Moving Image Learning Integrated Problem-Based Interactive Media to Improve Students' Critical Thinking

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Abstrak

Potensi yang sangat besar dari penggunaan bahan ajar digital dalam format media interaktif menjadi solusi yang menjanjikan untuk meningkatkan skill abad ke – 21 bagi para siswa sekolah menengah kejuruan. Oleh karena itu, penelitian ini bertujuan menciptakan media pembelajaran interaktif berbasis masalah untuk meningkatkan keterampilan berpikir kritis siswa sekolah menengah kejuruan. Menggunakan metode penelitian dan pengembangan dengan model Alessi & Trollip, subjek penelitian ini meliputi satu ahli media, satu ahli materi, tiga guru, dan 28 siswa. Pengumpulan data dilakukan melalui observasi, wawancara, dan angket, dianalisis secara kualitatif dan kuantitatif yang menggunakan instrumen terdiri atas lembar pengamatan, daftar pertanyaan dan kuisioner. Secara umum, hasil penelitian ini berhasil menciptakan media pembelajaran interaktif yang termasuk dalam kategori layak berdasarkan hasil validasi oleh ahli media, ahli materi dan praktisi. Serta hasil penilaian kepraktisan oleh siswa juga memperoleh hasil layak. Selain itu, media pembelajaran interaktif yang dikembangkan juga terbukti efektif dalam meningkatkan keterampilan berpikir kritis siswa yang terlihat melalui hasil skor rata-rata kelas eksperimen 86,73, lebih tinggi dari kelas kontrol, menandakan media ini efektif meningkatkan keterampilan berpikir kritis. Diharapkan riset ini dapat menjadi acuan bagi para guru untuk menerapkan media interaktif berbasis dalam rangka meningkatkan keterampilan berpikir kritis siswa khususnya pada pembelajaran Cahaya Gambar Bergerak di SMK.

Kata Kunci: Media, Interaktif, Video, Berbasis Masalah, Sekolah Menengah Kejuruan.

Abstract

The enormous potential of using digital teaching materials in interactive media format is a promising solution for improving 21st century skills for vocational high school students. Therefore, this research aims to create problem-based interactive learning media to improve the critical thinking skills of vocational high school students. Using research and development methods with the Alessi & Trollip model, the subjects of this research included one media expert, one material expert, three teachers and 28 students. Data collection was carried out through observation, interviews and questionnaires, analyzed qualitatively and quantitatively using instruments consisting of observation sheets, lists of questions and questionnaires. In general, the results of this research succeeded in creating interactive learning media which is included in the appropriate category based on validation results by media experts, material experts and practitioners. And the results of the practicality assessment by students also obtained decent results. Apart from that, the interactive learning media developed was also proven to be effective in improving students' critical thinking skills as seen through the experimental class's average score of 86.73, higher than the control class, indicating that this media is effective in improving critical thinking skills. It is hoped that this research can become a reference for teachers to implement interactive media-based in order to improve students' critical thinking skills, especially in learning Light Moving Images in vocational schools.

Keywords: Media, Interactive, Video, Problem Based, Vocational High School.

1. INTRODUCTION

The transformation in vocational high school learning, particularly focusing on the multimedia department, is progressing significantly and achieving positive outcomes. One crucial aspect contributing to its success is the utilization of digital learning resources to enhance teaching methods and student engagement (Nazarova et al., 2021; Sousa & Rocha, 2019). Furthermore, the implementation of character values along with knowledge plays a crucial role in shaping students' character and behavior, contributing to a comprehensive educational experience so that students truly possess skills that they can ultimately utilize in

the workforce (Durmus & Dağlı, 2017; Rochmat, 2018). Furthermore, the emphasis on developing students' skills in vocational high schools demonstrates the commitment of stakeholders to continuously collaborate with the industry, in order to align the curriculum with the needs of the industrial world (Shamir et al., 2019; Xue & Li, 2021). Moreover, through the integration of innovative learning models such as Discovery Learning, Problem Based Learning (PBL), and Project Based Learning (PJBL), the focus is on more interactive learning activities, which is in line with the demands of the 21st-century education system (Hendriana et al., 2018; Rati et al., 2023). Overall, this transformation reflects a comprehensive effort to modernize teaching practices and enrich the learning experience for students in vocational high schools.

In addition to the implementation of innovative learning models mentioned above, the utilization of digital learning media is another important aspect. Several experts agree that digital learning media plays a crucial role as a learning resource for students in Vocational High Schools (SMK). Research has shown that the implementation of innovative technologies such as Quizizz and Digital Comic Media can significantly improve students' learning outcomes (Ghofur, 2022; Khasanah & Lestari, 2021). Furthermore, the use of digital learning media, such as smartphone-based applications, has been proven to enhance students' engagement and enthusiasm in the learning process, ultimately leading to improved learning achievements (Triyono et al., 2022; Metruk, 2022). Moreover, the digital competence of teachers in utilizing digital learning tools is crucial for the successful integration of digital media, making the readiness of teachers an important consideration in the digitalization of teaching materials (Buabeng-Andoh, 2020; Paetsch & Drechsel, 2021). Overall, the adaptation and utilization of digital learning media not only facilitate learning but also prepare SMK students to face the challenges of the industrial world.

One innovative approach mentioned earlier is Problem-Based Learning (PBL), which has been found to stimulate the improvement of students' critical thinking skills (Abdulah et al., 2021; Aufa et al., 2021) Problem-Based Learning (PBL) is a valuable pedagogical approach that plays a crucial role in enhancing students' learning experiences in vocational high schools. By implementing PBL, students actively engage in solving real-world problems, which encourages the development of higher-order thinking skills, knowledge, and skills that can be adopted by students (Maulida et al., 2020; Rujira et al., 2020). This approach allows students to explore complex and ill-structured problems, promoting collaboration, self-directed learning, and interdisciplinary connections, ultimately leading to a deeper conceptual understanding of the subject matter (Lin & Tu, 2021; Nugroho & Hermasari, 2023). Studies have shown that the adoption of PBL significantly improves students' critical thinking skills, as evidenced by pretest-posttest comparisons and N-gain analysis (Darhim et al., 2020; Eka Putra & Iswantir, 2021).

In line with this, studies on the integration of PBL with assistive virtual simulations in digital learning environments have been proven to motivate students and significantly enhance their critical thinking skills, surpassing traditional teaching methods (Irawati et al., 2022; Lestari et al., 2021). It is evident that the effectiveness of the PBL model in enhancing critical thinking skills has been highlighted in various educational learning settings, making PBL one of the recommended models or approaches as an independent and effective method for developing critical thinking skills. The teaching method for Learning Motion Picture Lighting in Vocational Schools is currently experiencing several obstacles, especially due to the use of monotonous learning media and the dominance of traditional lecture methods. Although the lecture method is still effective in some situations, over-reliance on this method often reduces active student involvement. From the observations made, many students appeared passive and were not actively involved in class discussions. The use of classical learning methods is less successful in creating an interactive and interesting learning

experience, which is very important to motivate students to explore the concept of Moving Image Light Learning more deeply. This condition limits students' ability to participate actively, hone critical thinking skills, and apply knowledge in real situations. Therefore, it is important to adopt more innovative and diverse teaching approaches to improve student participation and understanding of Moving Image Light Learning material in vocational schools. The strategy of digital media integration involves the use of technology to enhance the learning and communication processes. Interactive media in the field of education aims to provide a more personalized learning experience and support the development of lifelong learning skills (Budiarto et al., 2021; Motamedi, 2019).

Several studies have successfully integrated interactive multimedia with various learning methods. Other research has developed digital learning materials in the form of interactive e-books combined with a problem-based learning approach for vocational high school education (Ramdani et al., 2021). The developed product has been deemed suitable by experts and can be implemented in the learning process. Other research also successfully developed interactive multimedia in their research, which promotes character formation through life values (Komalasari & Rahmat, 2019; Pritasari et al., 2021). Additionally, The use of multimedia components, such as animations, makes the learning environment more engaging and immersive. Multimedia in modern learning enhances interaction, accessibility, and cost-efficiency, catering to different student learning styles. Emphasizing skills like literacy, numeracy, and technology proficiency is crucial in meeting the demands of today's era. Additionally, integrating STEM education with interdisciplinary approaches is seen as key to achieving relevant educational objectives (Rizaldi et al., 2020; Wandani et al., 2023). Findings from various studies have also suggested innovative techniques such as collaboration in problem-solving using mobile multimedia to enhance students' collaboration and problem-solving skills (Kandriasari et al., 2023; Rina, 2022). Certainly, all these findings suggest that the use of interactive media and innovative teaching approaches will greatly assist in developing students' essential skills to face various challenges.

Previous research findings have shown that the utilization of interactive media using a problem-based approach in the context of various subjects in high school has proven to be effective in students' academic achievement as well as their soft skills (Kovalchuk et al., 2022; Supandee & Yachulawetkunakorn, 2023) Furthermore, these interactive media have also been proven to enhance students' understanding of the learning materials (Xu et al., 2021; Yulianci et al., 2021). This research integrates the Problem Based Learning (PBL) approach with interactive media to enhance the critical thinking of vocational high school students. The novelty of this research lies in the use of a combination of PBL and interactive technology, which has not been widely implemented in the context of vocational education. The results of the study indicate that this integration significantly improves students' critical thinking abilities, as reflected in the increase in pretest and posttest evaluation scores. This research contributes new insights to the education literature by offering an effective innovative learning method to enhance students' critical thinking skills at the vocational education level. Also current research is crucial due to the lack of consistent empirical data and the insufficient implementation of integrating learning media in vocational high school activities, while rapid technological advancements create new challenges and opportunities that have not been fully explored. Therefore, this study aims to fill this gap by strengthening the foundation in the integration process between innovative models and interactive media for learning in vocational high schools. One of the efforts to address the issues at SMK 2 Batik Surakarta is by utilizing innovative learning media in the form of interactive media for the subject of Moving Image Lighting Techniques (Video) based on problem-solving, with the hope of enhancing students' critical thinking skills. Thus, the aim of this research is to

develop problem-based interactive media that is suitable for improving students' critical thinking skills in vocational high schools.

2. METHODS

This study utilized the Research and Development (R&D) method by adopting the model from Alessi and Trollip, which consists of three main stages: planning, designing, and developing (Alessi & Trollip, 2001). This model was chosen because it provides a systematic framework for developing multimedia products or technology-based multimedia commonly used in education. In line with this, according to (Lutfi et al., 2021), the Alessi and Trollip model includes several steps: (1) Planning, (2) Design, (3) Development. The procedures that will be followed in this research and development showed in Figure 1.
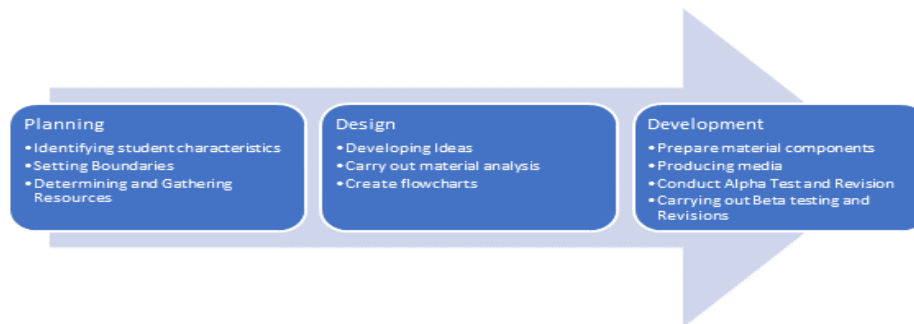

Figure 1. Reserch Design

This study involved various subjects, including one media expert, one material expert, three teachers as educational practitioners, and students who will assess the media for comprehensive evaluation of content, flow, and program quality (Hasyim et al., 2020). The data collection method adopted was a non-test technique, which included observation, interviews, and the use of questionnaires (Saputri et al., 2018; Sulistio & Qohar, 2020). Each data collection technique used appropriate instruments, with observation and interviews conducted in the planning stage. Observation sheets were used to observe learning activities, question lists for interviews aimed to identify teacher needs, and questionnaires were used for needs analysis. Meanwhile, items/questions/statements regarding the feasibility of problem-based interactive media in video learning in vocational high schools will be used as an instrument for the questionnaire. The questionnaire adopted for this research is a tiered questionnaire with 4 tiers, namely 1-4 (Widiyanto, 2023). The instrument criteria for material experts, learning media experts, practitioners and students are described in the table. Where Table 1 is an instrument for media experts and Table 2 is an instrument for material experts.

Table 1. Media Expert Instrument Grid

No	Assessment Aspects	Indicator
1	Visual Communication	1) Text readability
		2) Color combination in the application
		3) Color combination in the illustration
		4) Clarity of command/navigation buttons
		5) Content layout composition
2	Illustration	1) Suitability of the illustration to the material
		2) Illustrations make it easier for students to understand the material
3	Media Benefits	1) Learning supplement

No	Assessment Aspects	Indicator
		2) Minimize misperceptions
		3) Make it easier for teachers to deliver material
	Adaptation from research (Ferdiansyah et al., 2021; Lutfi et al., 2021)	

Table 2. Material Expert Instrument Grid

No	Assessment Aspects		Indicator
1	Material Contents	1)	Suitability of material to learning outcomes
		2)	The truth of the concept
		3)	Accuracy of material illustration
		4)	Level of clarity of material
		5)	Level of completeness of material
		6)	Suitability of material to the curriculum
2	Material Benefits	1)	Learning supplement
		2)	Minimize misperceptions
		3)	Make it easier for teachers to deliver material
	Adaptation from research (Hariyani et al., 2021; Yuningtyas et al., 2023)		

Furthermore, the instruments designed for validation in this study were first validated through consultation with experts, involving the selection of an expert for each type of instrument who then discussed the items of the instruments used, with the supervisor as a discussion resource (Sugiyono, 2018). The collected data, especially from the questionnaires used to test the interactive multimedia product, were analyzed using descriptive techniques based on the average percentage of the total validation results. To determine the feasibility of the interactive multimedia e-module, a minimum score of 63% of the total percentage is required to be considered suitable as a learning medium, in accordance with the eligibility criteria conversion table that can be seen on the Table 4 adopted from studies by (Andriyani & Suniasih, 2021). Meanwhile, the effectiveness testing procedure of the product is conducted using the t-test design with the assistance of the SPSS program, which adopts the pre-post control group design. The instrument used to measure students' critical thinking skills is adopted from several relevant studies, such as Riyanto et al. (2020) and Syawaludin et al. (2019).

3. RESULTS AND DISCUSSION

Result

During the planning stage, we gathered valuable information about the learning process in schools and the specific needs of teachers and students. Observations revealed that SMK Batik 2 Surakarta uses Microsoft 365 as a learning medium. However, the effectiveness of learning remains low, particularly during practicum activities involving video materials. Learning is still not optimal, as teachers predominantly send PPT files or short materials without providing complex explanations. The learning media used are considered inadequate because many students find them difficult to operate. Additionally, there is a lack of understanding among students regarding the importance of studying video lighting material, further hindering their learning progress. These issues indicate a need for more comprehensive and accessible learning resources to enhance student engagement and understanding. Efforts are needed to facilitate learning and teaching activities that save time and build student awareness of the importance of teaching materials, such as developing mobile application-based learning media. Therefore, the development of learning media plays

a vital role in resolving these obstacles. Interactive and fun learning media are expected to enable students to learn independently, while teachers can present teaching materials in an attractive format by combining audio, video, and animation in the application, thereby improving critical thinking skills in theoretical learning.

Based on previous observations and interviews with two subject teachers, several issues were identified: 1) the learning process is not optimal due to a lack of varied teaching methods, where teachers only deliver materials through Microsoft 365 and WhatsApp groups, 2) the use of learning media does not meet the criteria for developing students' critical thinking skills about the lighting arrangement of moving images (videos), and 3) students' critical thinking skills about the lighting arrangement of moving images (videos) are lacking. It is important to create learning materials that help students improve their critical thinking skills about lighting in videos, using a variety of teaching methods and interactive tools to ensure thorough understanding of the subject. After analyzing the needs of teachers and students at SMK Batik 2 Surakarta, it is clear that both groups require diverse learning methods, including interactive and engaging learning tools. Developing mobile-based learning tools can help meet these needs and address the issue of learning about moving image lighting principles. The researcher created mobile-based learning tools to enhance students' critical thinking skills in this area. Interviews and observations show that current learning tools at SMK are limited to YouTube and Microsoft 365, while students are tech-savvy due to smartphone use. This presents an opportunity to introduce more advanced interactive multimedia, like mobile apps, educational games, and virtual reality, to revolutionize how students engage with the material. This technological integration can significantly improve learning effectiveness, enabling students to explore social concepts in a more dynamic and interactive manner.

After that, the stage that must be passed is the design stage, at this stage the findings that were identified at the planning stage begin to be realized in the form of a simple flowchart as a form of flow for a mobile-based learning media product. It should be noted that flowcharts were developed as a manifestation of ideas in an effort to solve problems that were discovered to be resolved at the planning stage. After the flowchart, teaching materials are created by practicum teachers and researchers based on Basic Competencies and Indicators. The materials are sourced from the SYLLABUS for Class 12 Audio Video Processing Techniques (TPAV) in the 2013 Curriculum Multimedia Department. These materials focus on Moving Image (Video) Lighting and cover topics such as the function of lighting in moving images, correlating light sources with moving images, placing the light source according to the recorded image, and integrating lighting with moving images. Following the ideation and flowchart development, the next step is the development phase. This phase involves creating problem-based interactive learning applications or media. The materials prepared include text-based narratives, videos, graphics, and relevant exercises to achieve the learning objectives. The problem-based interactive learning media is then tested by experts and practitioners through alpha testing. The validation results from these experts are explained in Table 3.

Table 3. Alpha Test Results

No	Validator	Average Validation Results (%)	Qualification	Decision
1.	Media Expert	90%	Very good	Very Eligible
2.	Materials Expert	86,1%	Very good	Very Eligible
3.	Practitioner I	90,7%	Very good	Very Eligible
4.	Practitioner II	93,4%	Very good	Very Eligible
5.	Practitioner III	93,4%	Very good	Very Eligible

No	Validator	Average Validation Results (%)	Qualification	Decision
	Average Total Alpha Test Results	90,7%	Very good	Very Eligible

The alpha test focused on media and materials to minimize errors during the students' trial. According to Table 4, the validation conducted by five validators showed excellent results and deserved to be considered as a learning media. The assessment details are as follows: Media Expert gave a score of 90%, while Material Expert gave a slightly lower score of 86.1%. The three practitioners involved gave relatively higher scores, with Practitioner I and Practitioner III both giving a score of 93.4%, and Practitioner I giving a score of 90.7%. The average total score of the Alpha Test results for all validators is 90.7%. All validators classified the validation results as 'Very Good' and the final decision for each validator is 'Qualified'. This indicates a high consistency in the positive assessment of the validated problem-based interactive media.

However, some suggestions for improvement were given by the validators through the assessment sheet. These suggestions need to be accommodated in order to enhance the quality of the product according to the validators. The summarized points of the suggestions are as follows: 1) Reduce the amount of text in the complete material and add more videos related to the material, which is the module, 2) Provide captions for the navigation buttons at the bottom. Some of the suggestions from the validators have been accommodated before proceeding to the next stage, which is the beta test. Meanwhile, in the beta test, a number of students were involved to assess the level of suitability of the interactive media developed at each testing stage. The results of the problem-based interactive media beta test, showed in Table 4.

Table 4. Beta Test Results

No	Test Type	Average Results (%)	Qualification	Decision
1.	Individual Test (3 Students)	90%	Very good	Very Eligible
2.	Trial Expanded (28 Students)	90,3%	Very good	Very Eligible
	Average Total Beta Test Results	90,2%	Very good	Very Eligible

According to Table 4, students assessed problem-based interactive media through two types of tests: individual tests and expanded trials. These tests aimed to evaluate the effectiveness and feasibility of the media. The individual test, which involved 3 students, had a validation result of 90% and was deemed "Very Good" and "Very Eligible" for use. In the expanded trial with 28 students, the validation result was 90.3%, also with the qualification of "Very Good" and entitled to the decision of "Very Eligible." The average result from both tests was 90.2%, indicating a high level of feasibility and quality. Therefore, the final decision is that the problem-based interactive media is "Very Eligible" for classroom learning activities. This is the final version of the problem-based interactive media product, which has been deemed very good and suitable based on alpha and beta tests. Problem-based interactive media products showed in Figure 2.

Figure 2. Problem-Based Interactive Media Products

Next is the product testing phase, which is not detailed in the Alessi & Trollip model. Some experts believe that testing is done concurrently with implementation and dissemination, while others argue that testing the product's effectiveness is done before implementation and dissemination using common procedures adopted by most researchers. In this study, the effectiveness of problem-based interactive media was tested using post-test data from the experimental and control groups. The difference in average scores between the experimental and control groups was tested using paired sample t-tests and independent samples t-tests with SPSS 25 software. Before testing product effectiveness, the data that has been collected must first go through a series of prerequisite tests, namely the normality test and data homogeneity test. The results of the normality test, showed in Table 5.

Table 5. Normality with One Sample Kolmogorov-Smirnov Test

		Unstandardized Residual
N		60
Normal Parameters [a,b]	Mean	0.0000000
	Std. Deviation	637.5509405
Most Extreme Differences	Absolute	0.098
	Positive	0.077
	Negative	-0.098
Test Statistic		0.098
Asymp. Sig. (2-tailed)		0.200

Meanwhile, the results of tests carried out by SPSS 25 software showed that research data on students' critical thinking abilities regarding moving image (video) light comes from the same or homogeneous variance. It can be seen that the significance value is greater than 0.05 (0.173>0.05). After the data meets the prerequisite tests, the next step is to test the level of product effectiveness by referring to the previously determined hypothesis. The results of the analysis are a comparison of students' critical thinking abilities regarding the students' initial and final moving image (video) lights which are summarized in the Table 6.

Table 6. Post Test Results Independent Samples Test

Aspect	Mean	Std. Deviation	Significance	Trend
Experimental Class	86.73	5.22117	Significant	Improvement
Control Class	75.68	6.39195		

According to the statistical test results from SPSS 25 software, students in the experimental class had a higher post-test score of 86.73 in critical thinking abilities related to moving image light (video) compared to the control class score of 75.68. This suggests that using problem-based interactive media is more effective in improving critical thinking skills than non-problem-based interactive media in classroom settings. The developed problem-based interactive media product has been positively received by experts, practitioners, and students, and has been shown to enhance critical thinking abilities based on the improvement trend observed during experiments in the experimental class.

Discussions

After analyzing the needs and assessments of experts, practitioners, and students, it has been proven that interactive media for smartphones, integrated with a problem-based approach, is valid and suitable for Multimedia 1 and Multimedia 2 classes in vocational high schools. There are several reasons why this media is considered suitable. Firstly, it is a unique product that focuses on video learning topics for class XII, using a problem-based approach to enhance critical thinking skills. Secondly, it has an interactive and engaging multimedia format with animations, colors, backgrounds, and background sounds that capture students' interest. Lastly, this media is designed based on detailed needs analysis, making it a potential solution to existing learning problems, helping students understand the material more easily, and supporting teachers in delivering learning materials. The validators concluded that the presence of interactive elements in this media is considered significantly capable of enhancing students' learning motivation (Budi et al., 2021; Li & Ren, 2018). Experts believe that the element of interactivity in multimedia not only captures students' attention, but also encourages them to be more actively involved in the learning process (Indah Septiani et al., 2020; Manurung & Panggabean, 2020). Moreover, when creating this interactive media, it considers the various elements that make up the whole. For instance, it incorporates educational aspects that encourage problem-solving. This integration is done meticulously to encourage students to engage in active, scientific, and critical thinking. Another contribution can actually be seen from the utilization of the learning approach used, remembering that the more we are able to adapt the learning approach to the characteristics of the material, the easier learning outcomes will tend to be achieved optimally (Ismail et al., 2018; Risdianto et al., 2020). Furthermore, the use of problem-based learning models can also be supported by various learning resources to be more optimal. This study showed that using interactive media along with a problem-based approach is effective for teaching and learning in the classroom, highlighting its importance in improving academic performance and soft skills.

Eligibility scores are obtained through thorough analysis to determine if a learning media meets specific criteria. It is essential for learning objectives to be clearly communicated through multimedia. Integrated materials should complement each other and be easily understood by students. Including relevant and enjoyable exercises and games is also crucial. Developers' attention to these details ensures the media is appropriate and effective (Perdana et al., 2021; Triyono et al., 2022). Furthermore, this feasibility assessment also includes a thorough review of the quality features of the media. From eye-catching visual graphics, well-organized and appealing layout design, user-friendly selection of icons, to cohesive color scheme and easy-to-use media navigation that promotes smooth interaction among menus - all these elements have been examined by media specialists and have been given favorable reviews, categorizing this media as high quality. Certain scholars have emphasized the significance of these components in developing a learning environment that is both informative and enjoyable for users (Hasyim et al., 2021; Uge et al., 2019).

It is known that, one of the advantages of the product resulting from this research, apart from being integrated with a problem-based approach, is that it also contains material components that are not only text but also graphics, videos and practice questions. This is intended to make it easier for students to learn the material and motivate them to learn. The findings in this research are strengthened by a number of studies which state that interactive media is one of the solutions for improving students' soft skills (Fitriani et al., 2021; Lim et al., 2020; Yulianci et al., 2021). The advantage of interactive media developed is that it contains several elements needed to help students practice their critical thinking skills. Considering that in media development, it also refers to learning design theory, graphic elements, and student characteristics. However, this research is limited to focusing only on one subject in a series of video production processes in the Multimedia class. Nevertheless, this research implies that the interactive problem-based media product developed can facilitate students in developing critical thinking skills through theory and practice learning in the Multimedia class, both during independent and classical learning in the classroom.

4. CONCLUSION

Based on the analysis and issues that have been studied, it can be concluded that this development research has successfully achieved its goal in creating interactive media that applies a problem-based approach to enhance students' critical thinking skills in Multimedia classroom learning at vocational high schools. This success is attributed to the contribution of various supporting elements in the development process of interactive media, as well as constructive feedback from experts. It is expected that this product can significantly contribute to stimulating students' critical thinking abilities. For future research, it is recommended that this media be practically used for several subjects or materials by adapting the characteristics of the materials and the characteristics of the learners as users.

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