thinking; E-Module; SCT.

INTRODUCTION

The advancement of Information and Communication Technology (ICT) has driven the emergence of various creative innovations, one of which is the concept of electronic learning or e-learning. E-learning is defined as a form of information technology applied in education, where the teaching and learning process utilizes electronic systems to deliver learning content, facilitate interaction, or provide guidance in digital form, all mediated by internet technology (Saitya, 2021). Chemistry is taught in high school to help students relate its concepts to real-life situations. This connection enhances their understanding and engagement with the

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subject (Wahyuliani et al., 2022). However, students often struggle to apply concepts, analyze contexts, integrate information, and draw meaningful conclusions (Nisa et al., 2018). According to the research by Wahyuni & Palupi (2022), the ability to think creatively among students should be a key focus in the learning process, as it is crucial for organizing their thinking and reasoning to connect with real-world conditions. However, in practice, students have not yet fully developed their creative thinking abilities, which leads them to struggle with thinking critically and articulating their opinions in a creative context (Saputra & Salim, 2020). Other research has found that many students are still at a low level of creative thinking when solving problems and responding to the ideas of others (Amelia et al., 2021). Therefore, a learning design that aligns with the characteristics of technology is needed so that students can demonstrate their abilities when using it (Linggu & Tasir, 2022).

The results of observations conducted at SMAN 1 Martapura indicate that students continue to struggle with understanding chemistry concepts, particularly when applying them to real-life situations, especially in the context of buffer solutions. The concept of buffer solutions involves abstract ideas that require macroscopic, submicroscopic, and symbolic representations, as well as connections between these levels, for effective learning. When explaining the principles of buffer solutions, students often struggle to assign meaning, which leads to difficulties in understanding equilibrium shifts that occur (Widarti et al., 2020). Additionally, students prefer accessing learning materials via smartphones rather than the available textbooks. Observations also indicate that teachers continue to use learning media that students consider typical. Using media in learning can help teachers and students understand the material more efficiently, thereby enhancing the effectiveness of the learning process (Puad & Ashton, 2021). Using media in learning can help teachers and students understand the material more efficiently, thereby enhancing the effectiveness of the learning process. According to research by Rahmatsyah & Dwiningsih (2021), an e-module is a learning medium that integrates various supporting elements such as text, images, graphics, audio, animations, and videos, which can be accessed via computers and smartphones. With e-modules, students can learn independently by adjusting their pace and ability to complete learning materials (Supandi et al., 2021).

E-modules support optimal learning achievement for students of various intellectual levels. This material allows students to learn more flexibly and adjust their learning tempo according to their capabilities (Setiawan et al., 2022; Ambayon, 2020). This flexibility in the learning process benefits students and educators (Abisado, 2020). Developing e-modules is an alternative method to enhance students' creative thinking abilities. Findings Safitri et al. (2022) show that using e-modules in the material solution buffer makes participants more interested and happy to follow learning. The developed e-module is an E-Module based on the Scientific Critical Thinking (SCT) model. The Scientific Critical Thinking (SCT) model is a learning model designed explicitly by integrating elements from the Problem-Based Learning (PBL) model and the inquiry model (Rusmansyah et al., 2018). The SCT model involves students solving problems through scientifically

designed activities and encourages them to present their work within a framework that addresses real-world issues.

This research focused on the development of an e-module on buffer solution material based on the Scientific Critical Thinking (SCT) model, which uniquely integrates components of Problem-Based Learning (PBL) and Inquiry to cultivate students' creative thinking. While previous studies have examined e-modules and creative thinking separately, limited attention has been given to integrating SCT in digital learning environments for chemistry, particularly in abstract topics such as buffer solutions. The purpose of this research is to design and implement an SCT-based e-module that enhances students' conceptual understanding and fosters their ability to think creatively and critically. The urgency of this research stems from the ongoing challenges faced by students in connecting theoretical chemistry concepts to real-life contexts, as well as the growing reliance on digital learning tools. As students increasingly prefer mobile-based learning, developing engaging, independent, and scientifically structured digital modules becomes essential to meet current educational demands and support 21st-century learning competencies.

METHODS

This study used a Research and Development (R&D) design (Rohman et al., 2021). The development model applied was the 4D model, consisting of four stages: Define, Design, Develop, and Disseminate. The research aimed to develop an SCT-based e-module on buffer solution material to improve students' creative thinking skills.

The subjects in this study consisted of five validators: two chemistry education lecturers from FKIP Universitas Lambung Mangkurat, one lecturer in educational technology, and two chemistry teachers from SMA Negeri 2 Banjarmasin. Product testing was conducted with students from Class XI SMA Negeri 1 Martapura in the 2023/2024 academic year, involving five students in individual trials, 10 students in small group trials, and 35 students in limited trials. The study took place in January–February 2024 at SMA Negeri 1 Martapura, Banjar Regency, South Kalimantan.

Data Collection Techniques

The data in this study were collected using several instruments:

1. Validation sheets, used by experts to assess the validity of the e-module in terms of content, presentation, and language.
2. Student and teacher response questionnaires, used to measure the practicality of the developed e-module.
3. Observation sheets, used to record the learning process and classroom implementation.
4. Creative thinking test instruments (pre-test and post-test), consisting of descriptive questions designed according to the four indicators of creative thinking: fluency, flexibility, originality, and elaboration.

Data Analysis Techniques

The collected data were analyzed both quantitatively and qualitatively:

1. Validity analysis: Expert validation scores were calculated using percentage formulas, then categorized into validity levels.
2. Practicality analysis: Student and teacher questionnaire results were converted into percentages to determine the level of practicality.
3. Effectiveness analysis: Students' pre-test and post-test scores were analyzed using the N-gain formula to measure improvement in creative thinking skills, classified as high, moderate, or low effectiveness.
4. Qualitative analysis: Suggestions and feedback from validators, teachers, and students were also considered to refine the product and provide deeper insights into its practicality and effectiveness.

RESULTS AND DISCUSSION

This study developed an SCT-based e-module on buffer solution material to foster students' creative thinking skills. The e-module was tested at SMA Negeri 1 Martapura and designed as a web application accessible via Android smartphones, allowing for offline use. This format was considered more practical than printed books because students generally prefer learning through mobile devices, supporting independent learning anytime and anywhere.

Define Stage

At the initial stage, the researchers conducted a needs analysis by distributing questionnaires to students who had studied buffer solutions. The results showed that: (1) students acknowledged the importance of modules in learning, (2) teaching materials were considered influential in developing creative thinking skills, (3) smartphones were perceived as helpful for learning chemistry, and (4) students agreed that an SCT-based e-module should be developed for buffer solution material.

Concept and Learning Objectives Analysis

The selected basic competency in this study was 3.14, which emphasizes students' ability to classify various buffer solution systems and explain their applications in daily life. This competency was chosen because buffer solution material is often considered abstract and can be difficult for students to understand without concrete examples. Therefore, it was essential to design learning objectives that not only align with the competency but also make the material more meaningful and accessible to students.

The learning objectives were then translated into detailed indicators of learning achievement (IPK). These included: (1) distinguishing between true solutions, buffer solutions, and suspensions to strengthen students' conceptual understanding; (2) classifying different types of buffer solutions based on their composition and characteristics; and (3) analyzing the properties, mechanisms, and uses of buffer solutions in various real-life contexts, such as the regulation of pH in the human body, preservation in the food industry, and maintenance of

environmental balance. By achieving these indicators, students are expected to not only master the theoretical aspects of buffer solutions but also connect them to practical applications. Furthermore, these indicators were formulated to foster critical and creative thinking skills in accordance with the goals of the SCT-based e-module.

Design Stage

The e-module is designed based on an integrated learning model. The front cover page of the e-module includes several essential elements, such as the institutional identity (represented by the logo), the subject title (*Buffer Solution*), the development product title (*Digital Module*), a "Start" button to facilitate user navigation, and various chemistry-themed icons that serve to enhance the visual appeal and user engagement. These elements are displayed in [Figure 1](#).



Figure 1. Cover Display of the SCT-Based E-Module

[Figure 2](#) presents the main menu of the e-module, serving as the starting point for user navigation. It includes key sections such as Instructions, Introduction, Learning Material, Practicum, Evaluation, Practice Questions, and Developer. Each section is designed to guide students through the learning process interactively and support independent study with easy navigation and structured content access.



Figure 2. Main Menu Display of the E-Module

The learning material section is designed to provide concise content for each session, integrated with the SCT stages, supported by summaries and a bibliography, as shown in [Figure 3](#).



Figure 3. Learning Activities Menu

The scientific activity menu introduces the initial stages of the SCT model, where students are presented with a problem, guided to identify the problem, and then formulate a hypothesis as a temporary answer. This feature strengthens students' reasoning before moving on to the practicum activities, which are described in the next section and illustrated in [Figure 4](#).



Figure 4. Scientific Activity Menu: Problem, Problem Identification, and Hypothesis

In the evaluation and practice question section, each exercise is equipped with clear instructions. Students can input their name and class before starting, and upon completing the questions, the system automatically provides their score. This feature allows students to receive immediate feedback, supporting independent and effective learning. The display of this section is shown in [Figure 5](#).

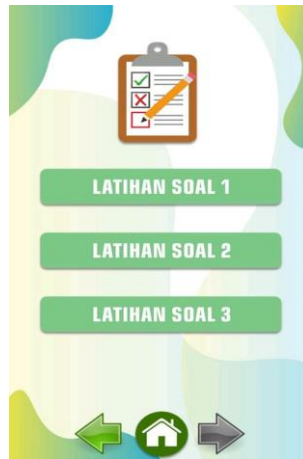


Figure 5. Display of the Evaluation and Practice Question Section in the SCT-Based E-Module

Development Stage

a. Results of SCT-Based E-Module Validity Test

The validity of the SCT-based e-module was determined through a validation questionnaire assessed by five validators: two chemistry education lecturers from FKIP Universitas Lambung Mangkurat, one educational technology lecturer, and two chemistry teachers from SMA Negeri 1 Martapura. The validation aspects included content, presentation, and language.

Table 1. Evaluation validation aspect eligibility media

Aspect Evaluation	Validators					Average	Score Validation	Information
	I	II	III	IV	V			
Contents	36	35	33	36	33	34.6	96.11%	Very Valid
Presentation	8	8	8	8	7	7.8	97.50%	Very Valid
Language	24	23	24	24	22	23.4	97.50%	Very Valid

The validation results in Table 1 indicate that the validation percentages for content feasibility, presentation, language, and media were 96.11%, 97.50%, and 97.50%, respectively. Based on these percentages, the SCT-based e-module teaching material on buffer solution content falls into the "very valid" category. However, some minor revisions are still needed according to the suggestions and feedback from the validators. The suggestions and feedback from the validators are as follows:

1. Change the initial menu from essential competencies to introduction
2. Add a glossary to the introduction menu
3. Added a concept map to the introduction menu
4. Add the name of the supervisor to the developer menu

b. Results of the Practicality Test of SCT-Based E-Modules

Individual trial results

Individual trial on 5 class XI 4 SMAN 1 Martapura students in the 2023/2024 academic year. This trial aims to determine the media's readability in assessing the practicality of the developed product.

Table 2. Legibility test for the individual

No	Participant Educate	Score	Percentage	Information
1	1	37	92.5%	Very practical
2	2	32	80%	Practical
3	3	32	80%	Practical
4	4	32	80%	Practical
5	5	33	82.5%	Practical
Average		33.2	83%	Very practical

Based on the calculation in Table 2, the average value of the percentage of students' readability in the individual trial was 83%, indicating that it was very practical. However, minor revisions are still needed according to suggestions and input from students, namely adding a photo to the author's biodata section.

Small group trial results

Small group trials for students consisting of 10 students of class XI 4 SMAN 1 Martapura in the 2023/2024 academic year. This trial aims to determine the readability of learning media based on the practicality score of learning media from the previous stage.

Table 3. Legibility test try group small

No	Participant Educate	Score	Percentage	Information
1	1	32	80%	Practical
2	2	33	82.5%	Very practical
3	3	31	77.5%	Practical
4	4	34	85%	Very practical
5	5	38	95%	Very practical
6	6	38	95%	Very practical
7	7	31	77.5%	Practical
8	8	33	82.5%	Very practical
9	9	32	80%	Practical
10	10	32	80%	Practical
Average		33.4	83.5%	Very practical

Based on the calculation in Table 3, the average percentage of students' readability in the small group trial was 83.5%, which falls within the very practical category. After the small group trial, students gave positive comments that the e-module was good teaching material, so no revisions were made to the e-module.

Limited trial results

Limited trials were conducted with 35 students from Class XI at SMA Negeri 1 Martapura. The trial aims to determine the practicality score of the developed e-module.

Table 4. Response participants educate

No	Amount participant educate	percentage	information
1	11	27.27%	Very practical
2	24	72.73%	practical
Results average percentage of practicality		80.91%	practical

Based on [Table 4](#), the average percentage response value was obtained based on the data results above—participants educated in e-modules as high as 80.91%, which includes the category practical. According to students, e-modules in the learning process can be described as practical. The results of teacher responses using media were measured using a teacher response questionnaire to determine the practicality of the media learning used during the learning process.

Table 5. Response of the teacher to the media on the test try is limited

No	Teacher	Score	Percentage	Information
1	1	36	90%	Very practical
2	2	38	95%	Very practical
Results Average		37	92.5%	Very practical

Based on the results in [Table 5](#), the teacher's response to using media in the moment learning process produced an average score of as high as 37, with a percentage of 92.5%, which is included in the category of very practical.

Discussion

Validity of the SCT-Based E-Module

The validation results confirmed that the SCT-based e-module met the criteria of validity, with percentages of 96.11% for content, 97.50% for presentation, and 97.50% for language. These findings show that the module fulfilled the standards of feasible teaching materials. [Wahyuni et al., \(2019\)](#) emphasized the importance of validation to ensure feasibility, while [Zhafirah et al. \(2020\)](#) also reported that SCT-based e-modules obtained high validity, particularly in content and language. Similarly, [Fauziah et al., \(2023\)](#) stated that a product is considered feasible if the components are systematically arranged and aligned with clear learning objectives. The high presentation score is consistent with [Dewi & Lestari, \(2020\)](#) and [\(Arsal et al., 2019\)](#), who argued that digital modules should present structured components such as introduction, content, and conclusion, with only minor revisions required.

Practicality of the SCT-Based E-Module

Practicality tests through individual, small group, and limited trials produced percentages of 83%, 83.5%, and 80.91%, while teacher responses reached 92.5%. These results categorize the e-module as practical to very practical. Positive student and teacher feedback confirms that the SCT-based e-module was easy to use and effectively supported learning. This is consistent with [Rismayanti et al. \(2022\)](#), [Fran \(2022\)](#), and [Riduan et al. \(2022\)](#), who emphasized that positive student responses are crucial indicators of practicality and readiness for implementation. ([Rusmansyah et al., 2023](#)) also highlighted that digital modules with systematic features and interactive content are considered highly practical and facilitate independent learning. Additionally, [Muzijah et al., \(2020\)](#) and [Juliani & Refelita \(2022\)](#) found that mobile-based resources make learning more engaging, in line with [García-Carmona \(2023\)](#), who stated that smartphones encourage student motivation in digital learning environments.

Effectiveness of the SCT-Based E-Module

The effectiveness of the module was evaluated through creative thinking tests and classroom observations. The N-gain results indicated moderate improvement in students' creative thinking skills across the four indicators: fluency, flexibility, originality, and elaboration. These improvements demonstrate that the integration of SCT into digital modules can foster higher-order thinking skills, particularly in chemistry learning.

Observer assessments also showed gradual adaptation in the classroom. During the first meeting, the practicality level was relatively low due to the teacher's unfamiliarity with delivering SCT-based learning, which led to difficulties in student comprehension. However, in the second and third meetings, the practicality scores increased significantly, reaching very practical levels. This aligns with [Maharcika et al. \(2021\)](#), who explained that repeated exposure to innovative learning tools enhances teaching effectiveness. Teacher mastery of the module in later sessions also contributed to clearer explanations, better interaction, and improved student understanding, consistent with [Riduan et al. \(2022\)](#) and [Zakiyatul & Buchori \(2023\)](#), who emphasized that consistent use of digital modules improves their practicality and ease of implementation.

In addition, the SCT-based e-module provides several advantages that further support its effectiveness. The module presents real-life problems that are factual and supported by images, allowing students to think more concretely when collecting and analyzing information ([Jayanti & Pertiwi, 2023](#)). Furthermore, the integration of e-modules enables students to leverage technology in learning, while at the same time encouraging teachers to adopt modern digital tools to maintain relevance in the digital era ([Naumoska et al., 2022](#)).

Effectiveness Analysis by Creative Thinking Indicators

a. Fluency indicator

The pre-test results indicated that students struggled to generate appropriate problem-solving ideas, often giving illogical answers despite listing multiple

responses. This difficulty was due to an incomplete understanding of problem-solving methods. After using the SCT-based e-module, students showed improvement in producing relevant and logical ideas. The difference between pre-test and post-test scores suggests that fluency improved because of repeated practice and the structured activities in the module. This finding aligns with [Dewi & Primayana, \(2019\)](#), who emphasized that contextual learning approaches help students adapt more quickly to new learning paradigms.

b. Elaboration indicator

Initially, students' answers were correct but lacked detailed explanation. This weakness stemmed from their limited ability to elaborate on problem-solving strategies. Post-test results, however, showed significant improvement, with students providing more detailed and comprehensive explanations. This progress can be attributed to the teacher's consistent guidance and the contextual presentation of learning materials. [Dewi & Primayana, \(2019\)](#) highlighted that contextual approaches make it easier for students to understand and elaborate ideas. The improvement also reflects the impact of regular practice questions provided throughout the learning process.

c. Originality indicator

The originality indicator was still relatively low. Students often provided general or cliché responses instead of unique ideas. This is partly due to their limited exposure to learning activities that specifically train originality. [Wahyuningsih's \(2020\)](#) similarly noted that originality requires deeper contextual practice and does not develop optimally without explicit training. Furthermore, teachers play a critical role in fostering creativity. [Sri & Nasution's \(2021\)](#) stated that a teacher's creativity in teaching has a significant impact on students' learning outcomes. Therefore, the low originality results in this study highlight the need for teachers to provide more varied and stimulating activities to nurture original thinking.

d. Flexibility indicator

The flexibility indicator initially received the lowest pre-test scores because students had little prior knowledge of buffer solutions and limited experience with creative thinking questions. After participating in the lessons, students' post-test responses showed improvement, as they could provide varied solutions and analyze problems from multiple perspectives. This progress reflects the benefits of continuous practice and teacher guidance. [Manazila et al. \(2022\)](#) argued that flexibility is best developed when students are trained to approach problems from different viewpoints. Similarly, [Wahyuningsih \(2020\)](#) pointed out that low student interest and limited practice opportunities often result in weak flexibility, and that active, practical learning methods are essential to cultivate this skill.

CONCLUSION

The Scientific Critical Thinking (SCT)-based e-module developed in this study is categorized as very valid, practical, and moderately effective as a learning material

in chemistry. The validity aspect was confirmed by expert assessments of content, presentation, and language, all of which obtained scores in the “very valid” category. The practicality aspect was supported by positive results from readability tests, student and teacher response questionnaires, and classroom observations, which consistently indicated that the module was easy to use and well-received. In terms of effectiveness, the SCT-based e-module contributed to the improvement of students’ creative thinking skills, as reflected in the N-gain score of 0.54, categorized as moderate. These findings highlight that integrating SCT into digital learning resources not only strengthens students’ conceptual understanding but also supports independent learning and the development of creative thinking in the digital era.

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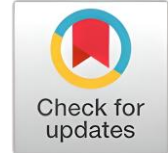
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Innovation in the Development of 2D Animation-Based Visualization Learning Media Using the ADDIE Method to Improve Student Learning Outcomes

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Abstract

The development of information technology has not been fully utilized in science learning at vocational high schools, where conventional methods still dominate and make it difficult for students to understand concepts. This study aims to develop information technology and create a new product in the form of 2D visualization. The study employed a development approach based on the ADDIE model and focused on developing learning media for Grade 10 science subjects using animated videos. Three aspects were evaluated: feasibility, practicality, and effectiveness. The assessment of these aspects showed that students were able to improve their learning outcomes and conceptual understanding in science subjects. Based on expert evaluations, media experts provided an average score of 87%, while material experts rated it at 80%. Teacher responses reached 94%, and student responses were 94.49%. The results of the post-test stage indicated an average achievement of 92.25%, with the highest score of 100 and the lowest score of 70. These findings suggest that the use of animated videos can effectively enhance students' learning outcomes and conceptual understanding. It is recommended that future studies expand the method, scope of materials, and sample size to further address the lower range of student scores.

Keyword: ADDIE Model; Animated Video; Learning Media; Science Education.

INTRODUCTION

In today's digital era, the implementation of interactive learning media has become increasingly important to support the quality of education. The use of learning media has shifted from physical to digital forms, closely related to technological developments (Suryono, 2024; Pratiwi & Kasrman, 2022). However, the utilization of technology-based learning media still faces challenges, particularly regarding how such media can effectively support students' conceptual mastery and critical thinking skills. In this context, the development of 2D animation-based visualization learning media using the ADDIE model serves as a strategic approach to enhance student learning outcomes while deepening their conceptual understanding (Ristanti & Sakti, 2021).

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This study employs a development approach based on the ADDIE model, which consists of five main stages: Analysis, Design, Development, Implementation, and Evaluation (Aprilianto et al., 2022; Illahi et al., 2024; Sugiyono, 2022). Previous research (Agustin et al., 2024; Saputra et al., 2023) demonstrated that interactive media developed using Adobe Animate in animation learning was highly valid and effective in improving learning outcomes, with a validity score above 0.79 and student responses reaching 86.7%. In addition (Sari & Huda, 2022; Wahyuliana, 2022) successfully designed Android-based 2D animation learning media using the ADDIE model, which was declared feasible through a validation test utilizing Flutter and Laravel. These findings confirm the effectiveness of the ADDIE model in producing interactive media; however, most studies have primarily focused on technical aspects. Research that emphasizes the connection between 2D animation media and the learning outcomes and conceptual understanding of vocational high school students remains limited. Therefore, this study introduces the development of ADDIE-based 2D animation to support science learning in Grade 10 vocational high schools.

The Analysis and Design stages of the ADDIE model play a crucial role in identifying student needs and the characteristics of learning before designing the media. Studies conducted by (Ningrum et al., 2021; Susanti & Ummah, 2021; Wulandari, 2024) indicate that the initial stages of ADDIE can produce animation media with validation scores above 85%, with the majority of students surpassing the Minimum Mastery Criteria (KKM). However, these studies have not yet highlighted the relevance of the media to the needs of vocational high school students in understanding science. Therefore, this study emphasizes the design of ADDIE-based 2D animation that is not only technically valid but also specifically aimed at improving the learning outcomes and conceptual understanding of Grade 10 vocational high school students.

A survey conducted at SMK Muhammadiyah 1 Purbalingga revealed that despite advancements in information technology, teachers rarely utilize computers for innovative learning media. Interviews with teachers and the vice principal also indicated that the learning process remains largely conventional, causing students to lose interest and struggle in understanding the material. This condition underscores the need for more adaptive learning media, such as 2D animation visualization. Several previous studies on similar topics were used as comparisons, references, and supporting evidence in this research. Among them, (Ayuni et al., 2022; Fathoni et al., 2020; Ningrum et al., 2021) suggested that animated videos or tutorial videos offer additional advantages, such as being more feasible, engaging, and practical for students. In another case, research (Fatmawati, 2021; Setiawan et al., 2024) found that animated videos can also serve as an alternative to improve student learning outcomes. However, empirical evidence regarding the specific application of 2D animation media in science learning at vocational high schools remains limited. Therefore, this study is expected to provide a new contribution in addressing this issue.

Based on previous research findings, the development of 2D animation-based visualization learning media has been proven effective in enhancing cognitive

aspects, student learning outcomes, and learning motivation (Handayani et al., 2023; Ikhsanudin, 2021; Kahir et al., 2024). Therefore, this study contributes by presenting 2D animation learning media based on the ADDIE model, specifically designed to support science learning in vocational high schools. The main contribution of this research lies in providing an adaptive, innovative, and applicable learning solution to improve student learning outcomes. Accordingly, the objective of this study is to develop, assess the feasibility, and evaluate the effectiveness of ADDIE-based 2D animation media in improving student learning outcomes in Grade 10 science subjects at vocational high schools.

METHOD

The product used in this study is an animated video based on Motion Graphics. The development model for this learning media follows the ADDIE method as proposed by (Sugiyono, 2022). The ADDIE model has been widely applied in previous studies, such as those by (Amrulloh & Indrianto, 2022; Gunawan & Hazwardy, 2020; Satriawati et al., 2023; Susanti & Ummah, 2021), which discuss the development of learning media using the ADDIE method. These studies highlight that the ADDIE model is relatively effective for testing a product and determining its feasibility. In this study, the participants included Grade 10 students of SMK Muhammadiyah 1 Purbalingga, one science teacher, two media experts, and one subject matter expert. The trial was conducted in two stages: a small group (10 students) and a large group (30 students). Student selection was carried out using *purposive sampling*, taking into account the diversity of academic abilities as well as a relatively balanced gender distribution. Prior to the intervention, the science teacher provided information regarding students' prior knowledge, which revealed that most students still faced difficulties in understanding science material when taught using conventional methods.

Data Analysis Techniques

The data analysis was carried out using validation obtained from:

1. Expert Validation Data (Media and Content)

The data were analyzed by calculating the average score of each indicator, which was then converted into a percentage and categorized into feasibility criteria (very feasible, feasible, moderately feasible, less feasible, not feasible). These criteria were adapted from the study of (Ayuni et al., 2022), which had been previously validated.

2. Teacher and Student Response Questionnaire Data

The data were processed using a similar method with a 5-point Likert scale. The scores obtained were converted into percentages to determine the practicality and feasibility level of the media. The instrument was adapted from validated instruments used in previous studies (Pratiwi & Kasriman, 2022; Sari & Huda, 2022). The reliability of the instrument was tested using internal consistency (Cronbach's Alpha) to ensure the stability of respondents' answers.

3. Student Learning Outcomes Data

The data were analyzed by calculating the average scores and the percentage of mastery learning. Classical mastery was determined by comparing the number of students who achieved scores \geq *Minimum Mastery Criteria* is 70 with the total number of students (30). To strengthen the analysis, post-test results from both the small group and large group trials were compared to examine the consistency of learning outcome improvements. The test consisted of 10 multiple-choice questions developed based on the basic competency indicators of the respiratory system material. The test items were validated by the science subject teacher to ensure alignment with learning objectives and an appropriate level of difficulty.

Adapted from the study by (Ayuni et al., 2022) a likert scale was used to determine the threshold criteria, as shown in Table 1.

Table 1. Likert Scale

Criteria	Score
Strongly Agree (SA)	5
Agree (A)	4
Somewhat Disagree (SD)	3
Disagree (D)	2
Strongly Disagree (SDA)	1

Then, the percentage was calculated to process the ideality of the obtained data using the following formula (1):

$$(P) = \frac{\text{score obtained}}{\text{maximum ideal score}} \times 100 \% \tag{1}$$

The scores were then converted into qualitative data for interval or distance comparison, as shown in Tables 2, 3, and 4 below. The instrument was developed by adapting indicators from similar studies (Aprilianto et al., 2022; Ayuni et al., 2022) and tailored to the needs of Grade 10 science subjects. Content validity was obtained through expert judgment from two media experts and one subject matter expert.

Table 2. Feasibility Categories

Interval	Criteria
80% < Score \leq 100%	Highly Feasible
60% < Score \leq 80%	Feasible
40% < Score \leq 60%	Moderately Feasible
20% < Score \leq 40%	Less Feasible
0% \leq Score \leq 20%	Not Feasible

Table 2 above shows the feasibility scores in percentage form. These scores will be used to assess the feasibility of the animated video media.

Table 3. Practicality Categories

Interval	Criteria
80% < Score ≤ 100%	Highly Practical
60% < Score ≤ 80%	Practical
40% < Score ≤ 60%	Moderately Practical
20% < Score ≤ 40%	Less Practical
0% ≤ Score ≤ 20%	Not Practical

Table 3 above presents the practicality scores in percentage form. These scores will be used to assess whether the animated video is highly practical for use by Grade 10 students.

Table 4. Effectiveness Categories

Interval	Criteria
80% < Score ≤ 100%	Highly Effective
60% < Score ≤ 80%	Effective
40% < Score ≤ 60%	Moderately Effective
20% < Score ≤ 40%	Less Effective
0% ≤ Score ≤ 20%	Not Effective

Table 4 above shows the effectiveness scores in percentage form. These scores will be used to determine whether the animated video is effective for use in science learning. All of the tables above will be used as benchmarks to evaluate whether students can improve their learning outcomes through the use of 2D animation.

RESULT AND DISCUSSION

The results of this study utilized the Research and Development (R&D) procedure with the ADDIE model, which can be seen in Figure 1 as follows:

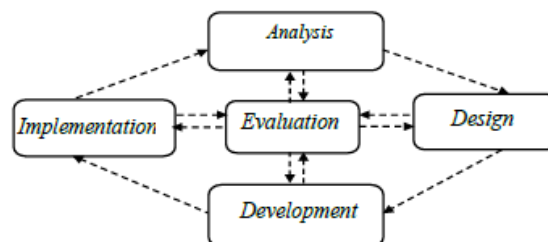


Figure 1. ADDIE Procedure

Analysis

In the first stage, a needs analysis was conducted through observations and interviews to identify existing problems (Safitri, 2020). This process resulted in the development of appropriate problem-solving strategies related to the learning media to be used in science instruction. Observations and interviews with the science teacher revealed that, throughout the teaching process, only lectures and

PowerPoint presentations were employed. Interviews with students indicated a lack of innovation, making the learning process appear monotonous, which resulted in low scores in science subjects. Based on this information, an evaluation was carried out in the first stage, namely the analysis stage. Drawing on the analysis of student characteristics, curriculum, and student needs, the researchers developed educational media in the form of an animated video for the respiratory system module in living organisms for Grade 10 students at SMK Muhammadiyah 1 Purbalingga, aiming to help students more quickly master the presented module.

Design

In the second step, the researchers designed the materials required for product development. The content was selected based on the textbooks available at the school and used to create a story plot that explains the material or theory. Once the content was compiled, voiceovers for characters (dubbing) and background music were added. Next, the researchers used the After Effects application to design the 2D animation. After Effects is user-friendly and produces videos that can attract students' interest during the learning process (Fitria & Reinita, 2022). The 2D animated video covers several key topics, including the characteristics of living organisms, with a particular focus on the respiratory system of humans, animals, and plants.

Development

The development of 2D animation visualization media was carried out based on a storyboard using software such as After Effects. In developing the learning media, the researchers also recorded audio narration, similar to the approach used by (Aprilianto et al., 2022) to be applied in the animated instructional video. The learning media was subsequently validated by media experts as well as the subject teacher and the vice principal of curriculum, who acted as content experts. The media experts assessed the video specifications in terms of media characteristics and visuals, while the content experts evaluated the appropriateness and accuracy of the material. The final product of the animated video, which was developed and validated, consists of the following sections:

a. Opening Section

The opening section, as shown in Figure 2, presents the school logo, the video title, and background music that plays from the beginning to the end.



Figure 2. Opening Section Display

b. Main Content Section

The visualization of the material in this section covers the topic of the respiratory system in humans, animals, and plants. Figure 3 illustrates the 2D animation results for the human respiratory system.

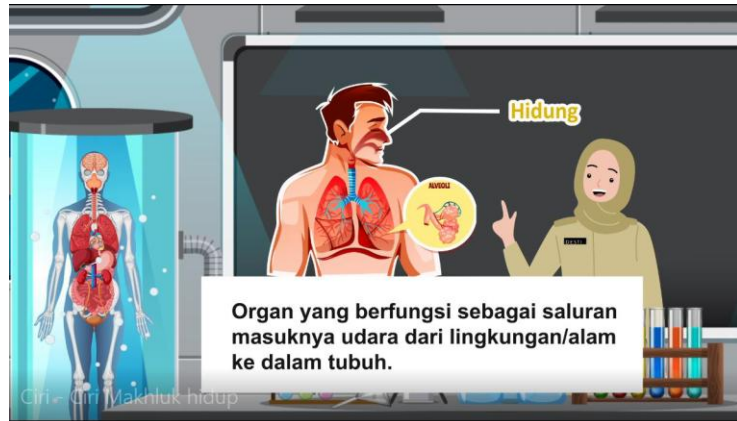


Figure 3. Visualization of the Human Respiratory System

Meanwhile, Figure 4 below presents the visual result of a 2D animation illustrating the respiratory system in animal.



Figure 4. Visualization of the Animal Respiratory System

Furthermore, Figure 5 depicts the 2D animation of the plant respiratory system.



Figure 5. Visualization of the Plant Respiratory System

c. Closing Section

This section includes acknowledgments to the video production team and SMK Muhammadiyah 1 Purbalingga.

d. Stage 4: Validation

The animation was validated by media experts. Based on the validation results from two media experts, the animated video for science learning was evaluated in terms of media aspects, visual appearance, quality, technique, and effectiveness, and was categorized as feasible for implementation in the testing stage. In addition to the assessment, the media validators also provided constructive feedback, including:

- 1) The character narration should be made louder, while the background music volume should be reduced.
- 2) The text size should be enlarged, and the text color must contrast clearly with the background.

The aspects evaluated included video playback, audio clarity, image or video clarity, text clarity, and video creativity. The score obtained from the media experts' assessment was 87%, which falls into the "highly feasible" category. The second stage of validation was conducted by content experts, focusing on the appropriateness of the material presented in the 2D animated video. The results of the content validation showed a score of 80%, also categorized as "highly feasible." These findings demonstrate that the developed media not only meets the technical requirements of presentation but also aligns with the learning needs of science education in vocational high schools.

Implementation

After obtaining validation from media experts and subject matter experts, the next stage was the implementation of trials with student participants. The testing process was conducted in two phases, namely small-group and large-group experiments.

a. Small-Group Experiment

In this phase, the researcher presented the animated video, which had been designed and validated, to students during the learning session. The video was shown after the teacher delivered an introductory explanation of the lesson as a preliminary activity. Following the video presentation, the students were given a post-test consisting of 10 items developed based on the animated video content. After completing the post-test, the students were asked to fill out a response questionnaire. The small-group experiment involved 10 students selected heterogeneously. The results demonstrated a very practical score of 82.5%, particularly in terms of the ease of understanding the animated video. Based on these findings, it can be concluded that students were able to comprehend the material effectively when delivered through the video.

b. Large-Group Experiment

The large-group experiment involved 30 tenth-grade students selected heterogeneously. After viewing the animated video, the students were administered a post-test, followed by a response questionnaire. The questionnaire consisted of five indicators: (1) Video Normalization, (2) Topic Relevance, (3) Text Quality, (4) Audio Quality, and (5) Video Attractiveness.

Table 5. Response Points

Indicator	Respondents	Total Score	Percentage
1	30	119	99,16 %
2	30	111	92,5%
3	30	111	92,5%
4	30	117	97,5%
5	30	109	90,83%

From the percentage results of the five indicators presented in [Table 5](#), the average score obtained was $X = (99.16\% + 92.5\% + 92.5\% + 97.5\% + 90.83\%) = 94.49\%$. Therefore, it can be concluded that the findings from the large-group respondents, based on the five indicators, achieved an average of 94.49%, which falls into the category of highly feasible and highly practical.

Evaluation

In this study, data were collected using three primary techniques: observation, interviews, and questionnaires. Observation was conducted to identify challenges or problems within the school, while interviews were carried out to validate and confirm the findings from the initial observations. Following the evaluation stages of analysis, design, development, and implementation, the outcomes of the implementation were assessed based on scores obtained from both teacher and student responses.

a. Results of the Teacher Response Questionnaire

The teacher response questionnaire was distributed to and completed by the science subject teacher after viewing the instructional animation video. The results of the questionnaire, based on five indicators, are presented in [Figure 6](#).

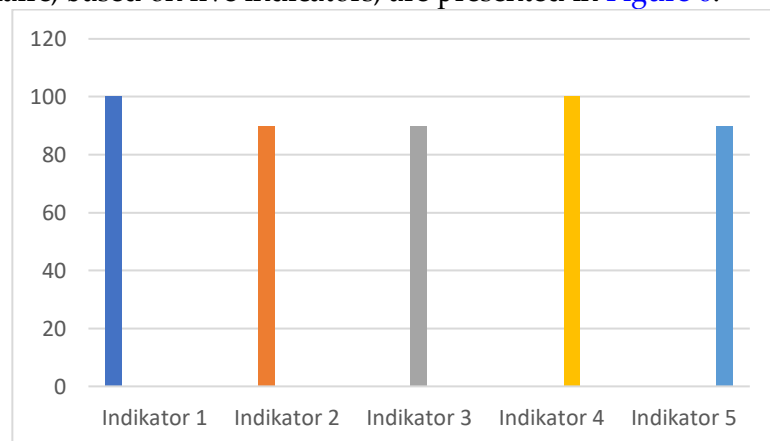


Figure 6. Indicators of Teacher Response Results

It can be concluded that the teacher’s response yielded an average score of 94%, which falls within the highly feasible and highly practical category.

b. Summary of Post-Test Results

The accumulation of post-test results from both the small-group and large-group trials was conducted to assess the feasibility of using the animated video as a learning medium for 10th-grade students. The outcomes of the post-test administered to a total of 30 participants are presented as follows.

Table 6. Post-Test Results Score

Validation Type	Percentage / Score	Criteria
Highest Score	100	Highly Feasible
Lowest Score	70	Feasible
Average Score	92,25	Highly Feasible

Based on [Table 6](#), it can be observed that the lowest and highest scores range from 70 to 100, with an average score of 92.25. The consistency between expert validation (87%), teacher responses (94%), and student responses (94.49%) indicates a shared perspective that the media is practical, engaging, and feasible for use. Therefore, it can be concluded that the development of instructional media in the form of animated videos for science subjects at SMK Muhammadiyah 1 Purbalingga is categorized as highly feasible and practical to be implemented in the learning process.

The findings of this study confirm that the development of 2D animation-based learning media using the ADDIE model is effective in enhancing learning motivation and conceptual understanding of Grade 10 vocational high school students in science subjects. These results are consistent with the study by [\(Fatmawati, 2021\)](#) which developed Powtoon animation videos for English learning at the elementary level during the pandemic, demonstrating that animated media effectively increased students’ learning interest and facilitated material comprehension. Similarly, [\(Ayuni et al., 2022\)](#) developed mathematics learning animations integrated with entrepreneurial values, which proved to improve critical thinking skills among elementary students through visualized content. Nevertheless, the novelty of this study lies in its application within the vocational high school context and its focus on the integration of 2D animation in science learning. This provides a meaningful contribution by extending the use of animation as a learning medium that is not only technically feasible but also relevant to the needs of vocational students. Thus, the findings of this research not only reinforce previous evidence but also offer new perspectives on the role of digital animation in science education at the vocational secondary school level.

CONCLUSION

This study demonstrates that the development of 2D animation-based learning media using the ADDIE model is not only considered technically feasible by experts, teachers, and students but also proven effective in enhancing conceptual

understanding and learning motivation among vocational high school students in science subjects. These findings highlight that the integration of animation-based visualization in learning can overcome the limitations of conventional methods, which are often monotonous, while providing learners with a more interactive, engaging, and meaningful learning experience.

Theoretically, this study enriches the body of research on learning media development by emphasizing the role of the ADDIE model in producing 2D animation products that are not only valid in terms of content and design but also relevant to vocational learning needs. Practically, the findings provide guidance for teachers in utilizing digital animation as an effective medium to improve learning outcomes and serve as a consideration for policymakers in promoting the integration of creative technologies in science learning at vocational high schools. Nevertheless, this study has several limitations, including the relatively small number of participants, the scope of materials limited to a single science topic, the lowest score recorded at 70, and the relatively short duration of the trial. These limitations imply that the generalization of findings should be made with caution. Therefore, further research involving larger samples, broader material coverage, and longer implementation periods is necessary to strengthen the evidence of the effectiveness of 2D animation media across various learning contexts.

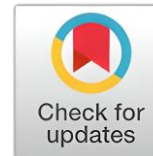
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Enhancement of folk story writing containing pancasila profile character values

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Abstract

The aim of this research is to develop the writing of folk tales that contain the character values of the Pancasila profiles as reading material recounts. The character values in folklore are developed based on themes and messages, encompassing global diversity, mutual cooperation, creativity, critical thinking, independence, and faith in God Almighty. Understanding these values is reinforced through folklore retelling. The folklore development follows the ADDIE model with three main stages: analysis, design, and development. Data were collected from orally transmitted folklore, including fables, myths or legends, adventure stories, fantasy tales, and fairy tales. Analysis was conducted on folklore structure, retold story structure, Pancasila character values, and the need for folklore writing through surveys and expert validation. The folklore development stage involved validation by teachers, education experts, and students. Data analysis was conducted using a qualitative descriptive approach. The quality of folklore teaching materials received an excellent rating, with scores of 95% from textbook subject matter expert and 93% from storyteller experts. Thus, folklore containing Pancasila character values is deemed suitable for implementation in the MK lecture on the development of teaching materials in language. Indonesian Language and Literature Education Study Program and study materials for the MK Literacy in the Language Education Masters Study Program.

Keywords: Character Value; Folklore; Pancasila Profile; Recount.

INTRODUCTION

One of the objectives of Indonesian language lessons in schools is to foster awareness of local culture and the surrounding environment. This objective is in line with the characteristics of Indonesian language lessons, which are to develop language skills based on linguistic competence; the ability to understand, appreciate, respond to, analyze, and create literature; and critical, creative, and imaginative thinking. The development of language competence is the foundation of literacy skills ([Badan Standar Kompetensi dan Akreditasi Pendidikan, 2024](#)). Therefore, strengthening literacy skills through Indonesian language subjects for various communication purposes in the context of Indonesian social culture, such as appreciating Indonesian folklore, can also be used for the purpose of developing language competence, appreciation skills, and creative and imaginative thinking skills. Various studies that emphasize narrative text comprehension or appreciation of folk tales are used to examine values that can strengthen literacy, such as cultural understanding, character value understanding, and character education.

Folktales as a medium for character education can play an important role in shaping a person's behavior. This is because the characters in folktales provide examples of how to act. This is in line with Bandura's Social Learning Theory, which explains that people learn through observation and imitation ([Kusuma & Nurzaman, 2024](#)). The process of

observation and imitation is carried out by looking at behavioral models seen in the social environment, such as through folk tales that have been passed down from generation to generation (Sidik & Putraidi, 2018). In addition, the Literary Anthropology approach provides a relevant framework for analyzing folk tales as cultural values and the character of the community that owns them, which can be observed and imitated as a step in character building. Literary anthropology is also defined as an effort to study attitudes and behaviors that emerge as culture in literary works (Endraswara, 2013). Thus, folk tale books become an effective tool in character education for communities, students, and guardians of national culture.

Education and character development of the nation as reflected in folklore should be well documented and remain part of national character education. In addition, character building has been firmly incorporated into the values embraced by society and even forms part of the nation's philosophy of life. As explained, folk tales reflect the principles of Pancasila as a reflection of Indonesian life, so that children indirectly learn about Indonesian culture. Through the origins of these folk tales, such as the characters in the stories and the historical evidence from the stories that can still be seen and witnessed today, it is very helpful to instill Pancasila principles in children's characters. Through the Pancasila philosophy, character values are emphasized as guidelines for life. This is in line with (Melasarianti, 2015), who states that character education through folk tales is in line with the values of Pancasila, which is the philosophy of life of the Indonesian people. Folktales contain values such as mutual cooperation, tolerance, and integrity, which are part of character education in accordance with the principles of Pancasila. Therefore, there is a great responsibility in character education carried out by the concern of the entire community that owns the culture, one of which is the culture in the form of folktales.

Rewriting folk tales in the form of recount texts is not only about the topic of the story but also serves to develop the characters, highlight the values of community wisdom as the setting of the story, and incorporate character values that are in line with the Pancasila profile. The character values incorporated in the writing of folk tales can be values that are embraced in global society, such as 21st-century character values. Meanwhile, the Pancasila values incorporated into the writing of folk tales refer to the principles of Pancasila, namely the values of faith and devotion to God Almighty and noble character, global diversity, mutual cooperation, creativity, critical thinking, and independence (Anwas, 2010).

The development of folk tales that contain character values and Pancasila values is one of the supporting elements in the learning process. Character education through the process of learning folk tales in the classroom is considered to be in line with the needs of learning arts and culture, citizenship, Indonesian language, and even religion. This is in accordance with the principle of learning that learning must be in line with needs (Oktaviani & Chan, 2023). Teaching materials that are tailored to learning needs include knowledge, skills, and attitudes (Oktaviani & Chan, 2023). Good teaching materials not only provide theoretical information but also need to be applied. Teaching materials for writing stories are one form of applying information on character, culture, and Pancasila values.

The results of developing folk tale writing can support the writing of narrative texts, for example in Indonesian language learning, such as developing narrative texts, developing folk tale writing skills, and retelling stories by formulating an outline. The story outline teaches what the characters want, why, the obstacles they face, and the resolution. This is in line with research on the development of Indonesian language teaching materials based on folk tales from Banjarnegara Regency, which shows that these teaching materials are valid and suitable for use (Martha & Andini, 2019). Thus, character values are certainly included in a folk tale. In addition, the outline of a folk

tale contains rich literacy (multiliteracies), not just cultural literacy. The use of folk tales as material for writing narrative texts in Indonesian language learning has been recognized as effective in developing writing skills, particularly in composing narrative texts such as retellings and short stories. Research results show that the use of illustrated folk tale books can increase students' reading literacy activities, which in turn supports the development of their writing skills (Asip et al., 2019).

As a means of strengthening literacy, folklore comes in various forms, such as recounts, short stories, and children's stories. Meanwhile, folklore texts appear in the form of fairy tales, myths or legends, adventure stories, fantasy stories, and fables, each of which has a text structure consisting of an introduction or orientation, a problem or complication, and a problem-solving or resolution, as well as containing multiliteracy. In addition, the integration of character values in the material for writing folk tale-based stories can serve as scaffolding for character education for students. This is in line with research findings showing that the development of affective competencies through folk tales can be used to develop ideas or concepts in composing short stories, thereby supporting character education through teaching materials that contain local wisdom values (Kusmana & Nurzaman, 2021).

The multiliteracies conveyed by folklore can still be expressed in the form of retellings, short stories, and children's stories. Collections of folklore that have been published can be a source of reading material that instills character education and multiliteracies. Thus, collections of folklore books are useful for strengthening literacy in families, communities, and schools. The school literacy movement and the community literacy movement can utilize folk tale books. The concept of the community literacy movement and school literacy is in line with the course descriptions in the Indonesian Language Education Study Program and the Indonesian Language and Literature Education Study Program at the Faculty of Humanities, UNJ.

METHODS

This study applies the ADDIE development model, which stands for Analysis, Design, Development of Production, Implementation or Delivery, and Evaluation. The ADDIE development model consists of activities that realize product design (Cahyadi, 2019). The prototype product to be created will be material on the values of Pancasila in the writing of folk tale retellings. In this study, the ADDIE stages adopted are the analysis, design, and development steps, as explained below.

In the analysis stage, researchers distributed questionnaires to analyze the needs for rewriting Indonesian folk tales. This stage aimed to identify students' needs in developing material for rewriting folk tales that contain the values of Pancasila.

At the design stage, the prototype material development plan was prepared based on the results of the needs analysis. The prototype included Pancasila character values such as mutual cooperation, creativity, and independence, which were integrated into the writing of the reconstruction stories.

Next, the development stage that had been designed was further developed with reference to the findings in the analysis stage. This prototype was developed in the form of a manual that included material and guidelines for writing folk tales by integrating the values of Pancasila. After the prototype was completed, it was validated by teaching material experts and story experts to assess the suitability of the content, presentation, language, and graphics. After going through the development and validation stages, the prototype of the folk tale writing material was used in the learning process at the Indonesian Language Education Study Program, Faculty of Language and Arts, Jakarta State University. This stage involved students as test subjects to see the usefulness of the folk tale writing material. An evaluation was then conducted to assess the results of the prototype testing of the story reconstruction

writing material. This evaluation involved collecting feedback from students and lecturers, as well as analyzing the use of the story reconstruction writing material in learning activities to develop folk tale reconstruction texts. The results of this evaluation were used to improve and refine the story reconstruction writing material before it was implemented more widely.

RESULTS AND DISCUSSION

The theory of character values through the Pancasila philosophy as a guideline for life to be integrated into the material for writing folk tales, as stated by Melasarianti (2015) and Anwas (2010) in their research. It is explained that Pancasila values, such as faith in God Almighty and noble character, global diversity, mutual cooperation, creativity, critical thinking, and independence, are part of character education.

In this study, the character values and Pancasila profile values developed in rewriting folk tales in the form of reconstructed texts fulfill the principles of applying character information, cultural information, and Pancasila values. Thus, the development of materials based on folk tales or in the form of folk tale outlines contains rich literacy (multiliteracies). This is in line with Asip, et al. (2009) and Kusmana & Nurzaman (2021). Recon text writing material can serve as scaffolding for student character education because the material created integrates character values and contains local wisdom values.

The research began with the distribution of a needs analysis questionnaire, followed by the transcription of folklore such as fairy tales, legends/myths, adventure stories, fantasy stories, and fables. Next, the structure of the folklore was analyzed, including the introduction/orientation, problem/complication, and problem solving/resolution. In addition, the character values contained in the story were also identified. The results of this analysis were used as the basis for the design of the folk tale reconstruction writing material to be developed. The results of the analysis are as in Table 1.

Table 1. Design

Rewriting Stories / Reconstruction (structure: introduction, recording, events, reorientation)	Pancasila Character Profile Values					
	Believe in God Almighty, be devoted to Him, and have noble character	Creative	Working Together	Glo bal Div ersi ty	Crit ical Thi nki ng	Inde pend ent
Bitari (Balinese folk tale)	✓		✓	✓	✓	✓
(Introduction) I Nyoman Jayaprana, later called Jayaprana, was the only surviving child of a family struck by a plague in the village of Kalianget. His two siblings (one boy and one girl) and his parents died from the plague. As an orphan, little Jayaprana took the courage to come and serve at the palace, where he was accepted. He						

was a very diligent servant, so King Kalianget loved him dearly. Jayaprana grew up, and at the age of 12, he already had a handsome face and a sweet smile.

(Recording of Events)

One day, the king ordered Jayaprana to choose one of the ladies-in-waiting or girls outside the palace to be his life partner.

Although he had no intention of finding a wife because he was still a child, Jayaprana could not refuse. Finally, Jayaprana found his beautiful soulmate named Ni Layonsari or Layonsari, who was the daughter of Jero Bendesa from Banjar Sekar. After receiving Jayaprana's report, the king wrote a letter to Jero Bendesa to marry Layonsari to Jayaprana.

The letter from the king was approved by Jero Bendesa. The wedding ceremony was set for Tuesday, Legi Kuningan. When they appeared before the king, Jayaprana and Layonsari bowed respectfully to His Majesty. For a moment, the king was speechless as he gazed upon Layonsari's beauty. After the wedding ceremony was over, the newlyweds returned home. **The king gathered all his servants to ask for their opinion on separating the couple so that Layonsari could become his wife.** After hearing various suggestions, the king ordered Jayaprana to go to Celuk Terima to investigate the boat that had been destroyed by the robbers.

Even though it had only been seven days of honeymoon, Jayaprana could not refuse even though his wife did not approve. Moreover, Layonsari had a bad premonition from her dream about her husband. But in the end, Layonsari could only surrender and pray that her husband would safely carry out his royal duties. During the journey with the entourage, Jayaprana often had bad premonitions and knew that he would be destroyed. Upon arriving at Celuk Terima, Patih Saunggaling handed over a letter

stating that Jayaprana must be killed and his wife become the king's property.

After reading the letter, Jayaprana wept bitterly while begging for the order not to be carried out. **However, he also realized that the king's orders could not be refused. Moreover, he was cared for and raised by the king.** With tears streaming down his face, Jayaprana invited Patih Saunggaling to kill him.

(Reorientation)

With a heavy heart, Patih Saunggaling drew his dagger, blood spurting forth along with a fragrant scent and strange phenomena from the sky and earth, such as hurricanes and earthquakes.

Jayaprana's body was then buried. It is believed that his grave can be found in the Celuk Terima Forest. The group returned home with heavy hearts. On the way, many members of the group died from snake bites and tiger attacks. The news of Jayaprana's death reached his wife, Layonsari. Layonsari was devastated, feeling that her life was meaningless without her beloved husband. Finally, Layonsari stabbed herself in the chest with a dagger. She died following her husband. The king, upon hearing the news of Layonsari's death, was saddened and eventually committed suicide.

Based on the results of the analysis at this design stage, it appears that the folk tale entitled Bitari contains character values in line with the values of Pancasila, such as faith, devotion to God Almighty, noble character, mutual cooperation, global diversity, critical thinking, and independence. The character values added to the folk tale are in line with the opinion that [Ekowarni \(2010\)](#), which influence all human thoughts and actions, are actually inherent in human character. These values are noble values (super values) that serve as guiding principles for achieving a higher level of humanity, a meaningful life, peace, and happiness. The values and behaviors of characters in folk tales can be used as a means to develop students' character by observing and imitating the characters' behaviors and values reflected in the environment of the folk tales. This is in line with the concept of the anthropological approach to literature presented by [Endraswara \(2013\)](#) shows that folklore contains cultural values and community characteristics that can be observed and imitated as an effort to build character. The use of these values takes the form of imitation and emulation applied to students so that they become the basis for thinking and behavior. This is in line with the explanations of [Kusuma & Nurzaman \(2024\)](#) and [Sidik & Putraidi \(2018\)](#), who state that a person can learn through a process of observation and imitation by

looking at behavioral models found in the social environment in folk tales that have been passed down from generation to generation.

Through these values, it is hoped that they can be used as a reference or foundation in teaching and developing character values in accordance with the values contained in Pancasila. This is also in line with the opinion of [Doni \(2010\)](#) that character is defined as a set of values that lead to a system, which underlies the thoughts, attitudes, and behaviors that are displayed. A person's specific behavior, attitude, or thoughts based on certain values will reveal their character.

Development

Realization of Folklore Development

The rewriting of stories is done by translating or paraphrasing folk tales while maintaining the chronology of the story. In addition, the writing also adds Pancasila character values by paraphrasing linguistic units (words, phrases, clauses, and sentences) that are identified as containing character values.

Lita' Sallemo

(Folktale of the Mandar People by Syuman Saeha and Hendra Djafar)

According to the story, in ancient times there was a great kingdom called the Kingdom of Binuang, one of the seven kingdoms in Pitu Ba'bana Binanga. The other kingdoms were the Kingdom of Balanipa, the Kingdom of Cendana, the Kingdom of Banggae, the Kingdom of Pamboang, the Kingdom of Mamuju, and the Kingdom of Tappalang. The Binuang Kingdom was led by a king called To Makaka. One day, the king wanted to know the strength of unity throughout the entire territory of To Makaka Binuang, which region was the most united, and which held the highest sense of unity. So, To Makaka held a competition to find out who were the most united people in his territory. Each region was summoned to participate in the contest to test which region had the strongest unity. The western, eastern, southern, and northern regions gathered at the location designated by To Makaka Binuang.

Each resident of the region showed their strengths before To Makaka Binuang. The first to demonstrate their abilities were representatives from the eastern region. After asking permission from To Makaka, a group of people from the eastern region joined forces to move a very large rock by lifting it together. Seeing this, the audience applauded. It was then the turn of the southern region. The residents of the southern region paid their respects to To Makaka and then quickly ran into the forest. A few moments later, they returned to To Makaka with a pig they had hunted in a short time, and the audience cheered again. It was time for the people from the eastern region to show their skills. They immediately dived into the river to catch fish. After catching the fish, they grilled them and distributed them equally to everyone. The audience was once again amazed. Finally, it was the turn of the residents of the western region. After paying their respects to To Makaka, the people from the western region also wanted to show their skills. The elder from the western region ordered his people to gather under a tall areca nut tree. The elder warned his relatives who had come from the western region.

“I am going to cut down this areca nut tree. When it falls, you must catch it. Do not let it fall to the ground. Do you understand?” said the elder from the western region.

“We understand.” The people from the western region cheered, ready to carry out the order.

The palm tree was slowly being cut down by the elders while the people lined up under the tree, ready to catch the palm tree that was about to fall. To Makaka and the participants watched the heroic event with bated breath. The cracking sound of the roots and trunks of the palm tree was clearly audible, and all the attendees rose from their seats. As the tree was about to fall, the people from the western region caught the areca nut tree with their

bare hands, holding the tree's trunk so that it did not touch the ground. The participants from other regions and everyone who witnessed the event applauded loudly, amazed and relieved to see that no one was injured by the deliberately felled tree. To Makaka finally announced the winner of the competition.

"I would like to express my gratitude to all of you who participated in this competition. You have shown how easy it is to do something when we work together, how easy it is to solve a problem when we unite to solve it. We must always maintain this unity and instill it in our children because by uniting, the land we stand on will continue to have a future. Now, since this is a contest, there must be a winner, so I announce that the winner who will receive a prize from me is the contestant from the western region." All the participants applauded.

"With this, I invite the Elders from the western region to come to the palace to receive a gift," continued To Makaka. Based on To Makaka's invitation, the Elders from the western region finally came to the Binuang royal palace. The Elders were invited to stand directly in front of To Makaka.

"This is the first time I have seen great people like you. Your greatness comes from one united heart, so it is only fitting that I give you a gift," said To Makaka as he handed over something in his hand.

"Take this as a gift from me. Remember, live your lives on this land," said To Makaka, giving a handful of soil to the Elders from the western region, who accepted it willingly. After returning from the Binuang royal palace, the Elder called the people of the western region to a meeting.

"My brothers and sisters, To Makaka Binuang has given us a gift in the form of this handful of soil," said the Elder, showing the soil in his hand.

"Melo'di aka lita' sallemo?" A middle-aged man who looked unwell asked.

"This is why I called you all here, to discuss To Makaka's intention in giving us this handful of soil," replied the Elder.

"Why didn't To Makaka give us a lot of rice as a gift? What is this handful of soil for?" another person interjected.

"Perhaps the soil is sacred, and if we keep it, it will turn into gold," added a young man who was present at the meeting.

"Where did To Makaka get the soil?" asked another person.

"This land was already in the palace when To Makaka took it and gave it to me. To Makaka also told us to all live on this tiny piece of land." The elders who got the gift from To Makaka were also confused.

"It seems that To Makaka does not respect us. How can we all live on a handful of land? This is an insult!" Someone began to get angry.

"Don't think hot-headed, only cool heads always get good and wise results," the elder tried to calm the situation.

"You should ask To Makaka what this handful of soil is for," said another.

"I am embarrassed to ask, because I think To Makaka is the person who cares most about the people, so surely the gift he gave us is a sign of his concern for us," added the elder.

"All right, since it is getting late, it would be better if we continue this discussion tomorrow," said the oldest person among those present. In the end, the discussion was fruitless. No one could solve the riddle of the handful of soil given by To Makaka. The elders from the western region had held six meetings over seven nights.

"If we still cannot reach a conclusion tonight about why this handful of land was given to us, then tomorrow we will return to the palace to ask To Makaka about the meaning and purpose of giving us this land," said the elder, reopening the discussion on the seventh night.

"The Elder is right, we should return to the palace to get an answer from this handful of soil." Several people agreed with the Elder.

“Wait a minute! To Makaka gave us a handful of soil as a gift, then asked us to live on that soil,” a young man suddenly spoke up.

“That’s right, that’s what To Makaka said,” the Elder confirmed.

“What To Makaka meant was that we should destroy the *lita' sallemo*, or handful of soil, and then go around scattering it until it was all gone. That would be the extent of our territory. That would be our land, the land where we could live without any more disturbances, because To Makaka had given it to us,” the same young man explained his brilliant idea. Everyone present at the meeting then realized that the *lita'sallemo* given by To Makaka, whose benefits they had debated, which they had thought was a form of insult, was actually a very big gift, much bigger than just a handful of soil. They finally agreed to scatter the *lita sallemo* in several areas as boundaries.

After lengthy negotiations that ended in an agreement to scatter the *lita' sallemo* given by To Makaka Binuang, several people were appointed to scatter the handful of soil. The crushed *lita 'sallemo* was first scattered in the Kanang area, passing through an area that could only be reached by boat, an area with very deep waters that was considered dangerous. The people assigned to scatter the soil were always afraid and anxious while scattering the soil in that area. In the Pattae language, such fear is called killing. Therefore, the area was eventually named Killing.

Arriving in the Killing area, the person assigned to scatter the soil from *lita' sallemo* moved on to a new area. Having successfully crossed the deep waters without any obstacles, the person scattering the soil gave thanks for leaving the Killing area alive. In the Pattae' language, life means *tatuo*. That is also the origin of the name of the area. The second area that was sprinkled with soil was named *Tatuo*. While continuing their journey, the people who were entrusted with sprinkling the soil until it was all used up moved towards the coastal area. The journey to that area was still made by boat, and because they were hungry, they passed the time fishing. Upon arriving at their destination, they roasted the fish they had caught because they had not eaten anything yet. They rested for a while and ate the roasted fish accompanied by the sea breeze, which made them feel very comfortable. The area, which was also one of the areas sprinkled with soil from *Lita' Sallemo*, was finally named *Tonyaman*, which in the Pattae' language means a feeling of comfort.

Leaving *Tonyaman*, the person who was sent to scatter the soil walked towards the mainland. On his way to scatter the remaining soil, he had to pass through highlands with deep ravines and a river flowing below. In the Pattae' language, a deep ravine is called *sarambu*, so the area became known as *Sarampu*. Finally, the handful of soil that was a gift from To Makaka Binuang was scattered all the way to the new market area. A handful of soil is called *lita' sallemo* in the Pattae' language. It is said that this is the origin of the name of the hamlet of *Lemo* in the village of *Kuajang*, *Polewali Mandar* district.

Story Idea Framework

Title: *Lita' Sallemo*

Theme: Unity and wisdom in Mandar society.

Storyline:

1) Introduction:

- Long ago, there was a kingdom called the Kingdom of Binuang, ruled by a king named To Makaka.
- The Kingdom of Binuang was one of seven kingdoms in *Pitu Ba'bana Binanga*.

2) Problem:

- King To Makaka wanted to test the unity and cooperation within his kingdom.
- To Makaka held a competition to test the solidarity between regions.

- Series of Events:
 - Each region demonstrated their strengths and cooperation, such as moving rocks, hunting pigs, and catching fish.
 - The Western region showed their prowess by holding a pineapple tree so that it would not fall to the ground.
- 3) Climax:
- To Makaka announced the Western region as the winner of the contest and gave them a handful of soil as a prize.
 - This prize confuses the community because they do not know how to use a handful of soil.
- 4) Resolution:
- After lengthy discussions, a young man suggests that the soil be scattered across various regions as a symbol of legitimate territorial boundaries.
 - Finally, the handful of soil was scattered in several areas, which were then named Killing, Tatuo, Tonyaman, and Sarampu.
- 5) Closing:
- The handful of soil became a symbol of unity, and the village of Lemo became known as the origin of the name Lita' Sallemo.

Folktale Text Based on Story Structure

Orientation

Long ago, there was a great kingdom called the Kingdom of Binuang, one of seven kingdoms in Pitu Ba'bana Binanga, led by a king named To Makaka. This kingdom was respected for the values of unity and loyalty upheld by its people. To Makaka, a wise king, wanted to test the strength of unity in his realm.

Complication

One day, To Makaka held a competition to find the most cohesive region in his kingdom. Each region—east, west, south, and north—was called upon to demonstrate their ability to work together. Representatives from each region tried to show their cohesiveness before To Makaka. The eastern region successfully lifted a large rock together; the southern region caught wild boars; while the northern region caught fish in the river and shared them with everyone.

When it was the western region's turn, they did something extraordinary. They held up a fallen areca nut tree with their bare hands to prevent it from falling to the ground. Seeing this courage and unity, To Makaka was very impressed.

Resolution

To Makaka announced that the western region was the winner and gave them a handful of soil as a prize. However, the people of the western region were confused about the meaning of the prize. They held discussions to understand the meaning of the handful of soil given by To Makaka.

Coda

After a long discussion, a young man came up with a brilliant idea: the handful of soil was a symbol of their territorial boundaries. They agreed to scatter the soil in the areas that would become their borders, such as Killing, Tatuo, Tonyaman, and Sarampu. Thus, the handful of soil became a symbol of unity and friendship between the regions under the Binuang Kingdom.

Sections with Pancasila Values

- 1) Words/Phrases with Pancasila Values
 - a. "Unity" - reflects the value of Indonesian Unity.
 - b. "Upholding a sense of unity" - contains the value of Mutual Cooperation.
 - c. "One united heart" - reflects Indonesian Unity.
- 2) Clauses with Pancasila Values
 - a. "How easy a task is when we do it together" - demonstrates the values of Mutual Cooperation and Social Justice.
 - b. "Must always be instilled in our children" - demonstrates the value of Belief in One God in continuous character education.
 - c. "Live on this land" - reflects Indonesian Unity in love for the homeland.
- 3) Sentences with Pancasila Values
 - a. "By uniting, the land we stand on will continue to see its future" - contains the value of Indonesian Unity.
 - b. "A cool head always yields good and wise results" - demonstrates the value of Democracy Led by the Wisdom of Deliberation/Representation.
 - c. "To Makaka is a man who cares most about the people" - demonstrates the value of Social Justice for All Indonesian People.
- 4) Paragraphs with Pancasila Values
 - a. The paragraph about the discussion to find the meaning of a handful of soil - reflects Democracy Led by Wisdom in Deliberation/Representation and Mutual Cooperation.
 - b. The paragraph about the division of tasks to scatter the soil reflects Indonesian Unity.
 - c. The closing paragraph, which explains that the handful of soil became a symbol of unity and friendship between regions, reflects the values of Indonesian Unity and Social Justice for All Indonesian People.
- 5) Pancasila Values in the Story
 - a. Belief in One God: Seen in the respect for the king as a trusted and respected leader.
 - b. Just and Civilized Humanity: Seen in how each region is given the same opportunity to show their solidarity.
 - c. Indonesian Unity: Very clear in the purpose of this story, which is to show the importance of unity.
 - d. Democracy Led by Wisdom in Deliberation/Representation: Seen in how the people of the western region discuss to understand the meaning of the gift given.
 - e. Social Justice for All Indonesian People: Realized through the opportunities given to each region and how the handful of soil becomes a symbol of shared ownership that benefits all.

Based on the results of this development, it appears that rewriting folk tales while maintaining the chronology of the story and explicitly incorporating the values of Pancasila can strengthen the function of stories as teaching materials for character education. Stories that are structured systematically and contain moral messages can be used as a reference for educators in character building. Through the elements of the story, such as characters, problems, and their solutions, critical and systematic thinking patterns in writing stories can be taught, and appreciation and multiliteracy can be fostered and improved.

The development of teaching materials on character values through folk tales is in line with research that finds folk tales to be effective material for writing reconstructive texts to be used in the Indonesian language learning process and character education,

because they contain moral messages, local culture, and social values that are relevant in the learning context. This is in line with Zubaedi's (2011) explanation, character education is defined as a deliberate effort to develop virtues or human qualities that are not only good for individuals but also good for society as a whole.

The development of these values is carried out by adding Pancasila character values as needed to the development of teaching materials through various paraphrases (words, phrases, sentences). This is done to support the process of developing folk tales that take cultural values that reflect the Pancasila values that have developed in society.

Through learning to write texts based on folk tales, it is hoped that students will be able to instill the values of Pancasila in their daily lives, thereby creating a good life and becoming individuals of high quality. Thus, students will develop their character and be able to apply the values of Pancasila in the context of culture, arts, ethnicity, heroes, and various other aspects that they have learned. This is also in line with the concept presented by Oktaviani & Chan (2023), which explains that learning principles and teaching materials must be in accordance with learning needs

That include knowledge, skills, and attitudes. Thus, the development of Pancasila character values can be carried out using teaching materials in the form of folk tales that contain cultural values in accordance with Pancasila. During this learning process, it is hoped that students can apply the values of the Pancasila Student Profile in their daily lives, including in the context of cultural traditions, arts, ethnicity, heroes, and various other aspects that they have learned.

CONCLUSION

The research conducted produced a product in the form of teaching materials in the form of retold stories containing Pancasila character values. This research applied the ADDIE development model, namely Analysis, Design, Development of Production, Implementation or Delivery, and Evaluation. The ADDIE development model consists of activities that realize product design, including creating and modifying products. The product to be created is a digital module that can be used by both students and educators. The analysis stage was carried out by distributing a needs analysis questionnaire to analyze the need for retelling materials from Indonesian folk tales. This stage aimed to determine the needs of students in developing retelling writing materials from folk tales that contain Pancasila character values.

The design stage involves developing a prototype for writing the reconstructed stories based on the results of the needs analysis. The prototype includes folk tales with an emphasis on integrating Pancasila values, such as mutual cooperation, creativity, and independence. The design in this development consists of the first step of recording folk tales directly from the original narrators who are the main sources of the stories. The development step is to retell folk tales in a more organized structure in accordance with the reconstruction text structure, namely by including a title, introduction, recording of events, and story reorientation structure, as well as adding and strengthening the values of the Pancasila character profile.

During the development stage, the teaching materials designed in the previous stage were developed and validated by text teaching experts and story experts. Based on the assessment by text teaching experts, a score of 95% was obtained, and by story experts, a score of 93% was obtained, with a rating of very good/highly acceptable. Thus, the development of this retelling of folk tales is deemed suitable for implementation in the teaching materials for the course on teaching materials development in the Indonesian Language and Literature Education Study Program and as study material for the Literacy course in the Master of Language Education Study Program.

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Development of V-Mart Learning Media to Improve Student Interest and Learning Outcomes

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Abstract

This study aims to develop V-Mart learning media based on PowerPoint and Quizizz. It utilised the material of determinants and inverse matrices of order 3x3 which is valid, practical, and effective. Research and Development (R&D) with the ADDIE (Analysis, Design, Development, Implementation, Evaluation) development model was employed. This study involved 97 senior high school students. The instruments were questionnaires validated by media and material experts, and students' tests. The results show that V-Mart was valid and feasible, with an average percentage of 92.19%. The average practicality from each class was 74.71%, 78.00%, and 75.00%. The effectiveness was visible from the classical completion of learning outcomes for each class, which were 81.25%, 84.38%, and 72.73%. There was an increase in learning outcomes for each class of 19.85%, 32.03%, and 31.49%. It thus can be said that V-Mart is worthy of recommendation as an innovative alternative to improve student learning, and can be further developed in other topics and digital learning platforms.

Keywords: ADDIE; Quizizz; V-Mart.

INTRODUCTION

Among the causes of low student interest in Mathematics is the use of unappealing learning media, with abstract symbols exacerbating this condition. A strong interest in learning is hence crucial for achieving good learning outcomes (Vidyastuti, Effendi and Darmayanti, 2022). On the other hand, efforts to increase student engagement in the learning process require teachers to consider both learning approaches and media. Teachers must plan engaging learning processes to encourage students to learn and actively participate.

Mathematics is among the important subjects in STEM, which is made up of important symbols used to realise existing ideas. By studying Mathematics, one can learn to think systematically (Rahmawati et al., 2021), which is significant in life. Learning Mathematics can help students improve their ability to solve everyday problems through critical and logical thinking (Radiusman, 2020). By studying Mathematics, students will be well equipped in obtaining, selecting and managing

information, mastering various problems, and forming systematic thought patterns (Kurniawan, Nurfahrudianto and Yohanie, 2023).

However, students' low interest in Mathematics learning contributes to their poor learning outcomes (Ndraha, Mendrofa and Lase, 2022), and learning achievement (Widiati, Sridana and Kurniati, 2022). Multiple factors influence students' learning interest, such as monotonous and uninteresting learning activities using limited teaching materials – for example, textbooks and whiteboards. During lessons, most students lose focus on what the teacher is saying, resulting in a poor understanding of mathematical concepts.

Therefore, the use of instructional media in learning activities is pivotal in helping teachers achieve the learning objectives (Putra, Sudiana and Pamungkas, 2020). Learning media are tools used to assist and facilitate learning (Pangestu and Setyaningrum, 2020) function to attract students' attention, which further fosters interest and motivation for more comprehensive learning. If students can understand the materials presented and show a learning interest, it means that teachers succeed in the learning process (Anwar *et al.*, 2022). As a class manager, teachers must be able to choose approaches, methods, and learning models that can create active, creative, innovative, effective, fun and interesting learning (Ayu Puspitasari, 2022).

The use of information, communication, and technology (ICT) in learning is increasingly necessary to attract interest and improve student learning outcomes in today's digital age. Learning media is proven to increase the effectiveness and efficiency of teaching and learning activities (Novelza and Handican, 2023). In so doing, teachers can use various media to support the learning process and optimise it. The presence of engaging media can reduce students' boredom, in which using interactive learning media can provide a more enjoyable and effective learning experience for students.

Concurrently, a computer program that has long been developed and utilised to support successful Mathematics learning is Microsoft PowerPoint. It is mostly used for presentation materials to help students understand mathematical concepts promptly (Gulo and Harefa, 2022). Microsoft PowerPoint can be integrated with Quizziz to create an engaging learning environment. Microsoft PowerPoint allows teachers to present material systematically, while Quizziz provides students with the opportunity to practice math problems interactively. With interactive learning, students can participate more actively and reduce boredom (Weddyastuti, 2022).

A study by Ketut Wirnawa dan Putri Sukma Dewi (2022) proved that the use of Microsoft PowerPoint media contributed significantly to student learning outcomes in Statistics material for about 60.3%, with the rest of influencing factors. Meanwhile, research by Setiawan dan Rachmayo (2022) shows that developing Microsoft PowerPoint with interactive hyperlinks can increase learning effectiveness by up to 86% in the very effective category through flexible and interactive material navigation (Wirnawa & Dewi, 2022). Other research also states that the percentage of effectiveness of using interactive hyperlink Microsoft PowerPoint media is 86%, which is considered very effective (Setiawan and Raharjo, 2022). These studies similarly emphasise the positive role of Microsoft PowerPoint in learning. Differences in their foci, however, open up the opportunity for integrating findings

that the general effectiveness found in the earlier study can be improved through innovation in interactive features. The second study, accordingly, serves a strong foundation for research into developing more optimal interactive Microsoft PowerPoint media in improving student learning outcomes.

This study argues the need to advance the Mathematics learning process by utilising existing technological innovations that can help students understand concepts, solve problems, and facilitate the achievement of mathematical goals (Baiduri, Taufik and Elfiani, 2019). In other words, interactive learning media has great potential in improving the quality of Mathematics learning (Setiawan and Raharjo, 2022).

Based on the preliminary test results, the average score was 61.40% in grades XI-7, 52.35% in grades XI-8, and 41.24% in grades XI-9 of MAN 1 Gresik. The low average student learning outcomes are presumably due to the lack of use of learning media. This leads to students feeling bored and tired during the learning process.

On the other hand, one of the advanced Mathematics materials in grade XI is the inverse of a 3×3 matrix. This material is considered difficult for students, as evidenced by the test results. Many students scored below the minimum passing grade of 75. This could be because teachers only taught the material through lectures and questions and answers without using learning media. This present study argues that innovative learning media can facilitate student learning and help them understand the concepts of the subject matter (Amsari *et al.*, 2022). Therefore, this study aims to develop a valid, practical, and effective V-Mart learning media based on Microsoft PowerPoint and Quizziz for the topic of determinants and inverses of 3×3 matrices. The developed media aims to increase student interest and learning outcomes.

METHODS

This study employed the Research and Development (R&D) method, producing V-Mart, a Microsoft PowerPoint-based learning video on determinants and inverses of 3×3 matrices. The selection of subjects was determined based on the results of discussions with MGMP Mathematics teachers at MAN 1 Gresik, as these three classes were the most active in learning activities. The development model that can be used in this study is the ADDIE model, which consists of 5 stages, namely Analysis, Design, Development, Implementation and Evaluation (Fayrus, Slamet and Pd, 2022).

The steps are in the following diagram:

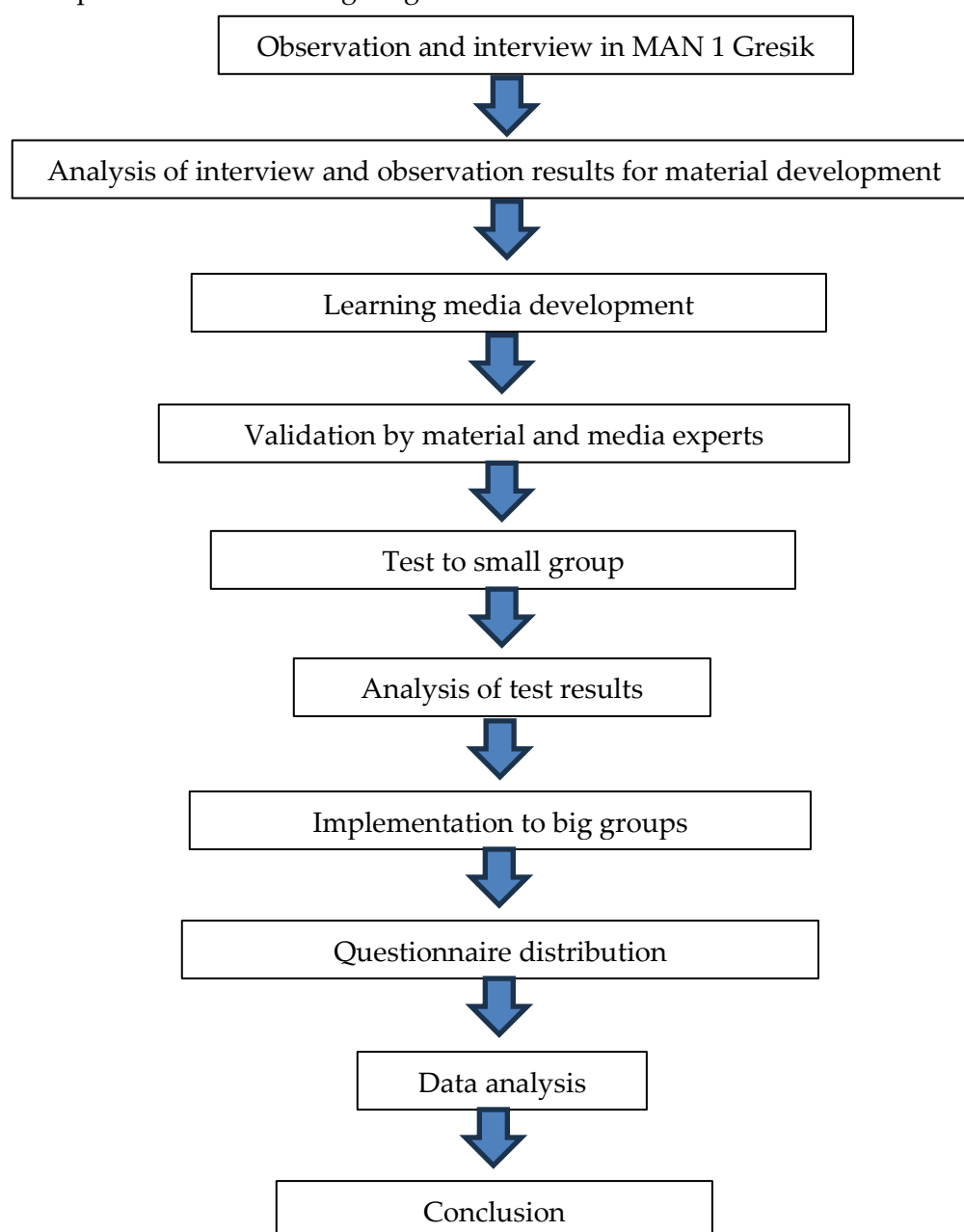


Figure 1. Research steps

V-Mart is a Microsoft PowerPoint-based learning video on the topic of determinants and inverses of 3x3 matrices, uploaded to YouTube. The uploaded video aims to assist student learning; if students do not fully understand the materials, they can replay the video until they understand the material better. To accompany this, practice questions are provided through the Quizziz application with the hope that students can practice questions independently and enjoyably. As facilitators, teachers play a crucial role in improving the quality and achievement of student learning. Teachers must plan an interesting learning process to build enthusiasm central to student learning, and be willing to be actively involved in the learning process (Wulandari, 2020).

Data analysis

1. Questionnaire validity

The Microsoft PowerPoint- and Quizziz-based V-Mart learning media were first tested for validity by a team of experts: two media experts and two material/content experts. The validation questionnaire in this development research used a Likert scale.

Table 1: Likert scale of expert validation

Statement	Score
Very good	4
Good	3
Poor	2
Very poor	1

(Sugiyono, 2024)

The validated questionnaire was further analysed using the percentage of values given by the validator with the formula:

$$V = \frac{\text{score from each validator}}{\text{maximum score}} \times 100\%$$

After obtaining the score from the validator, the average was calculated using the following criteria:

Table 2: Media validity criteria

Percentage (%)	Validity criteria
81 – 100	Highly valid
61 – 80	Valid
41 – 60	Fairly valid
21 – 40	Poorly valid
0 – 20	Invalid

(Arikunto, 2015)

2. Media practicality

The V-Mart learning media, based on Microsoft PowerPoint and Quizziz, was developed for practicality by using a student response questionnaire. The student response questionnaire used a Likert scale, as presented in the following table:

Table 3: Questionnaire for students

No	Item
1.	I found it easier to understand the material on determinants and inverses of 3x3 matrices after the teacher used learning media.
2.	I was more enthusiastic about participating in math lessons that used learning media.
3.	I felt more helped understanding the material on determinants and inverses of 3x3 matrices after the teacher used learning media.
4.	I feel bored if teaching and learning activities don't use learning media.
5.	I study more diligently because of this learning media.

No	Item
6.	This learning media is interesting to me.
7.	I get better grades after using learning media.
8.	I don't feel the benefits of learning media.

Table 4: Criteria for student response

Criteria	Positive statement	Negative statement
Strongly agree	4	1
Agree	3	2
Disagree	2	3
Strongly disagree	1	4

Table 5: Practicality criteria

Percentage (%)	Practicality criteria
80 – 100	Very practical
60 – 79	Practical
40 – 59	Fairly practical
20 – 39	Poorly practical
0 – 19	Not practical

3. Learning media effectiveness

To determine the effectiveness of the developed learning media, a descriptive test was used on the determinant and inverse matrix of order 3x3. Students are considered to have completed the learning if their score meets the minimum KKM (Minimum Completion Criteria) set by the school, which is 75. Therefore, the development of this interactive video would be considered effective if more than 70% of students achieve a score of 75 or higher.

The percentage of class completion was be calculated using the following formula:

$$P = \frac{\text{Students who complete}}{\text{Number of students}} \times 100\%$$

Note:

P : percentage of class completion

Table 6: Effectiveness criteria

Interval (%)	Category
$P > 80$	Very good
$70 < P \leq 80$	Good
$60 < P \leq 70$	Fair
$50 < P \leq 60$	Poor
$P \leq 50$	Very poor

RESULTS AND DISCUSSION

Results

This R&D study resulted in a product, named V-Mart, a Microsoft PowerPoint-based learning video and practice questions using the Quizziz application, covering determinants and inverses of 3x3 matrices in grade XI of MAN 1 Gresik.

The research and development method used was the ADDIE model:

1. Analyse

In the analysis stage, researchers analysed student needs, learning objectives, and the learning media.

Table 7: Test results

Class	Average percentage
XI-7	61.40%
XI-8	52.35%
XI-9	41.24%

Table 7 shows that the average percentage of test scores for previous material was still below the established KKM. This was due to the inadequate use of learning media, which caused students to feel bored and tired during the learning process.

2. Design

At the design stage, researchers designed the outline of the material that would be delivered in the learning media.

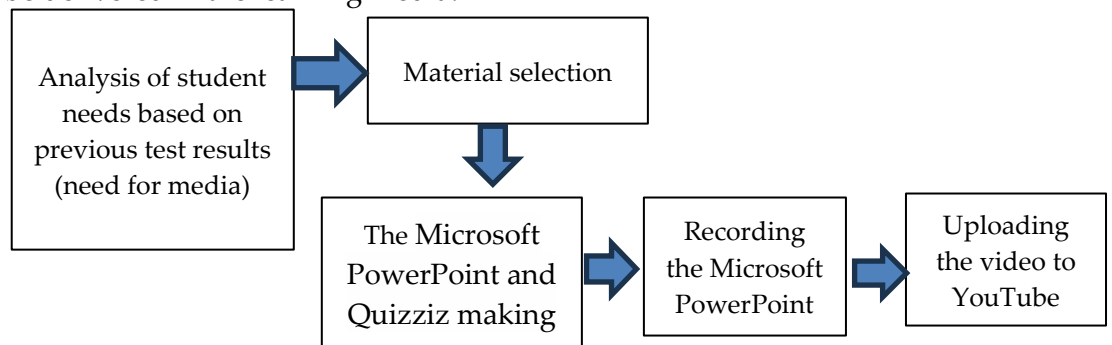


Figure 2. Media plan design

3. Development

During the development stage, researchers created learning media that aligned with the design, which was then validated by two media experts and two material experts. Once the product was deemed suitable by the experts, it was piloted on a small group.

The validation results from the four validators are shown in the following table:

Table 8: Validation results

No.	Validator	Expert	Score	Category
1.	Validator 1	Media	84.38%	Very valid
2.	Validator 2	Media	90.63%	Very valid
3.	Validator 3	Material	93.75%	Very valid
4.	Validator 4	Material	100%	Very valid
Average			92.19%	Very valid

Based on the validation results in Table 8 above, it was found that the learning media developed on the material of determinants and inverse matrices of order 3x3 were declared very valid and feasible in terms of material and media, with an average validity percentage of 92.19%. This high validation result indicates that there is a suitability of the material with the Learning Outcomes (CP), the feasibility of visual design, the appropriate use of communicative language, and the application of systematic development procedures through the stages of needs analysis, limited trials and revisions. Thus, this media has met the feasibility criteria and is considered potentially to supporting learning objectives optimally.

4. Implementation

At this stage, the media was tested on seven students of class XI-7 MAN 1 Gresik on November 5, 2024. This class was chosen because the students were more active than in other classes. The purpose of this small group trial was to determine whether the developed media was practical and effective. To determine the practicality of the developed media, the researcher used a student response questionnaire, while to determine the effectiveness of the media, the researcher used a descriptive test.

Practicality test

Table 9: Results of practicality test

No	Respondent	Score
1.	Student 1	24
2.	Student 2	23
3.	Student 3	25
4.	Student 4	26
5.	Student 5	26
6.	Student 6	24
7.	Student 7	25
Total		173
Average		77.23
Category		Practical

Effectiveness test

Table 10: Results of effectiveness test

No	Respondent	Score
1.	Student 1	100
2.	Student 2	100
3.	Student 3	100
4.	Student 4	100
5.	Student 5	88
6.	Student 6	80
7.	Student 7	64
Total		632
Average		90.29
Category		Very good

From the results of the trial conducted on seven students, there was one student who got a score of less than 75. Meanwhile, the average score was 90.29 in the very good category.

5. Evaluation

In the evaluation stage, researchers analysed the practicality and effectiveness of the media that had been developed previously. After the product was tested on a small group and obtained practical and effective criteria, the product was applied to a large group at MAN 1 Gresik, namely in class XI-7, which consisted of 32 students, XI-8, which consisted of 32 students and XI-9, which consisted of 33 students. Data collection was carried out by distributing questionnaires to determine students' responses to the developed media and a descriptive test of determinant material and 3x3 matrix inverses to determine the effectiveness of the developed media.

Practicality results of the learning media

The practicality of the learning media used was assessed through a questionnaire survey of student responses to the media. The results of the student response questionnaire to the learning media are shown in the following table:

Table 11: Questionnaire response

Class	Number of students	Total score	Percentage	Criteria
XI – 7	32	765	74.71%	Practical
XI – 8	32	801	78.00%	Practical
XI – 9	33	790	75.00%	Practical
Total score			2,356	
Average percentage			75.90%	
Criteria			Practical	

From Table 11, it can be seen that the average percentage of the results of the questionnaire responses of students in classes XI-7, XI-8 and XI-9 to the learning media for the material on determinants and inverses of 3x3 matrices is 74.84% as stated in practical criteria.

Effectiveness results of the learning media

The effectiveness of this learning media is seen from the results of a written descriptive test given to students after completing the learning using the learning media. This learning media was given to students in grades XI-7, XI-8, and XI-9 of MAN 1 Gresik. The results of the learning outcome test can be seen in the following table:

Table 12: Students' results of Class XI MAN 1 Gresik

Class	Number of students	Number of completed students	Number of non-completed students	Classical completeness	Category
XI – 7	32	26	6	81.25%	Very good
XI – 8	32	27	5	84.38%	Very good
XI – 9	33	24	9	72.73%	Good
Average percentage				79.45%	
Criteria					Good

Table 12 shows that the percentage of classical completion for class XI-7 was 81.25%, with very good criteria, for class XI-8 was 84.38%, with very good criteria, and for class XI-9, 72.73%, with good criteria. The average classical completion for the three classes was 79.45%. Therefore, the PowerPoint-based and Quizziz-based V-Mart learning media provided to the three classes were effective in their learning activities.

DISCUSSION

In this study, we developed the V-Mart media, a Microsoft PowerPoint and Quiz-based learning video aimed at improving student interest and learning outcomes. Before being tested in small groups, this learning media was validated by two media experts and two material experts. The validation results showed an average percentage of 92.19%, categorised as very valid. This high validation result indicates that the V-Mart media has met the aspects of content feasibility, design, and integration of learning elements according to media development principles. This is in line with research conducted by [Anomeisa et al. \(2020\)](#), which states that the Microsoft PowerPoint media developed is in accordance with competency standards and content standards in the use of technology, so that it is declared valid and can be used in learning ([Anomeisa et al., 2020](#)). Thus, the validation results in this study not only confirm the technical feasibility of the media but also indicate its effectiveness and relevance to learning objectives.

After obtaining expert validation results, the developed product was piloted on a small group of seven students from grades XI-7 at MAN 1 Gresik. The practicality of the learning media was determined by a questionnaire survey of student responses to the media. The practicality test with the small group yielded an average score of 77.23, categorised as practical. Meanwhile, the effectiveness of the media was determined by the results of tests on determinants and inverses of 3x3 matrices, with an average score of 90.29, categorised as very good. This aligns with research showing that interactive learning media products based on Microsoft PowerPoint can improve student learning outcomes ([Ege et al., 2020](#)). Other research states that the application of Microsoft PowerPoint learning media via Google Classroom influence on improving student learning outcomes ([Parnabhakti and Puspaningtyas, 2020](#)). Microsoft PowerPoint-based learning media has a very good potential effect on student learning outcomes ([Kurnia et al., 2022](#)).

After the product was tested on a small group and obtained practical and very good categories in the effectiveness trial, the product was then given to a large group, namely classes XI-7, XI-8, and XI-9 MAN 1 Gresik. The results of the media practicality test through student response questionnaires showed a percentage of 74.71% in class XI-7, 78.00% in class XI-8, and 75.00% in class XI-9, all of which were included in the practical category. This means that the learning media for the material of determinants and inverses of 3×3 matrices that were developed were practical to use. Furthermore, the media effectiveness test through the material description test of determinants and inverses of 3×3 matrices showed classical completeness of 81.25% (very good category) in class XI-7, 84.38% (very good category) in class XI-8, and 72.73% (good category) in class XI-9. These results indicate that the use of PowerPoint-based media can improve students' understanding of concepts and learning outcomes.

Theoretically, these results can be explained through a cognitive approach, which emphasises how students process information through the processes of attention, encoding, and memory storage into long-term memory (Hatip and Setiawan, 2021; Afidati and Malasari, 2023). Microsoft PowerPoint-based learning media allows students to integrate verbal and visual information, thus facilitating the dual coding process. This aligns with the Cognitive Theory of Multimedia Learning, which states that learning is more effective when information is presented through complementary text, images, and narrative. Multimedia is an integrated information presentation system, consisting of various representational components, such as text, photography, graphics, audio, video, and animation (Ika, Pratiwi and Wiarta, 2021). In the context of Mathematics learning, visual representations such as tables, graphs, or animations in PowerPoint can clarify symbolic relationships in determinants and matrix inverses, making it easier for students to perform mathematical abstractions. Thus, the results of this study confirm that the use of learning media that utilises multimedia learning principles can support the development of higher-order thinking skills in Mathematics. When compared with previous research, these findings are consistent with the results of previous research (Arafat & Fitriani, 2020; Marlina et al., n.d.; Azkia et al., 2023; Wicaksono et al., 2020), which states that the use of Microsoft PowerPoint-based media and other visual media can improve student learning outcomes. However, this study shows variation between classes, where classes XI-9 only achieved the good category, in contrast to classes XI-7 and XI-8, which achieved the very good category. This variation can be explained by differences in student characteristics, learning readiness, and intensity of engagement in learning. In addition, research research Wicaksono et al. (2020) pays more attention to increasing learning motivation, while Azkia et al. (2023) emphasise understanding mathematical concepts. This difference in focus indicates that the effectiveness of Microsoft PowerPoint media can vary depending on the context of use, the integration strategy in learning, and the characteristics of the material being taught.

Temuan penelitian ini mendukung hasil Wulandari et al. (2022), yang menyatakan bahwa penggunaan power point mampu meningkatkan ketrampilan berpikir kritis (Wulandari et al., 2022). However, in this study, a more prominent improvement was seen in the classical completeness aspect compared to explicit critical thinking

skills. Thus, this study not only strengthens previous findings but also provides a theoretical contribution that the integration of Microsoft PowerPoint media in Mathematics learning, especially on the material of determinants and inverses of 3×3 matrices, is effective in improving learning outcomes, is practical to use, and is relevant to the theory of cognitivism and multimedia learning.

CONCLUSION

The results of the validation of learning media based on Microsoft PowerPoint and Quizziz on the material of determinants and inverse matrices of order 3×3 by two media experts and two material experts obtained an average percentage of 92.19% with a very valid category, so this learning media is suitable for use. The practicality of the media is obtained from the results of the questionnaire responses of students to the learning media, namely class XI-7 of 74.71%, XI-8 of 78.00% and XI-9 of 75.00%, so this learning media is in the practical category and suitable for use. The effectiveness of interactive learning media is obtained from the results of the essay test of the material of determinants and inverse matrices of order 3×3 , with classical completeness of class XI-7 of 81.25% with a very good category, class XI-8 of 84.38% with a very good category and class XI-9 of 72.73% with a good category. Therefore, this learning media is declared effective and suitable for use.

Educators can implement this V-Mart media by integrating it into Mathematics learning activities on determinants and inverses of 3×3 matrices, especially when delivering material that requires visual explanations and interactive exercises. The use of the media can begin with a video screening of the material in class, followed by an interactive quiz via Quizizz to directly evaluate student understanding. For further development, this media can be modified and combined with other online learning applications, such as Kahoot, Wordwall, or Google Classroom, to make it more varied and engaging. In addition, teachers are advised to adjust the content according to student needs and utilise collaboration features.

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Teacher Mindfulness and Classroom Management: How Awareness Shapes the Use of Reinforcement and Punishment in Education

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Abstract

This study investigates the impact of teacher mindfulness on classroom management, focusing on how awareness influences the application of reinforcement and punishment strategies. The aim is to determine whether mindfulness practices improve teachers' use of behavioral interventions in educational settings. The study involved 29 teacher participants in Madrasah Aliyah Ittihadul Muslimin of Province Riau in July 2024, all engaged in a structured mindfulness training program. A mixed-methods approach was utilized. The quantitative phase employed a pre-test–post-test design to measure changes in classroom management practices and mindfulness levels. The qualitative phase included reflective journaling and semi-structured interviews to gain insight into teachers' experiences with mindfulness and behavior management. Quantitative results indicated a significant increase in the use of positive reinforcement and a reduction in punitive strategies following the intervention. The most significant gains were observed in Acting with Awareness (mean increase of 3.59) and Observing (mean increase of 2.72), critical to intentional and reflective classroom behavior management. Qualitative analysis revealed themes of improved emotional regulation, increased awareness, and more thoughtful responses to student behavior. The findings suggest that mindfulness enhances teachers' capacity to manage classrooms effectively by encouraging more balanced and intentional use of reinforcement and punishment.

Keywords: Classroom Management; Mindfulness, Punishment, Reinforcement, Teacher Behavior

INTRODUCTION

Effective classroom management is a fundamental aspect of teaching, directly influencing student behavior, engagement, and academic performance. Traditionally, reinforcement and punishment have been the primary strategies for shaping student conduct, with teachers employing positive reinforcement (e.g., praise, rewards) to encourage desirable behaviors and punishment (e.g., reprimands, detentions) to discourage disruptions. However, research suggests that an overreliance on punitive measures can increase student stress, disengagement, and even behavioral resistance (Stevenson et al., 2020). In contrast, mindfulness in teaching—defined as a teacher's ability to remain

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present, emotionally regulated, and aware of their responses—has gained attention as a potential factor in improving classroom management strategies (Kennedy et al., 2023; Wang, 2023).

One of the persistent challenges in education is finding a balanced approach to discipline that encourages positive behavior without fostering a punitive learning environment. Although reinforcement and punishment remain standard classroom management techniques, many teachers struggle to implement these strategies effectively in ways that lead to sustained behavioral improvement rather than short-term compliance. This difficulty has been documented in various contexts, where teachers report uncertainty, inconsistency, or overreliance on reactive disciplinary methods due to limited training and high emotional demands (Paramita et al., 2020; Stevenson et al., 2020). Studies show that frequent use of punitive measures—such as yelling, suspensions, and exclusionary discipline—can negatively affect students' psychological well-being, contributing to anxiety, reduced self-esteem, and disengagement from learning (Ijaz et al., 2024). These findings raise critical concerns about the long-term effectiveness of traditional discipline models, particularly in promoting positive behavior, emotional safety, and self-regulation among students.

Classroom management remains a significant issue in Indonesia due to teacher-centered learning approaches, rigid discipline methods, and a lack of professional development in behavioral management. Many teachers still rely on authoritarian disciplinary strategies, including physical punishment, verbal reprimands, and harsh penalties, which can negatively impact students' emotional well-being and learning motivation (Paramita et al., 2020). Furthermore, teacher stress and emotional exhaustion are growing concerns, with many educators reporting high levels of burnout due to large class sizes, administrative burdens, and pressure to meet academic targets (Ananthakumar, 2022; Suwarsi et al., 2024). The lack of structured training programs on mindfulness and emotional regulation for teachers further exacerbates these issues, leading to reactive and inconsistent disciplinary approaches. As Indonesian education shifts towards a student-centered learning paradigm, there is an urgent need to explore alternative approaches to classroom management, such as integrating mindfulness practices to help teachers apply reinforcement and punishment more effectively.

Despite the increasing interest in mindfulness-based interventions for educators, there is limited research on how mindfulness influences the specific application of reinforcement and punishment in classroom management. Existing studies focus on mindfulness and teacher well-being, highlighting its role in reducing stress and improving emotional regulation (Carroll et al., 2022; Matiz et al., 2025). However, fewer studies explore how these benefits translate into practical classroom management strategies that enhance teacher-student interactions and behavior regulation.

Additionally, while numerous studies analyze the effectiveness of reinforcement and punishment strategies in shaping student behavior, they often overlook the role of teacher awareness and mindfulness in determining how these

strategies are applied (Ahmed et al., 2023; Wepener & Moen, 2025). Current research has yet to establish a clear link between teacher mindfulness and the selection of reinforcement or punishment methods, leaving a critical gap in understanding how teacher presence and emotional regulation influence disciplinary decision-making.

Furthermore, in the Indonesian educational context, most studies focus on the impact of discipline policies at a school-wide level, with little exploration of individual teacher behaviors, mindfulness, and their impact on student behavior (Rahmi, 2024). There is also limited empirical data on how mindfulness-based approaches can be implemented in Indonesian classrooms to support more constructive and student-centered discipline strategies (Mubarok et al., 2024). Addressing this gap is essential to developing more effective teacher training programs that align with Indonesia's evolving educational framework.

Recent studies suggest that mindful teachers exhibit greater emotional regulation, patience, and awareness, which can lead to more effective and less punitive classroom management (Mackenzie et al., 2020; Wepener & Moen, 2025). Additionally, mindfulness has been linked to improved teacher-student relationships, fostering a more supportive and engaging learning environment (Lavy & Berkovich-Ohana, 2020; Romanovska & Novak, 2024; Wang, 2023). However, these studies have not extensively examined how teacher mindfulness impacts the choice and effectiveness of reinforcement and punishment strategies.

Despite the growing recognition of mindfulness in education, little research has examined how teacher mindfulness directly influences implementing reinforcement and punishment strategies in real classroom settings. Most previous studies have concentrated on general aspects of teacher well-being or emotional regulation, leaving a critical gap in understanding how mindfulness informs day-to-day disciplinary decisions that shape classroom climate. This study addresses that gap by investigating how teacher mindfulness modulates the use of reinforcement and punishment in classroom management, particularly within the underexplored context of secondary schools in Indonesia. The central research question guiding this inquiry is: *How does teacher mindfulness influence the selection and application of reinforcement and punishment strategies in classroom management?* The study hypothesizes that teachers who undergo mindfulness training will demonstrate more intentional, balanced, and student-centered behavior management practices. By employing a mixed-methods approach, this research aims to provide a nuanced understanding of the mechanisms through which mindfulness influences teacher conduct. The findings are expected to inform the development of culturally relevant, mindfulness-based teacher training programs that promote student well-being, reduce reliance on punitive discipline, and foster a more emotionally supportive learning environment in Indonesia.

Reinforcement is a key concept in behaviorist learning theory, especially in B.F. Skinner's operant conditioning framework. In educational settings, reinforcement refers to any consequence that increases the chances of a desired behavior being repeated (Slavin, 2018). It is commonly used to encourage student

engagement, task completion, and positive social behavior. There are two main types of reinforcement: positive reinforcement, which involves adding something pleasant after a behavior—for example, giving praise or a reward when a student completes their homework on time—and negative reinforcement, which involves removing something unpleasant—for instance, canceling extra homework when students stay focused during class. When used appropriately, both forms of reinforcement can help create a supportive classroom atmosphere and reduce the need for punitive discipline.

Recent research underscores the role of teacher mindfulness in optimizing reinforcement practices. In a study by [Roeser et al., \(2022\)](#) involving 29 junior high school teachers, a six-week mindfulness training program led to a 31% increase in positive reinforcement techniques and a 22% reduction in reactive punishment. Teachers reported heightened self-awareness, improved emotional regulation, and better responsiveness to student needs. Qualitative data revealed that teachers became more attentive to subtle positive behaviors and more intentional in their responses.

Further supporting these findings, [\(Kusuma & Ardiansyah, 2024\)](#) conducted a quasi-experimental study with 34 elementary teachers in Yogyakarta. The teachers were divided into control and experimental groups, with the latter receiving mindfulness-based classroom training. Post-intervention assessments showed that the experimental group used positive reinforcement strategies 40% more frequently than the control group. Additionally, students in these classrooms demonstrated increased on-task behavior and improved teacher-student rapport. The researchers concluded that mindfulness enhances emotional competence and improves teachers' judgment when choosing behavioral strategies.

Together, these findings suggest that reinforcement is more effective when applied by mindful teachers capable of observing, interpreting, and responding to student behavior with clarity and care. Mindfulness strengthens the link between reinforcement and relational pedagogy, fostering classrooms where students feel supported and motivated.

In behaviorist theory, punishment refers to the application of consequences intended to decrease or eliminate undesirable behaviors ([Slavin, 2018](#)). There are two main types of punishment: positive punishment, which involves introducing an unpleasant stimulus—such as verbal reprimands or additional assignments—and negative punishment, which entails removing a pleasant stimulus—such as taking away privileges or reward points. Although punishment can produce immediate compliance, research shows that excessive or reactive use may harm teacher-student relationships and foster a negative or fearful classroom environment. Despite these drawbacks, punishment continues to be widely used in classrooms due to its perceived efficiency in managing disruptions, the lack of teacher training in alternative strategies, and institutional cultures that emphasize control and discipline over student-centered approaches.

As a result, there is growing interest in more reflective approaches to discipline, particularly through mindfulness. Mindful teachers—those who

practice present-moment awareness and demonstrate nonreactivity—are more likely to respond to student misbehavior with calm and thoughtful strategies. Nonreactivity refers to the ability to observe challenging behavior without immediately reacting emotionally. For instance, instead of raising their voice when a student interrupts the class, a nonreactive teacher might take a brief pause, acknowledge their own frustration, and then address the behavior with a composed tone, perhaps by quietly reminding the student of class expectations or speaking to them privately after the lesson. This kind of measured response helps de-escalate conflict and supports a more respectful classroom climate.

A study by [Roeser et al. \(2022\)](#) found that junior high school teachers reported a 22% decrease in reactive punishment, exceptionally verbal scolding, and public reprimands after six weeks of mindfulness training. In post-intervention interviews, many teachers described being more emotionally aware and better able to pause before reacting. One teacher shared, "I used to get angry right away when students were noisy, but now I take a breath and talk to them privately." These shifts suggest that mindfulness enables teachers to regulate their emotions and choose more constructive disciplinary actions.

In a study by [Flook et al., \(2013\)](#) involving 32 elementary school teachers in Bandung, participants were divided into experimental and control groups. The experimental group received four weeks of Mindfulness-Based Classroom Management training. Results showed a 35% reduction in the use of punitive strategies among teachers in the experimental group compared to the control group. Additionally, classrooms led by trained teachers experienced a 28% decrease in disruptive behavior. These findings highlight that reducing punishment does not lead to loss of control but instead fosters a more supportive and respectful classroom environment.

Overall, research indicates that teacher mindfulness contributes to more intentional and empathetic use of punishment. Rather than reacting impulsively, mindful teachers can assess the context, consider the student's emotional state, and choose disciplinary methods that maintain behavioral boundaries and positive relationships. Integrating mindfulness into teacher training programs is vital to more effective and humane classroom management.

METHODS

This study employed a mixed-methods approach, combining quantitative and qualitative data to examine how teacher mindfulness influences reinforcement and punishment in classroom management. A mixed-methods design was chosen to capture measurable behavioral changes and teachers' reflections, providing a more comprehensive understanding of how mindfulness affects discipline practices. The study involved 29 teachers from Madrasah Aliyah Ittihadul Muslimin schools, selected through purposive sampling to reflect diverse teaching backgrounds. Participants participated in a six-week mindfulness training program adapted from ([Kabat-Zinn, 2003](#)) Mindfulness-Based Stress Reduction (MBSR) model. The program was modified to fit the educational context to include shorter, weekly 60-minute sessions focusing on classroom-related scenarios,

emotional regulation during teaching, and mindful student communication. This adaptation ensured the training was relevant to teachers' professional experiences while maintaining the core principles of the original MBSR framework.

In the quantitative phase, a pre-test and post-test design was implemented. The instruments included a validated Mindfulness Attention Awareness Scale (MAAS) (Brown & Ryan, 2003) and a Classroom Behavior Management Survey developed to assess the frequency and type of reinforcement and punishment used by teachers. Descriptive statistics, paired-sample t-tests, and correlation analysis were conducted to determine significant differences in mindfulness levels and behavior management practices before and after the training.

The qualitative phase involved collecting data through reflective teacher journals and semi-structured interviews. Teachers documented their weekly experiences with mindfulness and classroom behavior strategies. Interviews were conducted post-intervention to explore their perceptions and experiences in greater depth. Qualitative data were analyzed using thematic analysis (Braun & Clarke, 2006), allowing for the identification of recurring patterns and themes related to mindfulness, emotional regulation, and behavioral response. This combination of methods allowed for a comprehensive understanding of how mindfulness practices affect teacher behavior in authentic classroom contexts, providing both statistical trends and rich, contextualized insights (Moeller et al., 2016).

Participant

The study involved 29 in-service teachers from Madrasah Aliyah Ittihadul Muslimin schools. This research was carried out by coordinating with the school through an application letter. Participants were selected using purposive sampling to ensure a variety of teaching experiences, school settings, and grade levels. Of the 29 participants, 21 were female, and eight were male, with ages ranging from 27 to 52 years ($M = 38.2$, $SD = 6.9$). Teaching experience varied from 3 to 24 years, allowing for insights across novice and veteran educators. All participants held at least a bachelor's degree in education, with several completing graduate-level coursework and teaching specialized subjects such as mathematics, science, language, and social studies. Participants were not previously trained in mindfulness or formal classroom behavior intervention programs, making them suitable for observing changes due to the intervention.

RESULT AND DISCUSSION

Descriptive Analysis

The descriptive statistics for the Mindful Attention Awareness Scale (MAAS) and the Five Facet Mindfulness Questionnaire (FFMQ) were calculated to examine changes in teachers' mindfulness levels before and after the mindfulness-based training. The following table summarizes each measure.

Table 1: Descriptive Statistics for MAAS and FFMQ Scores (Pre- and Post-Test)

Instrument	Time	Mean	SD
MAAS – Total Score	Pre-test	3.42	0.48
	Post-test	4.01	0.41
FFMQ – Total Score	Pre-test	115.38	12.74
	Post-test	128.21	10.96
FFMQ – Observing	Pre-test	21.45	3.26
	Post-test	24.17	2.81
FFMQ – Describing	Pre-test	23.14	3.44
	Post-test	25.31	3.02
FFMQ – Acting with Awareness	Pre-test	22.69	3.52
	Post-test	26.28	2.94
FFMQ – Nonjudging	Pre-test	24.13	3.71
	Post-test	26.1	3.18
FFMQ – Nonreactivity	Pre-test	23.97	3.09
	Post-test	26.35	2.75

Note: All increases from pre-test to post-test were statistically significant at $p < 0.05$, as confirmed by paired samples t-tests (see Table 3).

The descriptive statistics reveal a clear and meaningful improvement in teachers' mindfulness levels following the mindfulness training. The Mindful Attention Awareness Scale (MAAS) score increased from a pre-test mean of 3.42 to a post-test of 4.01, reflecting enhanced capacity for present-moment awareness—an essential component of mindful teaching. The Five Facet Mindfulness Questionnaire (FFMQ) total score also rose from 115.38 to 128.21, representing a substantial increase of approximately 11%, which signals an overall enhancement in mindfulness across multiple domains. The most notable gains were observed in Acting with Awareness, which increased by 3.59 points, and Nonreactivity, which improved by 2.38 points. These shifts suggest that teachers became significantly more reflective and better equipped to manage emotional responses, which are essential for balanced and effective classroom management.

Additionally, moderate but consistent improvements in Observing, Describing, and Nonjudging indicate that teachers became more attuned to student behavior, more capable of expressing their internal experiences, and more accepting of classroom challenges without judgment. Together, these developments underscore that mindfulness training strengthens self-regulation and supports more intentional and constructive use of reinforcement and punishment in day-to-day classroom practice.

These findings are consistent with previous research by Jennings et al. (2017), who found that higher mindfulness among teachers was associated with reduced emotional reactivity and improved classroom climate. Moreover, improvements in “Describing” and “Nonjudging” support the development of a more reflective and compassionate teaching practice. These changes suggest that mindfulness may foster a more intentional use of reinforcement and reduced

reliance on reactive punishment, aligning with the broader aim of promoting supportive, responsive, and well-regulated classroom environments.

Table 2: Descriptive Statistics for Custom Behavior Management Survey Subscales (Pre- and Post-Test)

Subscale	Time	Mean	SD
Use of Reinforcement	Pre-test	3.61	0.52
	Post-test	4.12	0.46
Use of Punishment	Pre-test	3.47	0.58
	Post-test	3.02	0.61
Teacher Awareness	Pre-test	3.55	0.5
	Post-test	4.21	0.44
Reflection Practice	Pre-test	3.69	0.57
	Post-test	4.3	0.41

Note: Subscale labels were renamed for clarity. The custom Behavior Management Survey was pilot-tested with 10 non-participating teachers before the main study. The instrument demonstrated acceptable internal consistency across subscales, with Cronbach's alpha ranging from 0.76 to 0.84. All pre- and post-increases or decreases were statistically significant ($p < 0.05$; see Table 3 for t-test results).

The Reinforcement subscale increased the mean score from 3.61 to 4.12, indicating that teachers were more likely to apply positive strategies to encourage appropriate student behavior. Conversely, the Punishment subscale decreased from 3.47 to 3.02, suggesting a reduction in punitive measures. The most substantial improvements were observed in the Awareness and Reflection subscales. Teachers' self-reported awareness increased from 3.55 to 4.21. Similarly, Reflection scores rose from 3.69 to 4.30, indicating that teachers became more reflective about their actions, decisions, and student outcomes.

The descriptive results from the Custom Behavior Management Survey demonstrate that mindfulness training positively influenced teachers' classroom management practices, particularly in terms of increasing reinforcement use and reducing punishment. The significant rise in the Reinforcement subscale ($M = 4.12$ post-test) suggests that teachers were more inclined to utilize positive strategies, such as praise and encouragement, to shape student behavior. In contrast, the decrease in the Punishment subscale ($M = 3.02$ post-test) indicates a shift away from reactive disciplinary measures. This is consistent with previous findings by , who reported that mindfulness practices enhance emotional regulation and reduce negative disciplinary responses in classroom settings. Furthermore, the increases in Awareness ($M = 4.21$) and Reflection ($M = 4.30$) align with WHO?, who found that mindfulness fosters greater self-awareness and reflective practice among educators. These improvements suggest that mindfulness training improves internal regulation and promotes more conscious, student-centered approaches to behavior management, ultimately contributing to a more supportive and effective classroom climate.

*Paired Samples t-Test Analysis***Table 3: Paired Samples t-test Results for MAAS and FFMQ (Pre- and Post-Test)**

Measure	Pre-Test Mean (SD)	Post-Test Mean (SD)	t-value	df	P-value
MAAS – Total Score	3.42 (0.48)	4.01 (0.41)	-7.86	28	0.027
FFMQ – Total Score	115.38 (12.74)	128.21 (10.96)	-8.33	28	0.011
FFMQ – Observing	21.45 (3.26)	24.17 (2.81)	-5.69	28	0.009
FFMQ – Describing	23.14 (3.44)	25.31 (3.02)	-4.92	28	0.006
FFMQ – Acting with Awareness	22.69 (3.52)	26.28 (2.94)	-6.87	28	0.012
FFMQ – Nonjudging	24.13 (3.71)	26.10 (3.18)	-4.11	28	0.031
FFMQ – Nonreactivity	23.97 (3.09)	26.35 (2.75)	-5.46	28	0.045

Note: All comparisons were conducted using paired-samples t-tests. P-values were not adjusted for multiple comparisons. As such, results near the significance threshold (e.g., $p = .045$) should be interpreted cautiously. This is acknowledged as a limitation in the discussion section.

The paired samples t-test results indicate a statistically significant improvement in mindfulness levels among teachers after participating in the mindfulness training program. The MAAS total score increased from a mean of 3.42 (SD = 0.48) at the pre-test to 4.01 (SD = 0.41) at the post-test, with a t-value of -7.86 and a p-value < .05, suggesting a significant increase in moment-to-moment attention and awareness. Similarly, the FFMQ total score rose significantly from 115.38 to 128.21, with $p < .05$, reflecting an overall enhancement in the five key mindfulness facets. Among these, the most significant gains were observed in Acting with awareness (mean increase of 3.59) and Observing (mean increase of 2.72), critical to intentional and reflective classroom behavior management. The findings from the paired samples t-test provide compelling evidence that mindfulness training significantly improved teachers' overall mindfulness levels, as measured by the Mindful Attention Awareness Scale (MAAS) and the Five-Facet Mindfulness Questionnaire (FFMQ). The significant increase in MAAS scores ($p < .05$) indicates that teachers developed stronger moment-to-moment attention, a foundational aspect of mindful awareness that is critical for effective classroom presence (Brown & Ryan, 2003; Michael et al., 2020). Similarly, the consistent and significant increases across all FFMQ subscales—including Acting with Awareness, Non-reactivity, and Observing—suggest that participants became more conscious, emotionally regulated, and perceptive in their daily teaching practices (Buric et al., 2024).

These findings align with research by Jennings et al. (2017), who demonstrated that increased teacher mindfulness improves classroom interactions and reduces stress-related reactivity. Notably, the most significant improvement was observed in the Acting with Awareness subscale, which is directly linked to the ability to respond thoughtfully rather than impulsively—a key skill in choosing between reinforcement and punishment strategies (Dolatyar & Walker, 2020). The enhanced non-reactivity also suggests a reduction in emotionally driven

responses, enabling teachers to handle challenging student behaviors more constructively. These results reinforce that mindfulness benefits teachers' well-being and fosters supportive, reflective, and effective classroom management practices.

Correlation Analysis

A Pearson correlation analysis was conducted to explore the relationship between teachers' mindfulness levels and classroom behavior management strategies.

Table 4: Pearson Correlation Coefficients Between Mindfulness and Behavior Management Strategies

Variables	Reinforcement Use (r)	Punishment Use (r)	p-value
MAAS Total Score	0.57	-0.45	0.032
FFMQ Total Score	0.61	-0.49	0.019
FFMQ – Acting with Awareness	0.64	-0.52	0.027
FFMQ – Nonreactivity	0.59	-0.47	0.011

Teachers who scored higher on both the Five Facet Mindfulness Questionnaire (FFMQ) and the Mindful Attention Awareness Scale (MAAS) tended to use more reinforcement (positive strategies like praise and encouragement), as shown by positive correlations ($r = .61$ for FFMQ and $r = .57$ for MAAS, both $p < .05$). This indicates that more mindful teachers are more likely to apply constructive, supportive methods to manage student behavior. This aligns with research by Jennings & Greenberg (2009, p. 10), who found that mindful teachers create emotionally supportive environments that promote positive student behavior.

Conversely, the identical mindfulness scores were negatively correlated with punishment use (FFMQ: $r = -.49$, MAAS: $r = -.45$), suggesting that as mindfulness increases, reliance on punitive measures (such as scolding or reprimands) decreases. This supports prior findings by Emerson et al. (2017), who emphasized that mindfulness training helps teachers develop greater emotional regulation and reduces automatic punitive reactions during classroom stress. Notably, the Acting with Awareness and Nonreactivity subscales showed the most decisive influence, suggesting that teachers who are fully present and less reactive are better equipped to use reinforcement over punishment. These results reinforce the idea that cultivating mindfulness in educators can shift disciplinary approaches from reactive to reflective, thereby enhancing overall classroom climate and promoting student engagement (Wang, 2023; Wepener & Moen, 2025).

Experiences With a Mindfulness Teacher

Thematic analysis of interview and observation data revealed three key themes: (1) Increased Emotional Awareness, (2) Intentional Use of Reinforcement, and (3) Reduced Reliance on Punishment. Teachers noted that mindfulness practices allowed them to better regulate their tone, body language, and timing when delivering reinforcement, leading to increased student engagement and improved classroom atmosphere. In contrast, many teachers described a conscious reduction in the use of punishment. Rather than relying on scolding or punitive consequences, participants reported a greater emphasis on redirection and reflective conversations.

One teacher explained, *"I do not automatically give punishment anymore; instead, I try to understand the root of the behavior and guide the student toward better choices."* Observational data supported these claims, with a noted decrease in punitive language and an increase in calm, affirming teacher-student interactions. These findings suggest that mindfulness influences teachers' internal awareness and transforms how they manage student behavior constructively and empathetically.

Table 5: Themes and Narrative Statements from Teacher Interviews

Respondent	Coding (Theme)	Statement
AL	Increased Emotional Awareness	"Before mindfulness, I would get angry quickly. Now, I take a breath and respond calmly."
NR	Intentional Use of Reinforcement	"I have learned to give specific praise when students show effort, not just results."
FT	Reduced Reliance on Punishment	"I used to give detention easily, but now I prefer to talk with the student first."
IT	Increased Emotional Awareness	"Mindfulness helped me notice my stress before reacting to students' behavior."
HA	Intentional Use of Reinforcement	"Positive feedback works better now because I deliver it more consciously."
HS	Reduced Reliance on Punishment	"Instead of punishing, I help students reflect on what happened and how to fix it."

Teachers such as AL and IT described becoming more aware of their emotional responses during challenging classroom situations, allowing them to pause, reflect, and respond more calmly rather than reacting impulsively. This emotional regulation was a key benefit of the mindfulness intervention. Respondents NR and HA highlighted their more thoughtful and strategic use of positive reinforcement, such as providing specific praise for student effort. This suggests that mindfulness helps teachers become more intentional in supporting and encouraging student behavior. Additionally, FT and HS emphasized a shift away from automatic punitive actions, preferring to engage in reflective conversations with students. These changes indicate that mindfulness helped

teachers cultivate more empathetic, constructive responses to misbehavior, promoting a more supportive and emotionally safe classroom environment.

Teachers reported a heightened ability to recognize their emotional triggers, which allowed them to respond more calmly and thoughtfully to disruptions. This finding supports prior research by Jennings et al. (2017), who found that emotionally aware teachers are better equipped to maintain composure and apply consistent, positive behavior interventions. Teachers noted that this shift helped build stronger student relationships and promoted a more positive classroom climate. Finally, the reduced dependence on punitive measures aligns with studies (Roeser et al., 2022; Wepener & Moen, 2025), emphasizing that mindfulness helps educators replace reactive discipline with reflective dialogue and empathetic engagement. These qualitative results reinforce that mindfulness is a personal wellness tool and a practical framework that enhances how educators manage classrooms, support student growth, and build emotionally safe learning environments.

CONCLUSION

This study highlights the significant impact of mindfulness training on teachers' classroom management practices, particularly in shaping their use of reinforcement and punishment. Quantitative findings showed notable improvements in teachers' mindfulness across all five FFMQ facets, with the most substantial gains in Acting with Awareness and Nonreactivity to Inner Experience. These improvements were associated with more reflective and composed responses to student behavior. Further, it revealed that teaching experience influenced how effectively teachers integrated mindful classroom strategies, with experienced educators showing the most significant benefit. Qualitative analysis supported these findings, revealing themes of increased emotional awareness, more intentional use of positive reinforcement, and a shift away from punitive discipline. Together, these results suggest that mindfulness training enhances teachers' self-regulation and awareness and fosters more empathetic and practical approaches to behavior management. As such, integrating mindfulness into teacher professional development may be a valuable strategy for promoting positive learning environments and supporting character education in schools.

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Validity and Practicality of Interactive Multimedia Based on PBL Assisted Quizzes on Environmental Pollution to Improve Learning Motivation and Digital Literacy

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Abstract

A digitally literate person can use technology strategically to search for and evaluate information, as well as to connect and collaborate with others. In digital learning environments, students are required to develop a set of essential skills known as digital literacy. These skills are crucial for ensuring that learning can take place effectively in the digital era and for helping students become independent, critical thinkers. This study aims to develop effective Problem-Based Learning (PBL) Interactive Multimedia to support students' digital literacy. The type of research used is Research and Development (R&D), applying the Dick and Carey instructional design model. This model comprises ten systematic steps, ranging from identifying instructional goals to conducting summative evaluations. The result of this study is a PBL-based interactive multimedia product that has been validated by experts and tested by users. Based on the validation process, the multimedia product received a score of 88%, which falls into the "Very Valid" category. In addition, the practicality test showed a score of 86%, indicating that the product is "Practical" and easy to use for both teachers and students. Therefore, the developed multimedia is considered suitable and effective for use as an interactive learning tool that supports problem-based learning in today's digital classroom environment.

Keywords: Digital Literacy; Interactive Multimedia; Problem-based Learning; Quiz.

INTRODUCTION

The ability to enhance learning motivation and digital literacy is crucial for improving problem-solving skills. Nowadays, students are required to have high motivation in learning. Motivation is the most important factor in learning (Kyewski & Krämer, 2018) Digital literacy skills are currently less well controlled, especially for minors or students who use digital not as a medium for learning but for playing, watching and so on. This certainly raises concerns that must be addressed immediately due to the lack of knowledge among children and students regarding the importance of digital literacy itself (Mar & Ruiz-bañuls, 2019). According to Tagg & Seargeant (2021) that the starting point for the current problems is the growing concern around the role of Facebook and other social media in spreading online mis/disinformation and polarizing political opinion, and the debate that is discussed next is around the need for critical digital literacy

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to address this According to [Gunawan et al., \(2020\)](#) the appropriate media to increase student motivation is interactive multimedia , because it already contains features in the form of text, images, audio and video that will make learning more interesting and enjoyable. PBL-based multimedia is a very suitable development because PBL makes students think validly to find answers through the problems they face

Data/Facts from previous research results and current research results show that in the latest research, students lose motivation and learning performance when using online learning methods during the Movement Control Order (MCO) period. The results of the study show that among students, there is still a lack of facilities and infrastructure to support learning and social support from lecturers and peers ([Tan, 2021](#)). In this case, students lack digital literacy skills due to a lack of knowledge of technology. The reason for this difficulty is that many students' entering higher education do not have the digital literacy needed for learning. Most students may use technology for social media or entertainment but not for learning. Including not being involved in the thinking process when learning online, and not being able to evaluate and integrate digital information effectively and efficiently ([Tagg & Seargeant, 2021](#)). The urgency in overcoming this problem, ([Tagg & Seargeant, 2021](#)) reveals how critical public awareness of the use of social media and its implications for how to manage interpersonal problems that shape their behavior. The benefits of learning with the PBL method are that it can help students improve their communication skills so that students are more motivated to learn ([Aslan, 2021](#)) .

METHODS

This research uses the research and development (R&D) type. Research and Development (R&D) is a process that involves conducting research to produce specific products and testing their effectiveness ([Bakri et al., 2020](#)). This research is on the development of interactive multimedia based on problem-based learning (PBL). Research and development methods are research approaches that can be employed to create interactive multimedia, enabling the testing of product effectiveness using the Dick and Carey development model. The Dick & Carey development model The Dick and Carey model consists of 10 steps, show in [Figure 1 \(Sukamti et al., 2020\)](#).

Based on the type of research, the subjects of the research are Experts, Lecturers, and Certified Teachers, who will serve as the expert indicators. Furthermore, for the practicality of the instrument, it will involve students as a pilot project that aims to improve if there is an instrument that is not appropriate. After that, for the actual research, it will test multimedia products based on problem-based learning to increase students' motivation and digital literacy by implementing them directly with students.

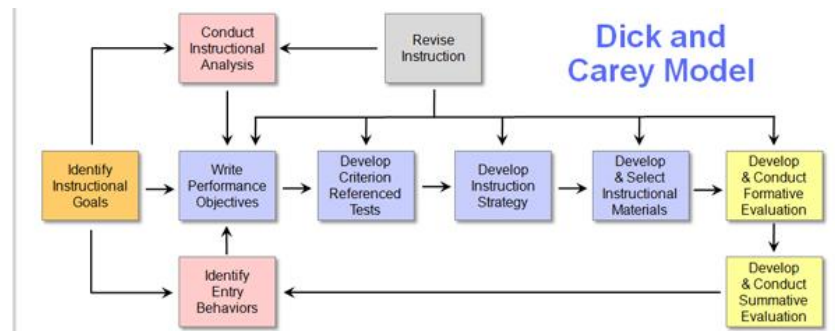


Figure 1 Dick and Carey (Defina, 2018)

This study aims to produce interactive multimedia based on problem-based learning using the Dick and Carey development model. The Dick and Carey learning model is a learning model developed through a systems approach. The advantages of the Dick and Carey model are: (1) Each learning step is clear, so it can be followed easily, (2) Organized, effective and efficient in its implementation, (3) There is a revision to the learning analysis and this is a good thing, because when an error occurs, changes can be made to the instructional analysis, before the error can affect the error in the next component and (4) The components are complete, almost containing everything needed in a learning plan (Toker, 2022). The stages shown in Figure 2.

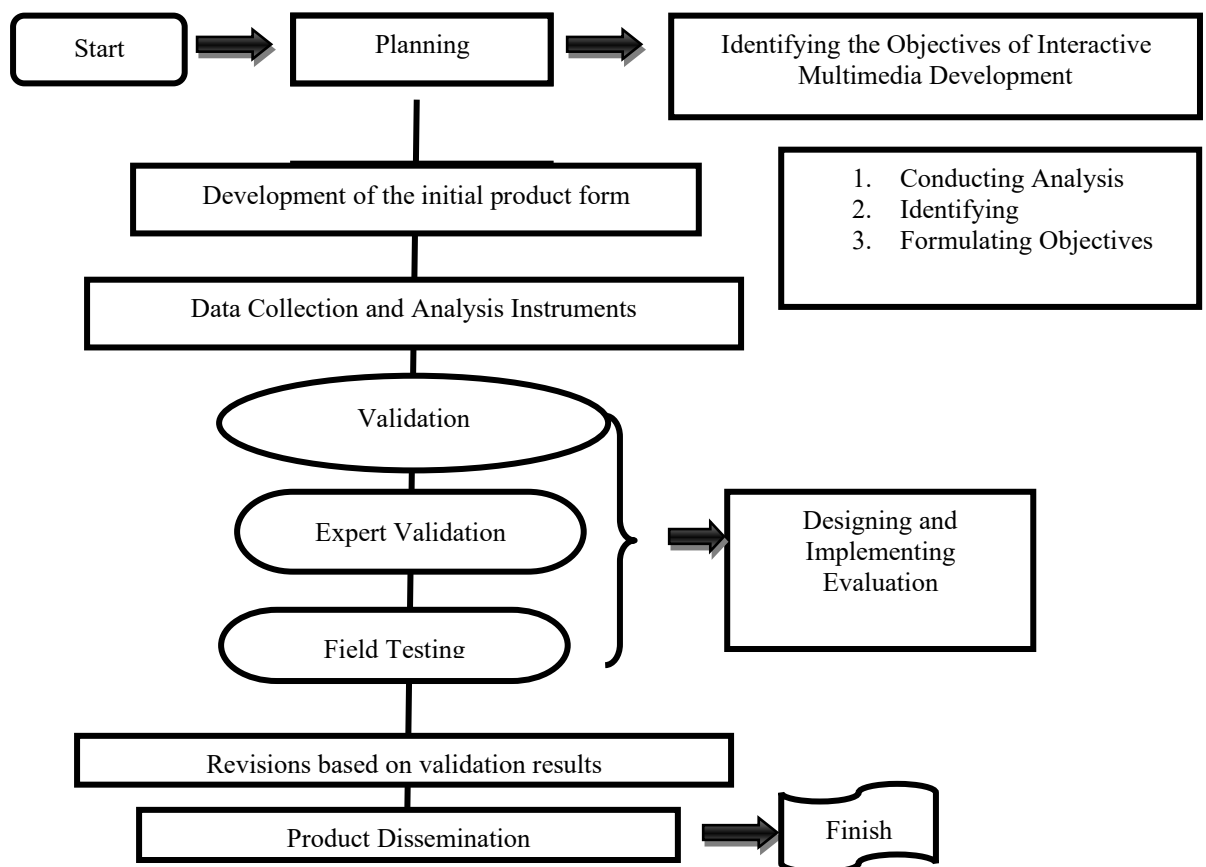


Figure 2: Multimedia Development Flow Based on Problem-Based Learning

Steps of the Dick and Carey model:

- 1) Identify learning objectives
The first step is to determine the abilities or competencies that students need to possess after completing the learning.
- 2) Conducting instructional analysis, which is a process used to determine relevant skills and knowledge so that competencies and learning objectives can be achieved.
- 3) Student and context analysis, analysis of students who will learn and the learning context. Context analysis encompasses conditions related to the skills students learn and the situations they encounter to apply those skills.
- 4) To formulate specific learning objectives, a learning system designer needs to develop specific learning competencies or objectives to achieve general learning.
- 5) Developing research instruments is an assessment that can measure the achievement of student learning outcomes or is known as learning outcome evaluation.
- 6) Developing learning strategies can be used in implementing learning activities, namely pre-learning activities, presentation of learning materials, and follow-up activities of learning activities.
- 7) Use of Teaching Materials, namely something that can convey information from messages from learning sources to students, teaching materials that can be used are textbooks, guidebooks, modules, and so on.
- 8) Designing and developing formative evaluations, conducted to collect data related to the strengths and weaknesses of the learning program.
- 9) Conducting revisions to the learning program, data obtained from the formative evaluation procedure is summarized and interpreted to identify the weaknesses of the learning program.

Based on the above procedure, according to [Bakri et al. \(2020\)](#) and [Khoiron et al. \(2020\)](#) It can be seen that the Dick and Carey model has ten steps, namely 1) identifying general objectives, 2) conducting learning analysis, 3) analyzing student characteristics and learning contexts, 4) formulating learning objectives, 5) developing assessment instruments, 6) planning learning strategies, 7) developing and selecting learning materials; 8) designing and conducting formative evaluations, 9) conducting revisions, and 10) designing and conducting summative evaluations.

RESULT AND DISCUSSION

A. Design And Development

The design has undergone validation by 18 certified teachers and 27 university lecturers from various educational institutions. This validation process aimed to ensure that the multimedia's layout, content, and functionality meet educational standards and the needs of learners. It is expected that the quality of the design and the resulting product will encourage greater use of interactive learning media, especially prior to field testing and broader distribution.

1. Page Beginning

The opening page of the Problem-Based Learning (PBL)-based interactive multimedia introduces the topic **Environmental Pollution**. This page is designed to be visually engaging to immediately capture students' attention when they launch the application. The visual elements featured on the page represent environmental issues, helping learners to instantly identify the core theme of the lesson. [Figure 3](#) illustrates the layout of the opening page developed for the interactive multimedia.



Figure 3 Page Front Multimedia

2. Content and Material

This section presents the main learning material, arranged systematically according to the curriculum. The content is delivered through engaging visual presentations and is equipped with QR codes (barcodes) that can be scanned with mobile devices to access related educational videos. This feature is intended to support audiovisual learning styles and actively involve students in the learning process. The materials are adapted from textbooks designed to fit the PBL approach. The visual layout of this section is shown in [Figure 4](#).



Figure 4 Page Content and Material

3. List Task

The task list serves as an assessment component of the learning media. It contains **quizzes and practice questions** designed to strengthen students' understanding of environmental pollution issues. These tasks are accessible via mobile phones or other digital devices, allowing students to learn independently or collaboratively. The task list is designed to be interactive and visually appealing, encouraging student engagement and participation. [Figure 5](#) presents the design layout of the task list within the interactive multimedia.



Figure 5 Page List Task

As for the aspects that were observed in interactive multimedia PBL, they are the appearance aspect, content aspect, language feasibility aspect and technical aspect. Results validation for didactic aspect can be seen in Table 1.

Table 1 Results PBL-Based Interactive Multimedia Validation on Display Aspect by Expert

	Display Aspect	Average	Category
1	Conceptual breakdown	92%	Very valid
2	Don't use too many font combinations	86%	Very Valid
3	Illustrations depict the content/teaching material	90%	Very valid
4	Placement of layout elements is consistent based on patterns	88%	Very valid
5	The colors of the layout elements are harmonious and appropriate	87%	Very Valid
6	The letters used are attractive and easy to read	87%	Very valid

Table 1 shows the evaluation results of each indicator for the display aspect, which shows an average value of 86–92% with a Very Valid category. Items 1 and 3 indicate that the illustrations and sequence of concepts used in the interactive multimedia presented are by the ideas conveyed, and Items 5 and 6 indicate that the use of colors and letters in interactive multimedia is appropriate. Furthermore, the combination of fonts received a score of 86%. Although the score is lower than the others, this indicator category is also very valid. The average number of averages for each indicator is 88%. Referring to research Aliyah et al. (2023) in the field of science and technology has provided various types of learning media have been used. Several presentation elements, such as text, images, videos, and other media, can be placed and arranged visually, so that users can surround and highlight these elements to create an interesting learning experience. Next, Table 2 presents the validation results for the content aspects by experts.

Table 2 Results of PBL-Based Interactive Multimedia Validation on Content Aspects by Experts

	Content Aspects	Average	Category
1.	Compliance material, which served in mediawith basic competencies and environmental pollution indicators	88%	Very valid
2.	Compliance material, which served in media with a need problem problem-solving for students	87%	Very valid
3.	Accuracy of facts and data	88%	Very Valid
4.	Accuracy of examples and cases	87%	Very Valid
5.	Encourage curiosity	86%	Very Valid
6.	Creating the ability to ask questions	87%	Very Valid

The value for each indicator in the content aspect ranges from 86% to 88% percent with a very valid category, and the average value for this category is 87% percent. The average of 87% in items 8,10 and 12 shows that the multimedia used is in accordance with student needs, the accuracy of examples and cases creates students' ability to ask questions. Referring to the content aspect in the study [Warsita \(2017\)](#) explained that learning resources must be designed in a more real way. For example, learning materials must offer challenges where students can work together to create solutions to lesson problems. Problem solving produces questions and questions that must be answered by students, who can then try to solve problems in the context of learning by using the information resources they have.

Table 3 Results of PBL-Based Interactive Multimedia Validation on the Aspect of Language Feasibility by Experts

	Language Eligibility Aspects	Average	Category
1	Correctness of sentence structure	88%	Very valid
2	Understanding messages and information	87%	Very valid
3	Grammatical correctness	89%	Very Valid
4	Effectiveness of sentences	86%	Very valid

The indicator value on the aspect of language feasibility, as shown in [Table 3](#), ranges between 86% and 89% with a valid category. The average value of the validity of PBL interactive multimedia, which is 88% with a very valid category, indicates that the language aspect is fully feasible to use without any invalid information. Item 15 has a higher average value because grammatical accuracy is considered to support learning referring to [Indrayanti et al.\(2024\)](#), language is a representation of a person's thoughts, feelings, and emotions. Good and correct grammar is very important for effective communication, both verbally and in writing. The writing must use good and correct language and comply with the

rules of grammar so that it is easy to understand and comprehend. Table 4 shows the validity of PBL Interactive Multimedia in technical aspects.

Table 4 Results of PBL-Based Interactive Multimedia Validation on Technical Aspects by Experts

	Technical Aspects	Average	Category
1	Ease of use of media	90%	Very valid
2	Practicality of using Media	90%	Very valid
3	The ability of media to help students understand environmental pollution material	90%	Very Valid

The indicator value on the technical aspect of interactive multimedia, as shown in Table 4, is 90% with a very valid category. This shows that the technical aspect is fully feasible to use without any invalid information. All items on the technical aspect show that interactive multimedia is easy, practical and able to help students understand the content presented. Furthermore, Table 5 shows the validity of PBL Interactive Multimedia as a whole in the aspects of appearance, content, language feasibility and technical.

Table 5 Results of Overall Validation of PBL-Based Interactive Multimedia by Experts /Expert

No	Aspect	Average	Category
1	Appearance	88%	Very Valid
2	Content	87%	Very Valid
3	Language Eligibility	88%	Very Valid
4	Technical	90%	Very Valid
	Average	88%	Very Valid

Experts have concluded that interactive multimedia PBL is Very valid with an average value of 88%, as shown in Table 5, so it can be continued to the assessment stage. The data obtained in each aspect becomes the basis for reflection for researchers in developing further multimedia. The validity of multimedia is considered important because based on research Setiyanto et al. (2023) multimedia can create a high-quality learning environment. Important elements of various media, user control over the delivery of information, and user interaction are some of the advantages of using media to create a good learning environment. Next, after the media is in accordance with the assessment aspect components by experts, namely implementation and evaluation, the assessment is carried out. PBL Interactive Multimedia Calculations are reviewed based on their ease of use and efficiency.

B. Implementation And Evaluation

After the assessment by the validator, a trial was carried out on the group. teachers consist of 50 people and students consist of 125 people as served on Figure 6 below.

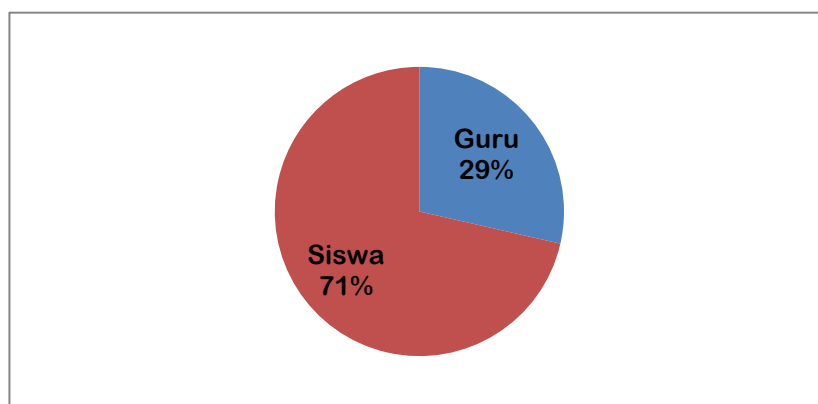


Figure 6 Respondents of the Practicality Test of PBL-Based Interactive Multimedia

Based on the analysis, the digital literacy of both teachers and students is identified as the primary focus of the assessment, as shown in Figure 4.6. The purpose of this assessment is to evaluate the ease of use and efficiency of the PBL-based interactive multimedia. Figure 4.6 illustrates how the multimedia supports digital literacy through its features and user-friendly design. Furthermore, the overall results of the teacher and student response questionnaires are presented in Table 6 below.

The implications of these findings suggest that the use of PBL-based interactive multimedia not only enhances student engagement but also strengthens digital literacy for both educators and learners. This is crucial in addressing the demands of 21st-century learning, which increasingly relies on technology integration.

For future development, it is recommended that the multimedia continue to be improved by adding more adaptive interactive features, integrating artificial intelligence for personalized learning, and expanding content across other subject areas. Additionally, ongoing digital literacy training for teachers is essential to ensure effective implementation of multimedia tools in various learning environments.

Table 6 Results of the Practicality Questionnaire by Teachers and Students Overall

No	Rated aspect	Respondents	Practicality value (%)	Category
1	Ease of Use	Teacher	85%	Practical
		Student	85%	Practical
2	Efficiency	Teacher	86%	Practical
		Student	86%	Practical
Average			86%	Practical

Table 6 shows that the assessment of the practicality of each aspect with a value of ease of use of 85% and Efficiency of 86% with the Practical category. Practical interactive multimedia can make learning more interesting for teachers and

students so that it is more meaningful. Yuniastuti & Khoiron (2021) said that learning patterns that emphasize teaching media are the best because they can provide information that is easier to understand and allow repeated learning without spending a lot of time at the same time. Digital learning is more effective than conventional learning, so even though there are some problems, technology must be used for teaching (Sawitri et al., 2019). Furthermore, in supporting digital literacy according to Dinata (2021), Digital literacy is very important for educational success. Students who have digital literacy skills will actively search for and collect relevant data in addition to understanding, expressing, and communicating concepts in a digital environment. Furthermore, this will instill in them a sense of confidence to express themselves artistically through writing, drawing, and communication, which will ultimately produce better results for themselves.

CONCLUSION

The results of the development research show that the process of creating PBL-based Interactive Multimedia assisted by Quizizz was carried out using the Dick and Carey instructional design model. This model includes ten systematic steps: (1) identifying general learning goals, (2) conducting learning analysis, (3) analyzing learners' characteristics and learning context, (4) writing specific learning objectives, (5) developing assessment instruments, (6) planning learning strategies, (7) developing and selecting learning materials, (8) conducting formative evaluation, (9) making necessary revisions, and (10) conducting summative evaluation.

After completing the development process, the product was evaluated for its quality. The validation results showed a score of 88%, which falls into the "Very Valid" category. This means that the content, design, and structure of the multimedia product are appropriate and meet academic standards. In addition to being valid, the product was also tested for practicality. It received a practicality score of 86%, indicating that both teachers and students found it easy to use and applicable in real classroom settings. This suggests that the developed multimedia is not only theoretically sound but also useful and effective for learning activities.

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iSpring Suite-Based Interactive Multimedia Development For Class V Volume Material Cube and Beam

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Abstract

The lack of variety in the use of media in learning can make students bored and learning becomes monotonous. Teachers still use teacher books, student books and learning media in the form of building spaces made of paper where the media is easily damaged. In fact, the use of the right media in the learning process can create a fun classroom atmosphere, so that students become active, creative, effective and get meaningful learning. The facilities provided by the school are also quite complete such as; Projectors, laptops as well as speakers and microphones are only used to the maximum. To maximize these facilities, the researcher wants to develop an interactive multimedia based on *the iSpring Suite* which aims to improve the learning outcomes of class V students of cube and block volume materials. This research method uses R&D research with the Borg and Gall development model consisting of 10 steps, but in its implementation the researcher only reaches the 8th step. The media created is then tested by material and media experts. The validation test was obtained as a result of the assessment according to material experts of 91.07% (very feasible) and according to media experts of 82.5% (feasible). In addition, after being used in learning, this media showed a significance result on the T-test of 23,723 and the N-gain test obtained a result of 0.7555 which was included in the high criterion. Based on the results of the study, it is shown that the use of interactive multimedia based on *iSpring Suite* is effectively used to improve student learning outcomes.

Keywords: Cube and Block Volume; Interactive Multimedia; Learning Outcomes.

INTRODUCTION

Education is an important part of the life of the nation and state because education is a means to develop and increase the potential of the nation's children. As stated in the preamble to the 1945 Constitution in the 4th Amendment to educate the life of the nation, to achieve this is with education because education is an effort to achieve national goals so the government makes regulations related to the world of education, one of which requires the public to study for 12 years. Based on the 1945 Constitution of the Republic of Indonesia Article 31 paragraph (1), "Every citizen has the right to education." Where education is considered a human right, every Indonesian

citizen and every citizen has the right to get education with the same portion without social disparities.

The curriculum applied in Indonesia at this time is an independent curriculum. Decree of the Minister of Education, Culture, Research and Technology of the Republic of Indonesia Number 56/M/2022 concerning Guidelines for the Implementation of the Curriculum in the Context of Learning Recovery. The Permendikbudristek states that the independent curriculum is an operational curriculum prepared by educational units based on the basic framework and curriculum structure provided by the Ministry of Education and Culture. According to [Aprillia et al., \(2022\)](#) The independent curriculum is a curriculum where the intracurricular learning is varied so that students can better understand and have concepts, and strengthen their knowledge. According to Permendikbudristek Number 56 of 2022, education refers to efforts to develop students' potential through a student-centered learning process, with a focus on learning recovery and the implementation of the Independent Curriculum. In the learning process, there is a scope of subjects given at the elementary school level as stated in Government Regulation Number 57 of 2021 concerning National Education Standards, one of which is the subject of Mathematics. Mathematics is an important aspect of daily life that can help us solve problems, understand the world around us, make informed decisions, develop critical thinking skills and become more creative and cooperative ([Ginanjar, 2019](#)).

Mathematics is one of the compulsory subjects in learning at school. Mathematics is a field of science that studies calculations, the study of using reason and the ability to think logically, because mathematics is closely related to education so that it is one of the compulsory subjects in every educational unit ([Kinanti et al., 2024](#)). According to Wandini and Banurea ([Wiryanto, 2020](#)) Mathematics learning is a process of learning science using reason and having a structured plan by involving thoughts and activities in building problem-solving skills and conveying information or ideas.

Children in primary school experience development in thinking and learning, and learning mathematics is one of the interesting subjects to develop ([Anggraini, 2021](#)). According to Susanto ([Astuti et al., 2020](#)) Mathematics Defense is a teaching and learning process carried out by teachers to improve students' critical thinking skills in creating new knowledge so as to increase good mastery of mathematics material. The classroom learning process in elementary school mathematics is designed to help students develop fundamental math understanding and skills ([Andini et al., 2023](#)). Usually the fundamental ones are in the form of introduction to basic mathematical concepts, exercises and applications to help students practice the concepts that have been learned, problem solving where students are encouraged to use their mathematical knowledge to solve problems and evaluation to conduct periodic assessments to determine the progress of students' learning. Mathematics is different from science because mathematics is a definite science.

Mathematics learning in elementary school is essential for children. Often considered a difficult and scary subject to teach to students because it is uninteresting and boring (Indofah & Hasanudin, 2023). According to Idris and Narayanan (Afrianti, 2022) A common difficulty experienced by teachers in mathematics learning is to understand and provide students with the right understanding of the basic concepts of mathematics material correctly. One of the things that teachers can do in mathematics learning to support the learning process is to use media in the learning process.

Literally media comes from the Latin baha-sa "medium" which means intermediary or tool. Media can help convey learning information that is interesting and easy to understand. According to Wulandari et al., (2023) Learning media is a tool used in delivering material so that it makes it easier for educators to teach so that students' attention and interest in learning are aroused. According to Sapriyah (2019) Learning media is everything that can be used to convey messages or information during the teaching and learning process so that it can encourage students' motivation and interest in learning. So it can be concluded that the media is an intermediary, both tools and non-tools, both visible and invisible, that can help in the process of conveying information in learning.

The use of media in learning is very necessary to help teachers in conveying learning information and also spur students' motivation to learn (Rejeki et al., 2020). According to Spiritual (2020) Some of the benefits of media in the learning process are (1) helping to make it easier for students and teachers in the learning process, (2) abstract teaching can be realized in concrete form through tools, (3) the teaching and learning process becomes not boring and not monotonous, and (4) sensory tools can interpret and dialogue, learning activities that use media will make it easier for students to understand the teacher's explanation. Because students use the sense of sight (eyes) also use the sense of hearing (ear) in the process of receiving lessons. Effective learning media can help and improve the quality of learning, increase students' motivation to learn, support individual learning according to students' abilities and also convey direct messages (Putri, 2022).

Along with the development of the times, technological development is so rapid. The use of media in learning is increasingly relevant in supporting the teaching and learning process (Arfandi, 2020). Interactive multimedia is one of the media that has the potential to help reveal the effectiveness and interactivity of learning. The application of interactive multimedia is considered practical, as evidenced by its implementation in teaching materials and tools by observers for teachers. The application of interactive multimedia as a learning medium can improve student learning outcomes (Rahmadani & Taufina, 2020).

Not only in the world of education, but mathematics is also very closely related to daily life; therefore, mathematics is very important to learn. In the learning process, the obstacles experienced by teachers are the lack of understanding of the right media and the lack of creativity of teachers to

create creative and interesting media for students so that students are less interested in paying attention to mathematics learning (Ayu et al., 2021). The results of the research conducted by Fauzi et al., (2020) The difficulties faced by teachers during the mathematics learning process include: 1) lack of interest in learning students in mathematics lessons; 2) students are lazy in memorizing formulas; 3) the difference between the learning system then and now; 4) the use of thematic books is less effective for mathematics learning, and 5) teachers have difficulty developing the material in the book. This is because mathematics is often considered a difficult and boring subject.

Based on the results of observations in class V and the results of interviews with class V teachers, there are several problems experienced in the mathematics learning process. The low motivation and concentration of students in the mathematics learning process often occurs because students do not have an interest in learning mathematics, they think that mathematics is a difficult and boring subject so that it can hinder the learning process. In mathematics learning, especially in the volume of cubes and blocks, teachers have difficulty in understanding students because they do not understand how the basic concept of building space and teachers have not developed interesting media to support the learning process. The learning media used is still not interesting, where teachers only use teacher books and student books in the learning process. As well as the lack of optimal utilization of the use of existing media such as projectors where the use of media itself aims to support the learning process so that the participants are interested and enthusiastic to participate in learning. In fact, the use of media in the learning process is very important to use, because the existence of learning media can support students in accessing wider learning, enrich the learning experience through interesting audio and visuals and make students more active (Nurfadhillah et al., 2021; Matje, 2022).

The results of observations and interviews that have been carried out can be drawn several causes of problems that occur in class V of SDN Tambakaji 03, including (1) the occurrence of Learning Loss in the basic concept material of building a space which makes students have difficulties in understanding the Volume meter (Blocks and cubes); (2) the strategies used by teachers are still monotonous in the learning process, so that the motivation and concentration of learning in students is low; (3) technology facilities that have not been used to the maximum; and (4) the lack of use of learning media in supporting the learning process, therefore it is necessary to develop digital media that can support the learning process, especially in the volume of cubes and blocks of Mathematics subject matter.

Based on the existing problems, the researcher wants to develop an Interactive Multimedia based on *iSpring Suite* to improve students' learning outcomes in class V cube and block volume material at SD Negeri Tambakaji 03. The use of the right media in the learning process can create a fun classroom atmosphere, so that students become active, creative, effective and get meaningful learning (Magistretti et al., 2022; Neteria et al., 2020). The

development of this media is one of the interesting things because it utilizes technology by using laptops and projectors as well as mobile phones to make learning more interesting. This interactive multimedia is arranged in such a way as a tool to support and assist students in the learning process. Interactive multimedia-based *iSpring Suite* Assist teachers in the dissemination of knowledge both online and offline, with interactive multimedia the teaching and learning process can be done anywhere and anytime (Rihani et al., 2022). In interactive multimedia, there are interesting animations, images, videos, and digital text that clarify the material of the volume of cubes and blocks studied.

Menuru Nurcahyo & Mulyati (2020) Interactive multimedia is the amalgamation of text, photos, graphic art, sound, animation, and video and allows users to interact and communicate with multimedia products. According to Susilo et al., (2023) By using interactive multimedia for students, they feel happy using the media, the media is easy to understand, and the ability of students to complete and conclude practice questions and quizzes increases. Interactive multimedia is very practical so that it is easy to accept, digest and used by students for learning (Ariyanti et al., 2020); Donna et al., 2021). Interactive multimedia is very easy for students to use and has interesting features so that it can improve critical thinking skills (Firdaus et al., 2020; Muchtar et al., 2021).

METHODS

The research conducted by the researcher employs quantitative approaches/methods, which involve testing objective theories by examining the relationships between variables. Meanwhile, the type of research used is Research and Development (R&D). Research and Development (R&D) is a research method used to develop and validate the effectiveness of educational products or products (Rashid, 2022). R&D is research that focuses on developing a new product or improving a product that other researchers have developed.

The subjects in this study are students of class V B SDN Tambakaji 03 for the 2024/2025 school year, with a total of 28 students. As many as six students are used for small-scale trials, and as many as 22 students are used for large-scale trials. The sample selection carried out by the researcher used the purposive sampling technique. Purposive sampling is a technique that can determine the sample used with certain considerations that aim to make the information obtained more representative (Lenaini, 2021). A V homework teacher and media and material expert who will act as an interactive multimedia consultant based on *iSpring Suite*.

The development model in this study refers to the model proposed by Borg and Gall, which was adapted by Sugiyono (Winaryati et al., 2021) The process consists of 10 steps, but the researcher only reaches the 8th step due to adjustments made to accommodate the research's needs and time constraints. Here are the steps: (1) potential and problem, (2) data collection, (3) product

design, (4) design validation, (5) design revision, (6) product trial, (7) product revision, (8) usage trial. Researchers take this development model because the development model is systematic and structured for the development of an educational product or program, Focus on the needs so that the developed product or program can meet the existing needs, development based as well as this model involves testing and revision of the product or program to ensure that the final product meets the expected quality standards.

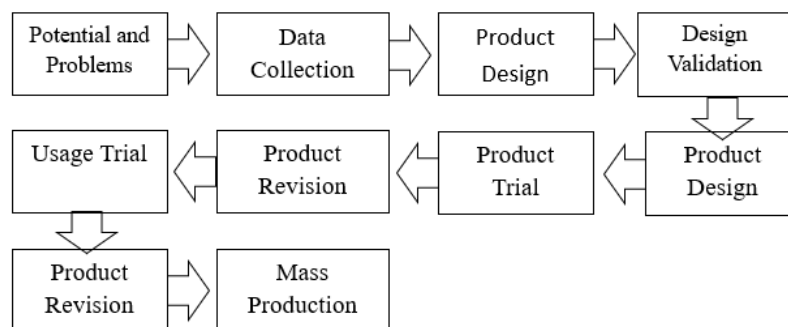


Figure 1. Steps of the Research and Development (R&D) method.

The research was conducted in August, coinciding with the odd semester of the 2024/2025 school year. The initial stage in the development of interactive multimedia based on *iSpring Suite* began with the researcher identifying existing potentials and problems through pre-research activities, namely identifying problems using interview techniques with class V teachers and the researcher also collected document data in the form of learning outcomes of grade V students of SDN Tambakaji 03 and documentation. The next stage after the researcher knows the potential and problems that exist at the research location, the researcher then collects data by providing a questionnaire of needs to teachers and students of grade V SDN Tambakaji 03, in addition to that the researcher also analyzes learning outcomes, after the researcher analyzes the needs of teachers and students, the researcher begins to design an interactive multimedia design based on *iSpring Suite*, after the interactive multimedia based on *the iSpring Suite* was created, then the researcher carried out the validation stage of product feasibility assessment to experts consisting of media experts and material experts and the last stage, the researcher conducted a trial of small-scale and large-scale use which aims to enable the researcher to determine the effectiveness of interactive multimedia in learning. The trial of the use of the product was carried out at SDN Tambakaji 03 on 6 students for small scale and 22 students for large scale in class V using *a pretest posttest*. From the results of small-scale and large-scale use trials, researchers can measure student learning outcomes by comparing *pretest* and *posttest learning outcomes*.

The data collection techniques used are test techniques consisting of *pretest* and *posttest*, as well as non-test approaches through interviews, observations, questionnaires, and documentation. The initial data analysis began with a normality test to find out whether the data was distributed normally or not

and the final data analysis to find out the difference in learning outcomes in the use of interactive multimedia based on *the iSpring Suite* was carried out using the T-Test test and the N-Gain test to determine the improvement of student learning outcomes.

RESULT AND DISCUSSION

Based on the development stages of Borg and Gall that have been described, the researcher uses 8 out of 10 development steps. The researcher developed interactive multimedia based on *iSpring Suite* to improve the learning outcomes of grade V students of SDN Tambakaji 03 on cube and block volume material.

(1) Potential Problem Stage

The researcher analyzed the potential and problems by conducting pre-research through observation interviewing homeroom teachers of grade V of SDN Tambakaji 03. Based on the results of interviews obtained by researchers to address the problems at SDN Tambakaji 03, it shows that the media used by teachers in learning is not optimal because teachers still use teachers' books and students' books in the learning process, as well as the lack of optimal utilization of the use of existing media such as projectors where the use of media itself aims to support the learning process so that the participants are interested and enthusiastic to follow Learning. The problem of limited media in learning mathematics of cube volume materials and blocks makes researchers want to develop this product to overcome the problem of learning mathematics of cube and block volume materials.

(2) Stage of Data Collection

After the researcher analyzed the potential and problems that existed in grade V of SDN Tambakaji 03 in mathematics teaching of cube and block volume materials, the researcher collected data that will be used to design research to be carried out, both in the form of learning outcomes, questionnaires of teacher and student needs, and documentation.

(3) Product Design Stage

At this stage, the researcher has begun to make product designs regarding the media to be developed. The researcher used the help of the Canva application to make it easier to create media designs. The steps in preparing media creation carried out by the researcher are to determine the material and content to be included, look for elements and find the background of the media so that the appearance matches the material. In the media that the researcher developed, there is a display of Instructions, the main menu which contains learning outcomes, learning objectives, teaching materials, learning videos, evaluation questions and also the profile of the media developer. There are evaluation questions in the media so that teachers know the extent of students' understanding of the material presented. This interactive multimedia based on *iSpring Suite* can be used by students individually or in groups, according to the learning model that the teacher does. The *iSpring*

Suite-based interactive multimedia design display can be seen in the following image.



Figure 2 cover



Figure 3 Instructions for Use



Figure 4 Main Menu

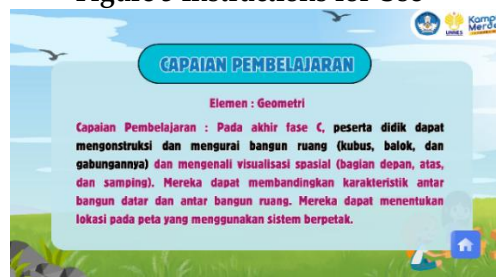


Figure 5 Learning Outcomes



Figure 6 Learning Objectives



Figure 7 Learning Materials



Figure 8 Learning Videos



Figure 9 Evaluation Questions



Figure 10 Developer Profile

(4) Product Design Validation Stage

The design that has been made will then be continued at the assessment stage by two experts, namely material experts and media experts. Research instruments are products that will be used to be validated by expert lecturers by filling in and responding to questions that have been made by researchers. This is done to find out whether the product made by the researcher is feasible or not. The material expert validation instrument consists of 3 aspects with 14 indicators, while the media expert validation instrument consists of 3 aspects with 10 indicators. The scores that have been obtained are then processed in the form of percentages as in [Table 1](#).

Table 1. Eligibility Criteria

Media Eligibility Score (%)	Criterion
20%-36%	Very unworthy
37% - 52%	Not eligible
53% - 68%	Quite decent
69% - 84%	proper
85% - 100%	Very deserved

Based on the results of the recapitulation of material experts, *iSpring Suite*-based interactive multimedia obtained a score of 51 with a percentage of 91.07% with the Very Feasible criterion. The results for the recapitulation of the assessment of interactive multimedia media experts based on *iSpring Suite* obtained a score of 33 with a percentage of 82.5% with the Eligible criteria. Thus, it can be concluded that the interactive multimedia based on *iSpring Suite* that the researcher developed is suitable for use in Mathematics learning in grade V of elementary school. [Table 2](#) shows the results of expert validation as follows.

Table 2. Expert Validation Results

Validator	Overall Score	Score obtained	Percentage	Criterion
Material Expert	56	51	91,07%	Highly feasible
Media Member	40	33	82,5%	Proper

(5) Design Revision Stage

Product validation, conducted by material and media experts, aims to determine the feasibility of the developed product before field testing. Input and suggestions from expert validators are used as a reference to improve and revise the product before use. The improvement results are based on the input and suggestions of expert validators as follows.

1. Adding the Definition of Unit Cubes



Figure 11 Views Before Validation



Figure 12 Post-Validation View

2. Add an Image caption to the bottom of the image

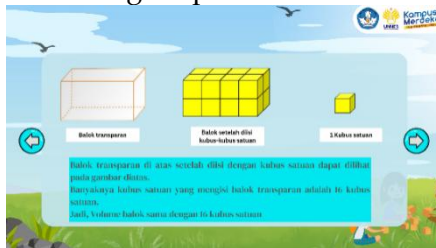


Figure 13 Views Before Validation



Figure 14 Post-Validation View

3. Writing the solution into two lines

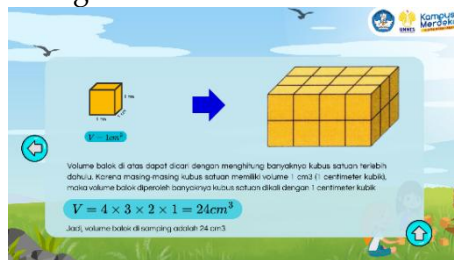


Figure 15 Views Before Validation

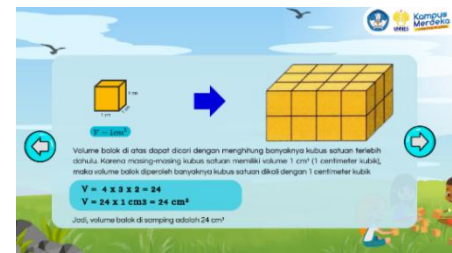


Figure 16 Post-Validation View

4. Addition of formula writing to find block volume



Figure 17 Views Before Validation



Figure 18 Post-Validation View

5. The color of the text for learning purposes is not contrasted with the background

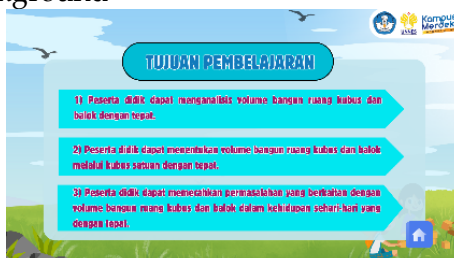


Figure 19 Views Before Validation

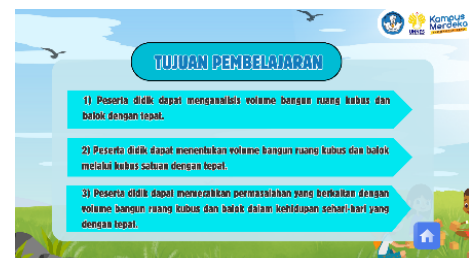


Figure 20 Views After Validation

6. Add Learning Resources



Figure 21 Post-Validation View

(6) Trial Stage

The small-scale product trial was carried out in class V of SDN Tambakaji 03 with a total of 6 students. The product trial aims to determine the effectiveness of the use of interactive multi-media based on *iSpring Suite* and the obstacles that occur.

The trial of this product uses the purposive sampling technique. Purposive sampling is a technique that can determine the sample used with certain combinations that aim to make the information obtained later more representative (Lenaini, 2021). The researcher involved 6 students who will conduct small-scale product trials, 2 students with higher rankings, 2 students with middle rankings and 2 students with lower rankings based on knowledge aspects. This is done so that product trials can be balanced and evenly distributed. The trial is carried out by providing a written test (*Pretest-posttest*) to students as well as a questionnaire of student responses related to media that has been developed by the researcher so that the research can compare the before and after conditions in using multimedia-based interactive *iSpring Suite*. The result was an increase in before and after learning using multimedia-based interactive *iSpring Suite*. Where the average obtained by students from 25.66 to 77.83. Data resulting from *Pretest* and *Posttest* on small-scale trials presented in Table 3.

Table 3. Small-Scale Trials

Action	Lowest Score	Highest Score	Average Score
<i>Pretest</i>	20	33	25,66
<i>Posts</i>	67	87	77,83

(7) Product Revision Stage

The product revision was carried out after IT researchers discovered product shortcomings during a small-scale trial that aimed to improve interactive multimedia based on *iSpring Suite*-based interactive multimedia based on teacher and student feedback instruments. The results of the revision of small-scale trial products will be used for large-scale trials.

Based on the results of the responses of teachers and students, there was a suggestion for interactive multimedia based on *iSpring Suite*, namely in the

developer's photo section which was not very good. The following is a before and after revision view given by teachers and students.



Figure 30 Views Before Validation



Figure 31 Post-Validation View

(8) Trial Stage of Usage

After the product was revised, the next step was to conduct large-scale trials on 22 students in class V of SDN Tam-bakaji 03. This large-scale trial was conducted by involving 22 students of class V of SDN Tambakaji 03 to find out the effectiveness of interactive multimedia based on *iSpring Suite* in the form of practice and understanding of cube and block volume materials. The trial was carried out according to the learning plan. The implementation of pretest-posttest is used to get a more accurate comparison of the results of students' conditions before and after being given treatment. The results of the *pretest* and *posttest* data showed an increase in students' average scores from 40.27 to 84.36 after testing using a large scale. Table 4 shows an increase in student learning outcomes in class V cube and block volume material before and after using the *iSpring Suite*-based in-active multimedia developed by the researcher.

Table 4. Large-Scale Trials

Action	Lowest Score	Highest Score	Average Score
<i>Pretest</i>	13	67	40,27
<i>Posts</i>	67	100	84,36

The normality test conducted by the researcher used the results *Pretest* and *Posttest* grade V students of SDN Tambakaji 03 who aim to find out whether the data is distributed normally or not. The normality test used is the Shapiro-Wilk Test which is the basis for decision-making, namely if the level of significance > 0.05, then the value of student data is normally distributed on the other hand, if the level of significance < 0.05, then the value of student data is abnormally distributed (Simanjuntak et al., 2023).

The results of the normality test showed that the calculation in the small-scale trial of the *pretest* part had a significance value of 0.204 and in the *posttest* part had a significance value of 0.371, while the level of significance value was 0.05. if the significance value > 0.05, it can be concluded that H0 is accepted to be distributed normally. The calculation results carried out in the large-scale test of the *pretest* part had a significance value of 0.297 and the *posttest* part had a significance value of 0.283. The level of significance value is 0.05, if the

significance value is > 0.05 , it can be concluded that H_0 is accepted as a normal distribution. Table 5 shows the results of the normality test as follows.

Table 5. Normality Test Results

Action	Shapiro-Wilk		
	Statistics	Df	Sig.
Small scale <i>pretest</i>	.864	6	.204
Small scale <i>posttest</i>	.900	6	.371
Large-scale <i>pretest</i>	.949	22	.297
Large-scale <i>posttest</i>	.948	22	.283

After conducting a normality test and the data is declared to be normally distributed, the next step is to conduct a t-test. t-test is carried out to determine the level of effectiveness of interactive multimedia based on *iSpring Suite* on student learning outcomes by finding out the difference in the average *pretest* and *posttest* scores. The results of the small-scale t test showed that the $t_{\text{calculation}}$ obtained was $-24,980$ and the table t was $2,570$. The results of $t_{\text{calculation}} 24,980 > t_{\text{table}} 2,570$ were obtained, then H_0 was rejected and H_1 was accepted. The results of the large-scale t test showed that the $t_{\text{calculation}}$ obtained was $-23,723$ and the table t was $2,079$. The result of $t_{\text{calculation}} 23,723 > t_{\text{table}} 2,079$ was obtained, then H_0 was rejected and H_1 was accepted. Based on the results of the analysis, it can be concluded that there are differences and influences in the learning outcomes of class V cube and block volume materials before and after using *iSpring Suite*-based interactive multimedia. Table 6 shows the results of the t-test as follows.

Table 6. T Test Results

		Paired Differences							
		Mean	Std. Devi ation	Std. Err or Mea n	95% Confidence Interval of the Difference		t	D f	Sig. (2- tailed)
					Lower	Upper			
Small- scale	<i>Pretest-</i>	-	5.11	2.08	-	-	-	5	<,001
	<i>posttest</i>	52.16 667	534	833	57.534 88	46.79 845	24.9 80		
Large- scale	<i>Pretest-</i>	-	8.71	1.85	-	-	-	2	<,001
	<i>posttest</i>	44.09 091	730	853	47.955 94	40.22 587	23.7 23		

Next is the N-Gain Test. The N-Gain test was conducted to determine the effectiveness of the use of interactive multimedia based on *iSpring Suite* by

measuring the average increase in scores in the *pretest* and *posttest*. The results of the N-gain test showed an increase in the learning outcomes of class V students of SDN Tamba-kaji 03 in the volume of cubes and blocks, namely 0.7075 for the small-scale N-Gain test and 0.7555 for the small-scale N-Gain test, which is included in the high effectiveness category. Table 7 shows the results of the N-Gain test as follows.

Table 7. N-Gain Test Results

N-Gain	N	Minimum	Maximum	Mean	Std. Deviation
Small-scale	6	.59	.82	.7075	.09542
Large-scale	22	.60	1.00	.7555	.11491

Based on [Table 7](#), it can be concluded that there is an increase in learning outcomes when using interactive multimedia based on *iSpring Suite* on the volume of cubes and blocks of grade V students of SDN Tambakaji 03.

This study differs from previous studies, both in terms of the year of the study, the population and the sample of the study, as well as the location of the study. In addition, the difference between the previous research and this research is in the theories and development models used to develop the product, namely using the development steps of Borg and Gall adapted by Sugiyono, and the content of the material in this product is the volume material of cubes and blocks for grade V elementary school. The development of interactive multimedia in this study is *the iSpring Suite* version 11, where version 11 is the latest version of *the iSpring Suite* application. Previous research in the evaluation section still uses link quizzes while in this study students can directly access all existing questions after working on the questions students can directly see the results of the grades they get.

The development of interactive multimedia based on *iSpring Suite* can foster teachers' creativity in supporting the learning process in the classroom. In addition, interactive multimedia based on *iSpring Suite* can assist teachers in conveying cube and block volume material. Students can also be more active in learning because the media attracts students' attention.

This research aims to contribute to mathematics education by providing a learning medium that supports its development. In addition, it is hoped that this learning media research can be used as an illustration for future research. *iSpring Suite*-based interactive multimedia received responses from both students and teachers during the learning process. It can be concluded that interactive multimedia based on *iSpring Suite* can improve student learning outcomes. The researcher's interactive multimedia is expected to be implemented in both online and offline learning. Teachers can develop interactive multimedia of cube and block volume materials that are completer and more innovative in order to improve the quality of schools.

CONCLUSION

The product of this research is an interactive multimedia based on *iSpring Suite* to improve student learning outcomes. The feasibility of *iSpring Suite*-based interactive multimedia meets the aspects that the material validators and media validators have assessed. The assessment from the material validator obtained a score of 91.07% with very feasible criteria, while the assessment from the media validator obtained a score of 82.5% with feasible criteria.

The effectiveness of the use of interactive multimedia based on *iSpring Suite* as a learning medium to improve students' learning outcomes on cube and block volume materials can be seen from the results of the t-test which showed the results of $t_{\text{calculation}} 23,723 > t_{\text{table}} 2,079$ where there was a difference and influence of student learning outcomes and seen in the results of the N-gain test showed an average of 0.7555 which was included in the category high effectiveness. The existence of this interactive multimedia based on *iSpring Suite* can make students learn cube and block volume material.

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Development of a Moodle-based e-learning with the flipped classroom model to improve self-efficacy and Mathematics learning achievement

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Abstract

Mathematics plays an important role in cognitive development. However, most students have low self-efficacy in mathematics. Low self-efficacy among students has an impact on their poor mathematics learning achievement. This study aims to develop Moodle-based e-learning using the flipped classroom model to enhance students' self-efficacy and mathematics learning outcomes. This research employed a research and development (R&D) method using the ADDIE development model. The results of the study indicate that: (1) the development of Moodle-based e-learning with the flipped classroom model obtained a validity score percentage of 95% in terms of content and 95% in terms of media, both categorized as very valid; (2) it received practicality scores of 100% in the one-on-one trial and 90% in the small group trial, both categorized as very practical; and (3) it significantly improved students' self-efficacy and mathematics learning outcomes, with N-gain values of 0.5 and 0.46 respectively, both categorized as moderate. The results of the independent samples t-test (two-tailed) showed a significance value of $0.000 < 0.05$ with $\alpha = 0.05$. Although this research was conducted during the COVID-19 pandemic when online learning was essential, the findings remain relevant and applicable in today's educational context. Even after the pandemic, as hybrid and digital learning become increasingly integrated with face-to-face learning, this model continues to offer significant benefits. It allows students to study materials independently outside the classroom and enhances meaningful interaction during in-person sessions. Therefore, the use of Moodle-based e-learning combined with the flipped classroom model can serve as a sustainable method to improve students' self-efficacy and mathematics learning outcomes in the long term.

Keywords: Flipped Classroom Model; Learning Achievement; Moodle-Based E-Learning; Mathematics; Self-Efficacy.

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INTRODUCTION

Mathematics is a fundamental subject in the field of education, as it serves as a foundation for mastering other branches of knowledge, such as physics, economics, technology, and even the social sciences. Mathematics trains students to think critically and logically (Cresswell & Speelman, 2020; Sachdeva & Eggen, 2021; Wang & Abdullah, 2024). Mathematics plays a crucial role in developing critical thinking skills from an early age (Pransiska et al., 2025; Utoyo et al., 2025). This foundational ability is vital in modern life, where mathematics has a significant influence across various fields and sectors (Gusteti et al., 2025). Furthermore, mathematics is one of the core skills that students must master to effectively tackle real-life challenges and problem-solving tasks (Fauzan et al., 2024; Hidayah et al., 2024). In everyday life, students are faced with various problems that require analytical skills, decision-making, and problem-solving abilities skills that are naturally developed through learning mathematics.

Although mathematics is essential for students to master, many students have negative attitudes toward the subject. They perceive mathematics as difficult and boring. These negative perceptions are often influenced by students' lack of confidence in their own mathematical abilities, a belief commonly referred to as self-efficacy (Afifah & Kusuma, 2021; Widyastuti & Nuriadin, 2021). According to Bandura, "Self-efficacy refers to an individual's belief in their ability to successfully perform a task or solve a problem" (Bandura, 1995). Self-efficacy theory, first introduced by Bandura, has become a central construct in educational psychology and has been widely adopted in studies examining motivation and academic performance. For example, research by Pajares and Miller (1994) and Zimmerman (2000) emphasized that students with high self-efficacy tend to be more persistent, more engaged, and achieve better outcomes in academic settings. In the context of mathematics education, self-efficacy has been found to be a strong predictor of student success (Schunk & Pajares, 2002; Phan, 2012). A low level of self-confidence in mathematics was also found among students at SMPN 8 Muaro Jambi. Based on observation, students' self-efficacy in mathematics was classified as low. Many students struggle with mathematics not only due to cognitive difficulties but also because of low self-efficacy, which significantly affects their learning outcomes. Low self-efficacy in mathematics often leads to decreased motivation, minimal classroom engagement, and avoidance of challenging tasks. For instance, students with low confidence in their mathematical abilities may hesitate to participate in class discussions, delay homework completion, and even develop anxiety related to math examinations. In the long term, this can hinder their academic development and reduce their willingness to pursue mathematics-related fields. Preliminary observations at SMPN 8 Muaro Jambi revealed that most students expressed feelings of inadequacy when faced with mathematical problems, and their performance consistently remained below average. This low self-efficacy had an impact on their academic achievement and declining learning outcomes. This finding aligns with several studies indicating that students' self-efficacy influences their academic performance and learning outcomes in class (Monika & Adman, 2017; Widyaninggar, 2015). These issues highlight the urgent

need for an instructional approach that not only delivers content but also actively builds students' confidence and engagement in learning mathematics.

One instructional approach considered effective in supporting students' self-efficacy and learning achievement is the use of the Flipped Classroom model. Several studies have found that students' self-efficacy can be improved through the flipped classroom model (Husna & Sofnidar, 2022; Ulya, 2019; Yanah et al., 2018). Other studies have also shown that the flipped classroom model is effective for use in limited face-to-face learning scenarios (Efendi & Maskar, 2020; Husna & Sofnidar, 2022; Supriatna, 2021). The flipped classroom is a student-centered learning model that incorporates the use of technology, allowing the learning process to be divided into pre-class, in-class, and post-class stages, enabling teachers to enhance their creativity (Abeysekera & Dawson, 2015).

The flipped classroom model aligns well with constructivist learning theories, where students actively construct knowledge through interaction, reflection, and collaboration (Bergmann & Sams, 2012). Moreover, studies such as by Thai et al. (2017) and Lo & Hew (2017) demonstrate that the flipped classroom model has the potential to foster deeper conceptual understanding and greater student autonomy based on two key factors that contribute to self-efficacy.

According to (Bates et al., 2017), the flipped classroom consists of three stages: pre-class, in-class, and after-class. This model is particularly well-suited to addressing challenges related to self-efficacy and mathematics learning, as it gives students greater control over their learning pace and encourages active participation during class. By accessing instructional materials such as videos before class, students can review concepts multiple times in a low-pressure environment, which can help reduce anxiety and enhance understanding. The in-class stage emphasizes problem-solving and peer collaboration, enabling students to build confidence through guided practice and immediate feedback. This restructured instructional approach helps learners feel more prepared and capable, ultimately improving both their self-efficacy and engagement in mathematics. Furthermore, according to (Basal, 2015), in the flipped classroom model, the teacher's role has shifted to that of a guide, facilitator, and organizer. With these roles, a more student-centered classroom environment can be created, paving the way for students to take on a more active role in their own learning. This shift in the teacher's role complements the flipped classroom structure by fostering autonomy and encouraging deeper engagement, which are essential for building students' self-efficacy in mathematics.

To implement the flipped classroom model especially in the pre-class and post-class stages media is needed as a learning tool and means for delivering material by teachers. One such tool is e-learning. The flipped classroom model cannot be separated from e-learning (Bishop & Verleger, 2013). One of the advancements in educational technology is the implementation of e-learning, which has improved the quality of the learning process (Arifin & Herman, 2018; Sari, 2017). E-learning tools also offer asynchronous learning opportunities, allowing students to access

materials at their own pace, which is particularly beneficial for building confidence and addressing individual learning needs (Almusharraf & Khahro, 2020).

Several studies have highlighted the potential of the flipped classroom model to enhance students' self-efficacy in mathematics learning, such as the research conducted by (Algarni & Lortie-Forgues, 2023; Vang, 2017). However, these studies did not focus on the development or use of e-learning integrated with the flipped classroom model. In another study, (Husna & Sofnidar, 2022) found that the flipped classroom supported by an e-learning platform (E-Lematika) was effective in improving students' self-efficacy. Nevertheless, their study did not examine students' learning outcomes after using the flipped classroom model and only evaluated its effectiveness, without developing an e-learning system based on the flipped classroom model. Based on previous research, there has been no study focusing on the development of e-learning integrated with the flipped classroom model aimed at improving both students' self-efficacy and learning achievement.

Additionally, there is limited research that simultaneously examines both self-efficacy and learning achievement as outcomes of e-learning–flipped classroom integration in the context of secondary school mathematics.

Thus, there is a research gap in developing an integrated digital learning solution grounded in self-efficacy theory and designed to improve both psychological and academic aspects of student learning.

Based on these gaps, this study aims to develop a Moodle-based e-learning platform integrated with the flipped classroom model to enhance both students' self-efficacy and mathematics achievement. This innovation is expected to offer an adaptive and engaging learning model that aligns with the demands of today's digital education landscape.

METHODS

Research Types and Procedures

To produce a product in the form of Moodle-based e-learning using a good flipped classroom, the type of research used is development research (Research and Development) with the ADDIE development model (Analysis, Design, Development, Implementation and Evaluation) by (Branch, 2009). In the Analysis phase, a needs assessment was conducted through interviews with mathematics teachers and a review of existing learning materials, revealing that many students struggled with low self-efficacy and poor engagement in mathematics. In the Design phase, lesson plans, and e-learning content outlines were created based on curriculum standards and flipped classroom principles. The Development phase involved producing learning videos and uploading them into a Moodle-based e-learning platform, ensuring that the content supported pre-class, in-class, and post-class activities. During the Implementation phase, the product was tested through one-on-one and small group trials with students at SMPN 8 Muaro Jambi.

Finally, the Evaluation phase included expert validation and analysis of trial results to assess the product’s effectiveness.

The research subjects were ninth-grade students at SMPN 8 Muaro Jambi. Data collection followed the stages outlined by Branch (2009), including (1) one-on-one trials, (2) small group trials, and (3) a large group (field) trial. The one-on-one trial involved mathematics teachers to evaluate the practicality of the e-learning product. The small group trial included six students with varying abilities to identify usability issues and observe student interaction with the Moodle platform. The large group trial involved 27 students with diverse academic profiles to assess the effectiveness of the flipped classroom-based e-learning in improving self-efficacy and mathematics achievement, using pre- and post-tests and questionnaires.

Data Collection Instrument

In this study, data was collected through questionnaires. Before being used, these questionnaires will be validated first. After the questionnaire is declared valid, the questionnaire is used as a research instrument. The questionnaires include:

1. E-learning Validation Questionnaire

This instrument is intended to assess the quality of Moodle-based e-learning development products with a flipped-classroom model. The questionnaires used are: (1) Material expert validation questionnaire; (2) Media expert validation questionnaire.

2. User Perception Questionnaire

This questionnaire is to see the practicality of the e-learning developed. These questionnaires include: (1) teacher perception questionnaire on e-learning; (2) learner perception questionnaire on e-learning.

3. Self-Efficacy Questionnaire

The self-efficacy questionnaire is used to see the effectiveness of e-learning that has been made. The questionnaire in this study was made and developed by referring to the dimensions proposed by (Bandura, 1995), the questionnaire grids that have been used in (Yuliana & Winarso, 2019) are presented in Table 1 below.

Table 1. Student self efficacy questionnaire grid

No	Dimensions	Descriptor	Indicator	Item No.	
				+	-
1.	Magnitude	Student's level of confidence when determining the level of difficulty in a doable task	Have an optimistic outlook	2	5
			Confident of success in the face of obstacles	4	12
			Confidence in one's abilities	3	9
			Planning for task completion	16	18
2	Strength	The student's level of consistency in doing a task	Persist in solving problems under various conditions	10	14
			Possess tenacity and perseverance	1	20

No	Dimensions	Descriptor	Indicator	Item No.	
				+	-
3.	Generality	Student's level of confidence in generalizing previous experience	Enhance best efforts	7	6
			Respond to the situation in a good and positive way	8	13, 15
			Using previous experience as a guide to success	11, 17	19

Data Analysis Technique

The data of e-learning development test results were analyzed by formula (1) (Amirono & Daryanto, 2016). The test results can be interpreted based on Table 2 (Mahuda, et al., 2020).

$$\bar{x} = \frac{\text{Jumlah skor yang didapat}}{\text{total skor maksimal}} \times 100\% \quad (1)$$

Table 2. Interpretation of test results based on percentage

Feasibility Percentage	Eligibility Criteria		Description
	Validity	Practicality	
P ≤ 20	Invalid	Not Practical	Revised
P > 20; P ≤ 40	Less Valid	Less Practical	Minor revisions
P > 40; P ≤ 60	Valid enough	Practical enough	Minor revisions
P > 60; P ≤ 80	Valid	Practical	Without revision
P ≥ 80	Very Valid	Very Practical	Without revision

Data analysis of pretest and posttest results of self-efficacy questionnaire and students' mathematics learning outcomes using N-gain test and paired sample t-test using SPSS. The test results can be interpreted based on Table 3 (Hake, 1999).

$$\text{Ngain} = \frac{(\text{rata-rata skor posttest}) - (\text{rata-rata skor pretest})}{(\text{skor maksimal}) - (\text{rata-rata skor pretest})} \quad (2)$$

Table 3. Interpretation of n-gain test results

Value Range	Criteria
N – gain > 0,7	High
N – gain ≥ 0,3; Ngain ≤ 0,7	Medium
N – gain ≥ 0; Ngain ≤ 0,3	Low
N – gain < 0	Failed

RESULT AND DISCUSSION

Analysis Phase Results

The core of this stage is to analyze the need for e-learning development and analyze the feasibility of its development requirements. Based on the results of observations made at SMPN 8 Muaro Jambi, information was obtained that due to the emergency covid-19 learning was carried out for only 20 minutes in 1 lesson

hour causing the learning process to be ineffective with the duration of learning which was considered very insufficient to achieve learning objectives. The results of open interviews conducted by researchers with mathematics teachers at SMPN 8 Muaro Jambi found that some students consider mathematics material to be difficult, especially in the geometry of curved-sided spaces. This also causes some students to have low self-efficacy and learning outcomes. The results of open interviews indicate a lack of teacher creativity in utilizing the use of communication tools, especially smartphones that support the smooth running of learning during this pandemic, which results in students finding mathematics more difficult and uninteresting.

Design Stage Results

This stage starts from the initial design based on the results of the analysis conducted previously. The complete design stages are described as follows: The font used in this e-learning is a sans serif type, namely "roboto" to take a simple, modern and elegant impression that is easy to read to make students feel comfortable in accessing. Then the chosen base color is red to take a striking and bold impression, expected to trigger user confidence so that self-efficacy arises to learn using this e-learning. The flowchart in this e-learning development is presented in Figure 1 as follows.

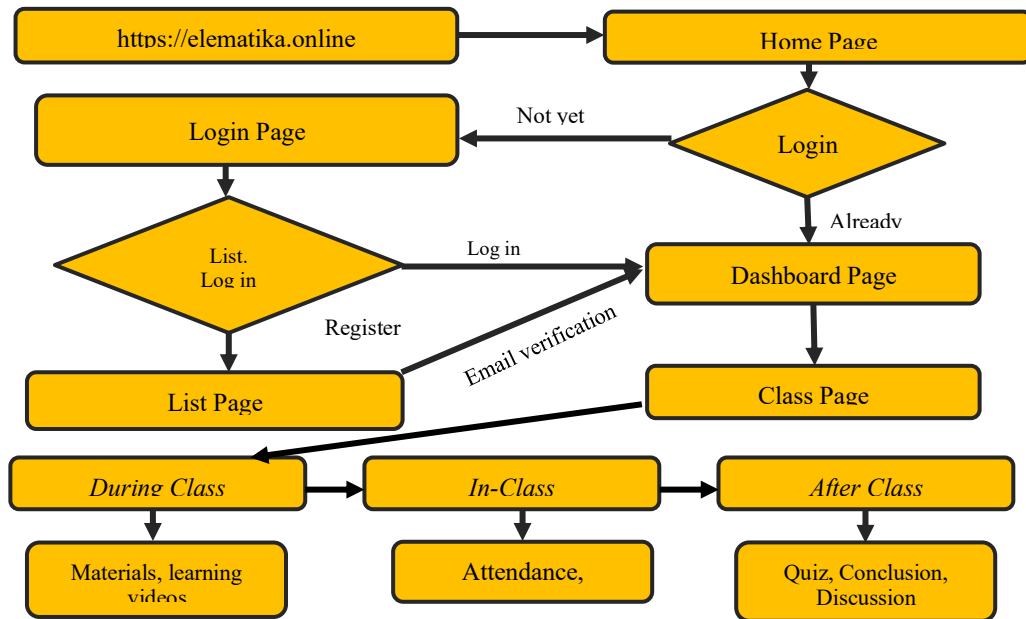


Figure 1. E-learning flowchart

The following is an e-learning design with a flipped classroom learning model. 1. The Home Page is the first scene that appears when a user first accesses the domain <https://elematika.online/>. Information on the main menus is displayed on this page making it easier for users to choose the menu they need. The home page is presented in Figure 2 as follows.



Figure 2. Home page

2. The Login page contains a form for users to log in as registered users to access existing classes on E-learning. This page allows users to enter their username and password which are then verified by the system before granting access. The login page is presented in Figure 3 as follows.

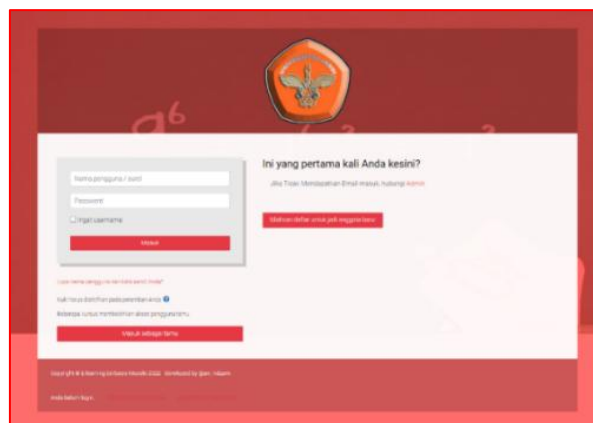


Figure 3. Login page

3. The Register page contains a form to register as users to access existing classes on e-learning. Students need to fill in their identity data to register as users. The register page is presented in Figure 4 as follows.

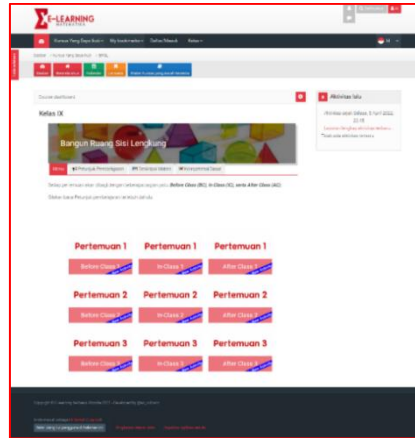


Figure 6. Class page

6. The Pre-Class page is created in the form of a Pop Up on the Class Page. In-Class Page. The Pre Class page contains a learning video, self-efficacy questionnaire (for meeting I) designed using the available Moodle features, namely quiz, and resources. And in each activity, a checklist input is given on the right to mark the activity that has been done. The pre-class page is presented in [Figure 7](#) as follows.

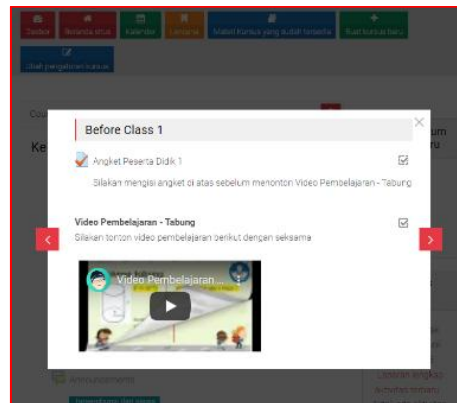


Figure 7. Pre-class page

7. The In-Class page is created in the form of a Pop Up on the Class Page. The In-Class page contains learner attendance which is designed using available Moodle features, namely Attendance. On this page, a feature is added to limit access for students who have not watched and checked the learning videos on the Pre-Class Page. The in-class page is presented in [Figure 8](#) as follows.



Figure 8. In-class page

8. The After Class page is made in the form of a Pop Up on the Class Page. The After Class page contains quizzes and discussion rooms, and a learning motivation questionnaire (for meeting III) designed using available Moodle features, namely quiz, and resources. On this page, a feature is added to limit access for students who have not filled in the attendance on the In-Class Page. The after class page is presented in Figure 9 as follows.

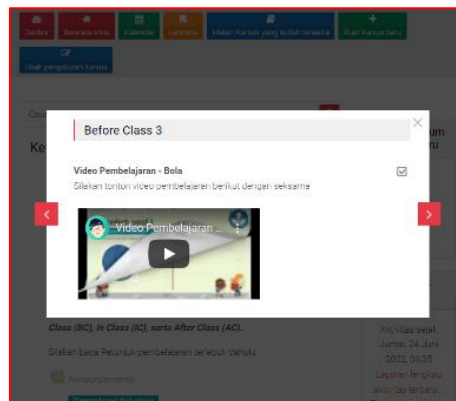


Figure 9. After class page

Development Phase Results

The development stage is carried out by validating research instruments, validating materials and media on e-learning to see the validity of e-learning, as well as one-on-one tests and small group tests to see the practicality of e-learning. The following are the results of each step:

1. Instrument Validation Results

The instruments used in this study were validation questionnaires, user perception questionnaires, and student learning motivation questionnaires, where the validators for validating this research instrument were two lecturers from the Jambi University Mathematics Education study program. The validation results are in Table 4 below.

Table 4. Research questionnaire instrument validation results

Validation	Percentage (%)	Category
Material Validation Questionnaire	100	Very Valid
Media Validation Questionnaire	98	Very Valid
Teacher Perception Questionnaire on E-learning	95	Very Valid
Questionnaire of Learners' Perception of E-learning	95	Very Valid
Student self-efficacy questionnaire	100	Very Valid

From the results of instrument validation for material validation questionnaires and media validation questionnaires, the percentage score of questionnaire validation is 100% and 98%, the percentage score of teacher perception questionnaire validation of e-learning is 95%, the percentage score of student perception questionnaire validation of e-learning is 95%, the average instrument validation score for self-efficacy questionnaire is 100%. So, it can be concluded that all questionnaires are in a very valid category and there is no need for revision, so they are suitable for use.

2. E-learning Validation

After all instruments are valid and can be declared fit for use, then the instrument is used to assess the validity of the e-learning developed. The results of this e-learning validation conducted by material experts and media experts can be seen in [Table 5](#) below.

Table 5. Results of validation of e-learning development with flipped classroom model

Validator	Percentage (%)	Category
Material Expert	95%	Very valid
Media Expert	95%	Very valid

From the results of validation by a team of experts, the percentage score of the validity of the e-learning developed is 95% in terms of material with very valid criteria and 95% in terms of media with very valid categories, meaning that it does not need to be revised, so that e-learning can be tested in the research.

3. Test Run

After the e-learning is proven valid, then the e-learning is tested in the research. The trial results can be seen in [Table 6](#) below.

Table 6. E-learning trial results

Test Run	Percentage (%)	Category
One-on-One Trial	100%	Very Practical
Small Group Trial	90%	Very Practical

The one-on-one trial was conducted to obtain perceptions or opinions from educators, in this case mathematics teachers, to see the practicality of the e-learning developed before being tested on students. Some of the main aspects of this assessment include aspects: E-learning media, materials, and benefits. From the results of the teacher perception questionnaire of e-learning, the percentage score of the practicality of the e-learning developed is 100% with very practical criteria, meaning that it does not need to be revised, so that e-learning can be tested into research.

Furthermore, a small group trial was conducted, to obtain perceptions or opinions from learners, in this student's case of class IX B, to see the practicality of the e-learning developed. Some of the main aspects of the assessment of the practicality test at this stage include aspects: E-learning media, materials, and benefits. Learners who acted as respondents in this small group trial consisted of 6 students of class IX B with low, medium and high categories, which was a suggestion from the mathematics teacher from class IX B. From the results of the questionnaire of students' perceptions of e-learning, the percentage score of the practicality of the e-learning developed is 90% with very practical criteria, meaning that it does not need to be revised, so that e-learning can be tested into research.

Implementation Stage

At this stage, a field trial was carried out with the aim of seeing whether the Moodle-based e-learning with the flipped classroom model developed could improve students' self-efficacy and learning outcomes. The field trial was conducted on 27 students of class IX B by giving a questionnaire before and after the trial. The pre-test and post-test data of the self-efficacy questionnaire and students' mathematics learning outcomes were analyzed with the N-gain test with the results as presented in Table 7 below.

Table 7. N-gain test results

Test	Score	Category
Students' Mathematics Self-efficacy	0,5	Medium
Student Mathematics learning outcomes	0,46	Medium

Based on the calculation in Table 7, the N-gain score of self-efficacy and students' mathematics learning outcomes were 0.5 and 0.46, respectively. This means that the development of e-learning with a flipped classroom model is effective for improving students' self-efficacy and mathematics learning outcomes in the moderate category. The N-gain scores in this study were categorized as moderate, indicating a moderate improvement in students' mathematics achievement after the intervention. While this suggests a positive impact of the flipped classroom model, it also indicates that there is potential for further enhancement. The moderate gain suggests that more interactive elements, frequent feedback, or additional support may be needed to optimize learning outcomes. Therefore, while the results show some success, future research should focus on refining the instructional design to better address students' diverse learning needs.

Furthermore, the pre-test and post-test data were analyzed by conducting a paired sample t-test. The prerequisite for the paired sample t-test test is that the data is normally distributed. The results of the data normality test show that all data are normally distributed, thus it can be continued in the paired sample t-test test. The test results can be seen in Table 8 below.

Table 8: Paired sample t-test results

	Testing	N	Correlation	Sig.
Pair 1	Pre-Test Self-Efficacy & Post-Test Self-Efficacy	27	,819	,000
Pair 2	Pre-Test Learning Outcomes & Post-Test Learning Outcomes	27	,673	,000

Hypothesis:

H₀: there is no difference in mean scores between pre-test and " "

H_a: there is a difference in mean scores between pre-test and " "

Criteria:

H₀ accepted if the value (sig) > 0.05; and H₀ rejected If the value (sig) < 0.05.

Based on Table 8, the sig value is obtained. (2-tailed) of 0.000 < 0.05 with $\alpha = 0.05$. So that H₀ rejected, meaning that there is a difference in the average value between the pre-test and post-test scores of self-efficacy and student math learning outcomes. The results of this data analysis indicate that, the results of the development of Moodle-based e-learning with a flipped classroom model are effective for significantly improving students' self-efficacy and mathematics learning outcomes.

Evaluation Stage

The evaluation stage is carried out with the aim of producing an e-learning product that has valid and practical criteria. This stage is carried out at each stage, which aims to improve the quality of e-learning at each stage.

The evaluation results at each stage are: (1) the analysis stage, namely analyzing the characteristics of students, in this case the researcher asks follow-up questions, so that the characteristics and needs of students for the learning process will be known. (2) the design stage, namely making a storyboard of the product to be made, in the form of Moodle-based e-learning using a flipped classroom. In this case, the researcher received a lot of input from the supervisor regarding the design of the product, namely there are several aspects that need to be added in order to produce an e-learning design that is as desired. (3) the development stage, at this stage of course researchers begin to develop products in the form of Moodle-based e-learning using a flipped classroom and then validated by a team of experts, from the validation stage carried out there are several aspects that need to be improved starting from media aspects to aspects supporting the flipped classroom model on e-learning.

Discussion

The development of Moodle-based e-learning integrated with the flipped classroom model has been shown to enhance students' self-efficacy and mathematics learning outcomes. These findings support Bandura's (1977) self-efficacy theory, which identifies four primary sources of self-efficacy: enactive mastery experience, vicarious experience, verbal persuasion, and physiological and affective states. This study demonstrated how each of these factors can be stimulated through well-structured flipped learning strategies. Similar patterns were reported in the study by Ulya et al. (2019), which found that students' self-efficacy improved after engaging with self-paced, technology-based materials. The current study confirms these findings but also highlights context-specific nuances that emerge in digital platforms like Moodle.

In the pre-class phase, students engaged with learning videos and formative tasks before entering the classroom. This stage provided enactive mastery experiences as students had the opportunity to build the initial understanding individually. Success in this stage helped reinforce confidence in their ability to handle upcoming in-class tasks. This aligns with the work of Husna and Sofnidar (2022), who emphasized that students' confidence improves when they are given opportunities to explore material independently prior to formal instruction. In addition, this stage relates to the importance of autonomy in self-efficacy development, as discussed by Schunk & Pajares (2002), where learners who are given control over the pace and sequence of learning feel more competent and motivated.

During the in-class sessions, collaborative activities allowed students to observe and learn from their peers' problem-solving strategies. This vicarious experience is critical, especially for students with lower initial self-efficacy, as they gain reassurance by seeing that their peers often with similar backgrounds or skill levels can succeed. This confirms the findings of Arnawa and Setiawan (2021), who noted that the flipped classroom approach not only enhances content understanding but also strengthens students' belief in their own capabilities. However, unlike the study by Vang (2017), which found that peer collaboration was most beneficial for high-achieving students, this study observed that all students benefited from peer exposure, possibly due to the structured scaffolding embedded in the Moodle environment.

Teachers played a crucial role in providing verbal persuasion, offering encouragement, detailed feedback, and continuous guidance. The use of Moodle's feedback features allowed personalized communication, reinforcing students' learning achievements or addressing their errors constructively. Such supportive interactions are essential for developing self-efficacy, as also observed by Bandura (1977). This study expands on the findings of Basal (2015), showing that digital tools such as Moodle's real-time feedback features can serve as powerful extensions of teacher presence, even beyond classroom walls.

The comfortable and structured learning environment, supported by a clear schedule and accessible digital materials, also contributed to reducing anxiety and improving emotional engagement important components of students'

physiological and affective states. This holistic support system helped create a positive learning atmosphere that encouraged persistence and resilience. This supports the findings of [Thai et al. \(2017\)](#), who emphasized the emotional benefits of flipped learning when content is delivered through user-friendly, consistent platforms. However, unlike their study conducted in higher education, this research shows similar benefits can be extended to secondary school students when sufficient guidance and motivation are present.

In terms of learning achievement, the observed increase in mathematics outcomes corroborates the theoretical linkage between self-efficacy and academic performance. Students with higher self-efficacy tend to set higher goals, persist longer in the face of difficulties, and use more effective cognitive strategies. As indicated by [Husna and Sofnidar \(2022\)](#), self-efficacy is a strong predictor of student success. Moreover, this finding is consistent with [Pajares and Graham \(1999\)](#), who emphasized that academic self-beliefs in mathematics significantly influence both effort and performance.

Nevertheless, the moderate N-gain suggests room for improvement in the model's effectiveness. During the implementation, several challenges were identified. Not all students utilized the pre-class materials effectively; some lacked the self-regulation skills to manage independent learning. Students with lower initial self-efficacy were more likely to skip videos or complete tasks superficially, which weakened the benefits of in-class discussions. Moreover, variations in digital literacy and internet accessibility also emerged as obstacles, particularly in less resourced contexts. These findings are in line with [Almusharraf and Khahro \(2020\)](#), who identified digital competence and self-regulation as key barriers in e-learning adoption.

To address these issues, several solutions are proposed. First, enhancing the interactivity of pre-class materials such as embedding quizzes or reflections in videos can improve engagement and accountability. Second, incorporating real-time teacher or peer support during pre-class activities may help students who struggle with independent learning. Third, scaffolding strategies like learning contracts or guided note-taking templates can support students' self-regulation. Lastly, peer mentoring systems can be formalized to provide additional support for students with low confidence or weak prior knowledge.

Future instructional designs could benefit from integrating motivational scaffolding strategies suggested by Keller's ARCS model (Attention, Relevance, Confidence, Satisfaction), particularly to sustain engagement among low-efficacy learners. Future research should explore the moderating role of students' prior knowledge, digital competence, and motivation in the success of flipped learning models. A deeper understanding of these variables can inform more tailored instructional strategies, especially in diverse educational settings. It is also recommended to conduct longitudinal studies to track changes in self-efficacy over time, as [Bandura \(1997\)](#) emphasized the cumulative nature of efficacy development.

CONCLUSION

The development of Moodle-based e-learning with a flipped classroom model obtained a validity score percentage of 95% in terms of material and 95% in terms of media with a very valid category. The development of Moodle-based e-learning with a flipped classroom model obtained a percentage score of the practicality of one-on-one trials and small group trials, namely 100% and 90% respectively with very practical criteria. The development of Moodle-based e-learning with a flipped classroom model can significantly improve students' self-efficacy and math learning outcomes with N-gain scores of 0.5 and 0.46 respectively in the medium category and both independent sample t-test results sig. (2-tailed) of $0.000 < 0.05$ with $\alpha = 0.05$.

The result of this development research is e-Learning developed based on Moodle using a flipped classroom that can be used as a learning media to help educators. Where the developed e-Learning allows to be accessed through android smartphones, computers or laptops, making it easier for educators to mobilize students to be able to learn independently at home. Then the developed e-Learning also helps educators in optimizing learning time so that it is more efficient and educators can be creative with the learning process to make learning activities more interesting.

This study has several limitations. First, the sample was limited to students from a single school, which may affect the generalizability of the findings. Additionally, the research was conducted during the COVID-19 pandemic, which may have influenced student engagement and motivation due to the shift to online learning. The N-gain scores used to measure learning outcomes, while useful, do not capture all aspects of student development. Future studies could consider a larger, more diverse sample and incorporate additional measures of learning to provide a fuller picture of the flipped classroom model's impact.

Although this research was conducted during the COVID-19 pandemic, when online learning was a necessity, the findings remain relevant and applicable in today's educational context. The use of Moodle-based e-learning combined with the flipped classroom model has proven effective in enhancing students' self-efficacy and mathematics learning achievement.

Even after the pandemic, as hybrid and digital learning begin to integrate with face-to-face instruction, this model continues to offer significant benefits. It enables students to independently study the material outside the classroom and maximize meaningful interaction during in-person sessions. Therefore, the implementation of this model is not only relevant during emergency remote learning but can also serve as a sustainable method to improve learning outcomes and students' self-efficacy in the long term.

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Judul singkat, jelas, lugas menggambarkan isi keseluruhan yang berfokus pada inovasi pembelajaran [Maksimum 14 Kata, TNR, BOLD, Sentence Case]

Penulis 1¹⁾*, Penulis 2²⁾ dst. [TNR 12, tanpa gelar dan tidak boleh disingkat]

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No. Handphone :

ABSTRAK [Times New Roman 10pt, bahasa Indonesia]

Abstrak ditulis dalam bahasa Indonesia berisikan latar belakang umum, tujuan penelitian, metode/pendekatan penelitian, hasil penelitian dan kesimpulan/saran. Abstrak ditulis dalam satu alenia, tidak lebih dari 200 kata. Bahasa penulisan sesuai PUEBI/tata bahasa Indonesia [Times New Roman 10, spasi tunggal].

Kata kunci: Kata kunci mencerminkan kandungan esensi artikel, disusun Alfabetis, jumlah 3-5 kata/frase dipisahkan dengan tanda koma.

ABSTRACT [Times New Roman 10pt, bahasa Inggris]

Abstrak ditulis dalam bahasa Inggris yang berisikan latar belakang umum, tujuan penelitian, metode/pendekatan penelitian, hasil penelitian dan kesimpulan/saran. Abstrak ditulis dalam satu alenia, tidak lebih dari 200 kata. Bahasa penulisan sesuai tata bahasa Inggris [Times New Roman 10, spasi tunggal].

Keywords: Kata kunci mencerminkan kandungan esensi artikel, disusun Alfabetis, jumlah 3-5 kata/frase dipisahkan dengan tanda koma.

diunggah: , direvisi: , diterima: ,dipublikasi:

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*Cara sitasi: Penulis. (Tahun). Judul. JINoP (Jurnal Inovasi Pembelajaran), Vol(No), Halaman.
doi:https://doi.org/10.22219/jinop.v?i?.ID_Artikel*

PENDAHULUAN [TNR 12 Spasi 1]

Pendahuluan (berisi latar belakang, permasalahan sesuai konteks penelitian, hasil kajian pustaka, yang semuanya dipaparkan secara terintegrasi dalam bentuk paragraf-paragraf, dengan persentase 15-20% dari keseluruhan artikel) Tinjauan pustaka yang relevan dan pengembangan hipotesis (jika ada) dimasukkan dalam bagian ini. [Times New Roman, 12, normal spasi 1].

Paragraf kedua disarankan untuk mengulas penelitian terdahulu yang relevan dengan topik penelitian, jelaskan kekurangan pada penelitian terdahulu, sehingga perlu adanya penelitian yang saudara lakukan. Tunjukkan adanya bagian yang menyebutkan kebaruan/ keunggulan inovasi pembelajaran dalam naskah artikel ini. Bandingkan. Bagian ini harus mencakup tentang tujuan penelitian dan sumbangsih hasil penelitian yang diharapkan nantinya.

Gunakan tinjauan pustakan yang relevan serta terbaru minimal 5 tahun. Penulisan rujukan diwajibkan menggunakan software mendeley dengan metadata yang sudah dibenahi aturan penulisannya sesuai *APA Style*. Menggunakan bahasa penulisan yang harus sesuai dengan tata bahasa/ PUEBI.

METODE [TNR 12 spasi 1]

Metode menjelaskan paparan dalam bentuk paragraf tentang rancangan penelitian, sumber data, teknik pengumpulan data, jenis data rancangan penelitian dan teknik analisis data yang secara nyata dilakukan peneliti, dengan persentase 10-15% . Menggunakan bahasa penulisan yang harus sesuai dengan tata bahasa/ PUEBI. [Times New Roman, 12, spasi 1].

HASIL DAN PEMBAHASAN [TNR 12 spasi 1]

Sub heading 2 [TNR 12 spasi 1, sentence case]

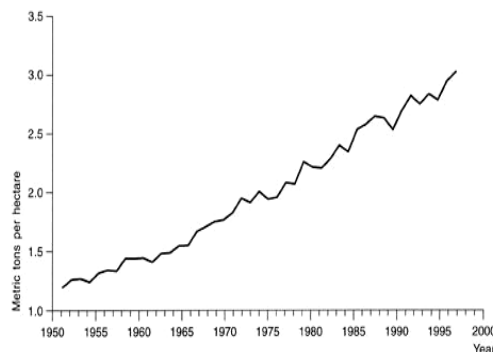
Hasil penelitian berisi paparan hasil analisis yang berkaitan dengan pertanyaan penelitian, sedangkan pembahasan berisi pemaknaan hasil dan perbandingan dengan teori dan/atau hasil penelitian sejenis, dengan persentase 40-60% dari keseluruhan artikel.

Dalam pembahasan diulas tentang temuan penting sesuai tujuan penelitian. Hasil penelitian dan kejelasan data digambarkan dengan gambar yang harus disebutkan pada badan naskah. Hasil penelitian digambarkan dengan tabel 1 (tabel berikut:), grafik/gambar 1 (grafik/gambar berikut:), dan/atau bagan 1 (bagan berikut:). [Times New Roman, 12, spasi 1].

Tabel 1. Nama tabel [contoh tabel 1 TNR 12]

Condition	M(SD)	95%CI	
		LL	UL
Letters	14.5(28.6)	5.4	23.6
Digits	31.8(33.2)	21.2	42.4

[isi tabel TNR 10pt, spasi 1]



Gambar 1. Nama gambar [contoh gambar 1, TNR12, Spasi 1]

Hasil analisis harus berkaitan dengan tujuan penelitian, serta dilakukan Pemaknaan hasil/temuan , dibandingkan dengan penelitian sejenis sebelumnya dn teori yang ada. Kemungkinan tindak lanjut kegiatan dapat juga disampaikan pada bagian ini.

SIMPULAN [Huruf TNR 12, Spasi 1]

Berisi temuan penelitian yang berupa jawaban atas pertanyaan penelitian atau berupa intisari hasil pembahasan, yang disajikan dalam bentuk paragraf. Saran / rekomendasi tindak lanjut penelitiann dapat disampaikan pada bagian ini [Times New Roman, 12, spasi 1].

DAFTAR PUSTAKA [WAJIB MENGGUNAKAN MENDELEY]

Penulisan pustaka hanya yang disitasi hanya dalam naskah ini dan diurutkan secara alfabetis dan kronologis. Sejumlah 80% daftar pustaka WAJIB dari Jurnal yang bereputasi baik, dan dapat dilacak. Pustaka minimal 7 tahun terakhir (85%) dengan jumlah Minimal 25 referensi. Penulisan daftar pustaka wajib menggunakan mendeley/Endnote yang sudah diedit metadatanya, pilih *APA Style* untuk model penulisan referensi.

Rujukan Buku:

Noddings, N. 2012. *Educating for Intelligent Belief or Unbelief*. New York: Teacher College Press.

Rujukan Artikel dalam Buku Kumpulan Artikel

Margono. 2012. Manajemen Jurnal Ilmiah. Dalam M.G Waseso & A. Saukah (Eds.), *Menerbitkan Jurnal Ilmiah* (hlm. 46-50). Malang: UMM Press.

Rujukan Berupa Buku yang Ada Editornya

Rusli, Marah. 2015. *Sosiologi Pendidikan: Kajian Berdasarkan Teori Integritas Mikro-Makro* (Arnaldi. S Ed.) Malang: UMM Press.

Rujukan dari Buku yang Berasal dari Perpustakaan Elektronik

Dealey, C. 2014. *The Care of Wounds: A Guide for Nurses*. Oxford: Blackwell Science. Dari NetLibrary, (Online), (<http://netlibrary.com>), diakses 26 Agustus 2012.

Rujukan dari Artikel dalam Internet Berbasis Jurnal Tercetak

Mappiare-AT, A., Ibrahim, A.S. & Sudjiono. 2015. Budaya Komunikasi Remaja-Pelajar di Tiga Kota Metropolitan Pantai Indonesia. *Jurnal Ilmu Pendidikan*, (Online), 16 (1): 12-21, (<http://www.umm.ac.id>) diakses 28 Oktober 2009

Rujukan dari Artikel dalam Jurnal dari CD-ROM

Krashen, S., Long, M. & Scarcella, R. 2017. Age, Rate and Evantual Attainment in Second Language Acquisition. *TESOL Quarterly*, 13: 543-567 (CD-ROM: *TESOL Quarterly-Digital*, 2007).

Rujukan Artikel dalam Jurnal atau Majalah:

Wentzel, K. R. 2016. Student Motivation in Middle School: The Role of Perceived Pedagogical Caring. *Journal of Educational Psychology*, 89 (3), 411-419.

Buku Terjemahan:

Habermas , Jurgen. 2017. *Teori Tindakan Komunikatif II: Kritik atas Rasio Fungsionaris*. Terjemahan oleh Nurhadi. Yogyakarta: Kreasi Wacana.

Rujukan dari Dokumen Resmi Pemerintah yang diterbitkan oleh Lembaga tersebut

Undang-Undang Sistem Pendidikan Nasional (UURI No. 20 Tahun 2003 dan Peraturan Pelaksanaannya. 2003. Jakarta: Departemen Pendidikan Nasional.

Rujukan dari Koran tanpa penulis

Jawa Pos, 27 Mei 2015. “Komitmen Mendikbud Segarkan Pramuka”. Halaman 3.

Rujukan dari Internet:

Winingsih, H. Lucia. 2013. *Peningkatan Mutu, Relevansi dan Daya Saing Pendidikan*. Jakarta: Pusat Dokumentasi dan Informasi Ilmiah-Lembaga Ilmu Pengetahuan Indonesia PDII-LIPI, diakses 2 Desember 2014 on-line [www. Pdii.lipi.go.id/katalog/index. php/search catalog /byld/257453](http://www.Pdii.lipi.go.id/katalog/index.php/search_catalog/byld/257453).

Rujukan Berupa Skripsi, Tesis, atau Disertasi.

Mulyana, Yoyo. 2015. *Keefektifan Model Mengajar Respons Pembaca dalam Pengajaran Pengkajian Puisi*. Disertasi tidak Diterbitkan. Bandung: Fakultas Fakultas Bahasa dan Seni Universitas Pendidikan Indonesia.

Musaffak. 2013. *Peningkatan Kemampuan Membaca Kritis dengan Menggunakan Metode Mind Mapping*. Tesis tidak Diterbitkan. Malang: PPs UM.

Petunjuk Penulisan Artikel JINoP (Jurnal Inovasi Pembelajaran)

Ketentuan Umum

1. Yang dimaksud dengan “Naskah” dalam pedoman ini adalah artikel hasil penelitian tentang inovasi pembelajaran di semua bidang studi dan jenjang pendidikan mulai dari SD sampai Perguruan Tinggi.
2. Penulis naskah wajib membuat dan menandatangani surat pernyataan bermaterai yang menyatakan bahwa naskah yang ditulis merupakan hasil karya sendiri dan belum pernah dipublikasikan di media lain.
3. Naskah dapat di unggah dan register lebih dulu melalui laman website : <http://ejournal.umm.ac.id/index.php/jinop/user/register>

Ketentuan Penulisan Naskah

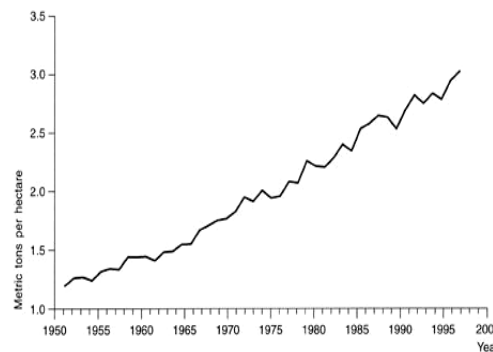
1. Bahasa yang digunakan dalam penulisan naskah adalah Bahasa Indonesia atau Bahasa Inggris.
2. Naskah diketik di atas kertas A4 dengan margin kiri 4 cm, margin atas, bawah dan kanan 3 cm, menggunakan tipe huruf Times New Roman, ukuran huruf 12, dan spasi 1.
3. Jumlah halaman naskah adalah 10 sampai dengan 15 halaman.
4. Sistematika Penulisan:
 - a. JUDUL [Times New Roman 14 bold]
Penulisan judul menggunakan kalimat singkat, namun cukup untuk menggambarkan isi (substansi) naskah secara keseluruhan. Judul tulisan berbahasa Indonesia terdiri dari maksimal 14 kata, sedangkan apabila berbahasa Inggris terdiri dari maksimal 12 kata.
 - b. Nama Penulis [Times New Roman 12 bold]
Nama penulis dicantumkan tanpa gelar, kemudian disertai alamat korespondensi (instansi), dan alamat surat elektronik (email). Apabila terdapat lebih dari satu penulis maka dituliskan seperti penulis Utama. Untuk penulis utama harap menyertakan nomor HP yang bisa dihubungi.
 - c. ABSTRAK dan Kata Kunci [Times New Roman 10 bold]
Abstrak terdiri dari maksimal 200 kata. Abstrak mencerminkan permasalahan, tujuan, metode penelitian, hasil dan saran. Abstrak ditulis dalam Bahasa Indonesia dan Bahasa Inggris, menggunakan huruf jenis Times New Roman ukuran 10, spasi 1. Kata kunci disusun secara alfabetis, mencerminkan kandungan esensi artikel, dibuat sejumlah 3-5 kata/frase.
 - d. PENDAHULUAN [Times New Roman 12 bold]
Pendahuluan (berisi latar belakang, konteks penelitian, hasil kajian pustaka, dan tujuan penelitian, yang semuanya dipaparkan secara terintegrasi dalam bentuk paragraf-paragraf, dengan persentase 15-20% dari keseluruhan artikel) Tinjauan pustaka yang relevan dan pengembangan hipotesis (jika ada) dimasukkan dalam bagian ini. [Times New Roman, 12, normal].

- e. **METODE** [Times New Roman 12 bold]
 Metode menjelaskan paparan dalam bentuk paragraf tentang rancangan penelitian, sumber data, teknik pengumpulan data, dan analisis data yang secara nyata dilakukan peneliti, dengan persentase 10-15% [Times New Roman, 12, normal].
- f. **HASIL dan PEMBAHASAN** [Times New Roman 12 bold]
 Hasil penelitian berisi paparan hasil analisis yang berkaitan dengan pertanyaan penelitian, sedangkan pembahasan berisi pemaknaan hasil dan perbandingan dengan teori dan/atau hasil penelitian sejenis, dengan persentase 40-60% dari keseluruhan artikel); Kemungkinan tindak lanjut kegiatan dapat juga disampaikan pada bagian ini Hasil penelitian dapat dilengkapi dengan tabel 1 (bukan tabel berikut:), grafik/gambar 1 (bukan grafik/gambar berikut:) , dan/atau bagan 1 (bukan bagan berikut:). [Times New Roman, 12, normal].

Tabel 1. Nama Ttabel [contoh tabel 1 TNR 12]

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[isi tabel TNR 10pt, spasi 1]



Gambar 1. Nama gambar [contoh gambar 1, TNR12, Spasi 1]

- g. **SIMPULAN** [Times New Roman 12 bold]
 Berisi temuan penelitian yang berupa jawaban atas pertanyaan penelitian atau berupa intisari hasil pembahasan, yang disajikan dalam bentuk paragraf . Saran dapat disampaikan pada bagian ini [Times New Roman, 12, normal].
- h. **Daftar Pustaka.**
 Daftar Pustaka ditulis dengan sistematika dan ditulis secara berurut sesuai abjad. Tanda baca koma diganti dengan tanda baca titik; tidak dicantumkan halaman kutipan; kutipan yang ada dalam batang tubuh (artikel) wajib dicantumkan di daftar pustaka begitu juga sebaliknya kutipan yang ada dalam daftar pustaka wajib ada di batang tubuh (artikel). 80% daftar pustaka **WAJIB dari Jurnal dan** 20% bisa dari buku dengan memerhatikan keterbaruan daftar pustaka minimal 7 tahun terakhir.

Contoh Penulisan Daftar Pustaka

Rujukan Buku:

Noddings, N. 2012. *Educating for Intelligent Belief or Unbelief*. New York: Teacher College Press.

Rujukan Artikel dalam Buku Kumpulan Artikel

Margono. 2012. Manajemen Jurnal Ilmiah. Dalam M.G Waseso & A. Saukah (Eds.), *Menerbitkan Jurnal Ilmiah* (hlm. 46-50). Malang: UMM Press.

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Musaffak. 2013. *Peningkatan Kemampuan Membaca Kritis dengan Menggunakan Metode Mind Mapping*. Tesis tidak Diterbitkan. Malang: PPs UM.

5. Pustaka acuan yang digunakan adalah maksimal 7 tahun terakhir dengan jumlah minimal 15 buah dan minimal 80 % diantaranya berasal dari jurnal ilmiah.
6. Redaktur berhak mengubah tulisan pada naskah sepanjang tidak mempengaruhi materi atau isi pokok pembahasan.
7. Segala sesuatu yang menyangkut perizinan pengutipan atau penggunaan *software* komputer untuk pembuatan naskah atau ihwal lain yang terkait dengan HaKI yang dilakukan oleh penulis artikel, berikut konsekuensi hukum yang mungkin timbul karenanya, menjadi tanggung jawab penuh penulis artikel.

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