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Development of Digital Learning Media in Interactive Multimedia Based on Inquiry Approach for Sociology Learning in High Schools

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Abstract

The rapid evolution of technology presents significant challenges in its integration into educational environments. Despite these challenges, interactive multimedia digital learning materials stand out as an effective means to meet educational objectives in high schools. By combining these materials with methodologies like inquiry-based learning, educators can offer a richer and more dynamic learning experience. Therefore, the objective of this research is to develop interactive multimedia with an inquiry-based approach that is suitable for use in education. The research method used in this study is research and development, adopting the Alessi & Trollip model. The research sample consist of 7 people which was media experts, subject matter experts, practitioners (subject teachers), and 42 students. Data collection is conducted through non-test methods such as observation and questionnaires. The research data is then analyzed qualitatively and quantitatively. The research results show that in the alpha testing phase, the developed interactive multimedia received a "Very Good" qualification from the experts and practitioners who acted as validators, with an overall average score of 87%. Meanwhile, the beta testing results with the research subjects, the students, gave a rating of 87% which falls under the "Very Good" qualification. Thus, interactive multimedia with an inquiry-based approach is deemed suitable for use as a learning medium in sociology subjects. This research showed that the inquiry-based multimedia for sociology could be a tool to facilitate learning activities in high schools.

Keywords: Multimedia; Interactive; Sociology; Inquiry; Digital

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INTRODUCTION

Currently, educational practices in teaching Sociology at the high school level have undergone a significant transformation. This shift emphasizes the importance of a multicultural-based learning approach that promotes understanding and appreciation of various cultures, races, and ethnicities (Januarti & Hendrastomo, 2018; Ghufronudin, 2019). Additionally, the recent inclusion of Social Sciences in education highlights the need for innovative teaching methods that challenge traditional dichotomies and encourage critical thinking beyond academic boundaries (Susanti & Junaidi, 2020; Yuningtyas et al., 2023). The current perspective that is evolving in the teaching of Sociology in secondary schools is also influenced by the curriculum changes driven by educational reform, aiming to

align learning objectives with the restructuring of the national curriculum (Hamriana, 2021). These developments underscore the dynamic nature of Sociology education in secondary schools, emphasizing the importance of adapting pedagogical strategies to meet students' evolving needs.

Digital media and interactive multimedia play a crucial role in modern education (Jianaer, 2023; Sekarwangi et al., 2021). Digital media, with its interactive features, enhances the learning experience by providing interactivity, collaboration, and self-organization for students (Syawaludin et al., 2019). This media expands the concept of education and enables the creation of innovative learning materials that go beyond traditional media. The integration of digital media in formal education can have a positive impact on teachers and students, promoting media literacy and personal development (Mahdi, 2019; Lindner et al., 2021). Furthermore, the use of interactive multimedia in arts education develops creative abilities, aesthetics, and appreciation, making a significant contribution to the holistic development of individuals (Han & Niu, 2019; Widodo et al., 2020). In distance education, the interactivity of digital media and web-based environments offer transparent and accessible learning opportunities (Aurum & Surjono, 2021), changing the perspective of education in the current era.

The current teaching methods in Sociology are facing significant challenges, particularly in the use of less varied media and a tendency to focus on classical methods such as lectures. Although lectures are not always bad to be implemented in the learning process, an excessive reliance on this method can limit student engagement. Based on observations in the learning process, it is evident that students often remain passive and lack active participation in classroom discussions. Traditional methods often fail to provide interactive and dynamic learning experiences, which are crucial in motivating students to explore sociological concepts in depth (Yaghmour & Obaidat, 2022). These limitations reduce opportunities for students to actively engage, develop critical thinking skills, and apply knowledge in real-world contexts. Therefore, a more innovative and diverse approach is needed in teaching Sociology to enhance student participation and understanding of the subject matter.

Based on the problems above, we know that the learning approach and use of media for learning is one of the problematic issues, the inquiry-based learning approach is considered to have the opportunity to be applied to the sociology learning. As known that the Inquiry-based learning (IBL) plays a crucial role in enhancing student engagement by providing a framework in which students actively participate in discovering knowledge through research and problem-solving (Haryanti et al., 2022; Novitra et al., 2021). This approach shifts the focus from passive information reception to active knowledge construction, emphasizing students' responsibility in the learning process (Tusriyanto et al., 2019; van Schijndel et al., 2018). Engaging in authentic questions and activities that mirror the work of professional scientists, students are motivated to explore, inquire, analyze, and reflect on information, leading to increased engagement and interest in the subject matter (Permana P & Manurung, 2020; Wale & Bishaw, 2020). Furthermore, IBL promotes the development of essential skills such as critical thinking, communication, and metacognition, which are crucial for meaningful engagement with content and preparing students to become competent individuals

in the field of science (Nunaki et al., 2019; Yuliati et al., 2018). Through a well-designed inquiry-based learning environment, it will certainly promote a participatory and interactive learning activity, where students not only enhance their content knowledge but also experience increased motivation and reasoning skills, contributing to a comprehensive learning experience (Sutiani et al., 2021).

Strategies to integrate digital media and interactive multimedia involve leveraging technology to enhance the learning and communication processes. The use of interactive multimedia in education aims to facilitate personalized learning experiences and promote lifelong learning skills (Motamedi, 2019; Greene et al., 2021). Furthermore, the advancement of digital technology has successfully revolutionized various industries, enabling the transformation of traditional products into digital formats through the Internet and computer devices (Kumar et al., 2019; Nicolaou et al., 2019). Collaborative efforts across various disciplines such as arts, engineering, education, and interaction design have explored the integration of multimedia into learning development and design spaces, presenting new possibilities to create more enjoyable learning experiences (Dron, 2022; Lubis et al., 2021). By embracing technological advancements and innovative approaches, organizations and professionals can harness the power of multimedia to enhance learning, communication, and the skills development of graduates (Teng, 2023).

Implementing inquiry-based learning successfully involves following a series of important steps. One of these steps is the creation of engaging interactive multimedia content (Wibowo et al., 2021; Kuanbayeva et al., 2022). This involves research and development phases such as data collection, planning, product development, and testing. Secondly, the use of inquiry-based instructional models is highly important in supporting students in their learning process (Sari et al., 2021; Lutfi et al., 2021). These models guide students through inquiry-based activities, enhancing their engagement and learning outcomes. Furthermore, integrating contemporary electronic learning elements into the inquiry-based learning approach can further enhance the learning experience (Lindner et al., 2021). These innovative models, when integrated with ICT, can have a more optimal impact on s tudents' learning achievements (Budiarto et al., 2024).

Several previous studies have successfully integrated interactive multimedia with various learning approaches. For instance, Dewantara et al. 2(020) conducted research and successfully developed interactive multimedia that is not only suitable but also adopts a problem-based learning (PBL) approach for biology education. Similarly, Komalasari & Rahmat (2019) developed interactive multimedia based on life values to stimulate the formation of students' characters. Furthermore, Hartiyani & Ghufron (2020) stated that multimedia can be integrated not only with learning approaches but also with smart devices such as smartphones. Through their research, they successfully developed interactive multimedia that can be operated on smartphones, which is tailored to the characteristics of students. By combining digital media with inquiry-based strategies, educators can create a dynamic and interactive learning environment that encourages student engagement and critical thinking (Aurum & Surjono, 2021). Integrating inquiry-based learning with interactive multimedia tools can significantly enhance the learning experience. For example, the use of interactive multimedia in inquiry-based learning can motivate students to actively participate in the learning process (Setiawan et al., 2023). By

incorporating multimedia elements such as animations and interactive modules, educators can create a more engaging and immersive learning environment. Additionally, the integration of multimedia interaction and motion recognition-based inquiry machines can simplify the interaction and operation of inquiry, making learning more accessible and cost-effective (Teng, 2023). By leveraging multimedia tools within the framework of inquiry-based learning, educators can accommodate various learning styles and promote deeper understanding among students.

Previous research findings have shown that the use of interactive multimedia with an inquiry-based approach in various subjects in high schools has been proven effective in engaging students during the learning process (Han & Niu, 2019; Sekarwangi et al., 2021). Additionally, this interactive multimedia has also been proven to enhance students' understanding of the learning material (Susantini et al., 2021). Of course, the advantage of interactive multimedia lies in its ease of access, being accessible through students' smartphones or laptops, and containing instructions, plans, and steps in the implementation of learning, including explanatory videos on the taught material, as well as exercises presented not only as questions but also in the form of games.

METHODS

This study falls under the Research and Development (R&D) method, and one of the R&D models adopted for this research is the Alessi and Trollip model, which consists of three main steps: planning, designing, and development (Alessi & Trollip, 2001). The selection of this model is based on the consideration that it provides a systematic approach and focuses on the development of multimedia products or multimedia-based technologies that are often used for learning processes (Yaniawati et al., 2021). Meanwhile, this research only focuses on determining the feasibility level of the product, known as the beta testing activity in the development step. As explained, the development model in this research will adhere to the Alessi & Trollip model, which consists of several steps: (1) Planning, (2) Design, (3) Development. The following is an overview of the research and development procedure.

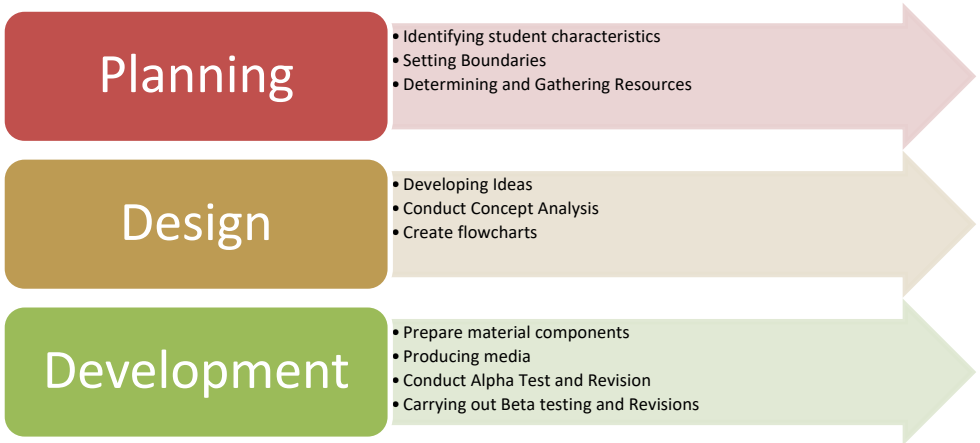

Figure 1. Research design

The research subjects involved in this study will consist of two media experts, two material experts, three learning practitioners (teachers), and student media assessments with the aim of conducting a comprehensive evaluation of the content, flow, and quality of the program (Yaniawati et al., 2021). The data collection technique used in this research is non-test technique, namely observation, interview, and questionnaire (Salim, 2019; Rejekiningsih et al., 2021). Each technique will use an appropriate instrument for data collection and will be included in different research steps. For example, observation and interview techniques will be used in the planning stage. The observation of learning activities data collection technique will use an observation sheet as an instrument, while a list of questions to explore teacher's needs will be used as an instrument for the interview method (Rachman et al., 2022).

Meanwhile, for the items/questions about the suitability of interactive multimedia with an inquiry approach in sociology learning, it will be used as an instrument for the questionnaire. The questionnaire adopted for this research is a graded questionnaire with 4 levels, namely 1- 4 (Ningtyas & Jati, 2018). The criteria for material experts, media learning experts, practitioners, and students are described in the following table.

Table 1. Media Expert Instrument Grid

No	Aspect	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	Usefulness	1) As a learning supplement 2) Minimize misperceptions 3) Make it easier for teachers to deliver material

Adaptation from research (Lutfi et al., 2021; Ferdiansyah et al., 2021)

Table 2. Material Expert Instrument Grid

No	Aspect	Indicator
1	Material Contents	1) Suitability of material to learning outcomes 2) Factuality of the material 3) Accuracy of material illustration 4) Level of clarity of material 5) Level of completeness of material
2	Usefulness	1) As a learning supplement 2) Minimize misperceptions 3) Make it easier for teachers to deliver material

Adaptation from research (Yuningtyas et al., 2023; Hariyani et al., 2021)

Tabel 3. Teacher Instrument Grid

No	Aspect	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	Usefulness	1) As a learning supplement 2) Minimize misperceptions 3) Make it easier for teachers to deliver material
4	Material Contents	1) Suitability of material to learning outcomes 2) Factuality of the material 3) Accuracy of material illustration 4) Level of clarity of material 5) Level of completeness of material

Adaptation from research (Yuningtyas et al., 2023; Ferdiansyah et al., 2021)

Table 4. Instrument Grid for Student Trials

No	Aspect	Indicator
1	Attractiveness and Ease of Use of Media	1) Ease of use 2) The attractiveness and accuracy of the media display 3) The attractiveness of images, animation and music in the media 4) The media contains elements of motivating learning 5) Availability of evaluation practice questions 6) Learning Process

Adaptation from research (Harianto & I Gde Wawan Sudatha, 2024; Rahayu & Sukardi, 2021)

Meanwhile, the instruments that have been created for each validator are first validated through consultation with experts. This validation process involves selecting an expert from each type of instrument to discuss the details of the instruments used. In this study, the expert who served as the discussion resource was the research advisor (Sugiyono, 2018).

The collected data is then analyzed, particularly for the questionnaire on interactive multimedia product testing, using descriptive techniques based on the average percentage assessment of the total validation results (Andriyani & Suniasih, 2021). The analysis of the feasibility level of interactive multimedia e-modules must obtain a minimum percentage score of 63% to be considered suitable as a learning medium. The following table presents the conversion criteria for the feasibility of interactive multimedia adopted in several studies (Febliza & Okatariani, 2020).

Table 5. Multimedia Interactive eligibility criteria

Percentage	Qualification	Decision
82 – 100%	Very good	Very Eligible
63 – 81%	Good	Eligible
44 – 62%	Enough	Less Eligible
25 – 43%	Deficient	Not Eligible

RESULTS & DISCUSSION

The planning stage is the initial step in developing interactive multimedia products. Data was successfully collected through observations and interviews, such as the results of the latest observation conducted during a sociology learning session at a high school, showing that the teaching methods are still limited in terms of the variety of media used. Most of the material is delivered through videos from YouTube and information sources from several specific websites. This is ironic considering that almost all students in that class have smartphones and are accustomed to using technology extensively in various aspects of daily life. The potential for wider technology utilization seems to have not been fully explored. The use of interactive learning applications, social media as a discussion forum, or even augmented reality for simulating sociological concepts could be interesting alternatives to increase student engagement. The limitations of the media used appear to restrict not only the way students receive information but also how they interact with the material, which could ultimately impact their understanding of the subject of sociology itself.

Referring to the results of the interview and recent observations on sociology learning in high schools, it appears that the media used is still limited to YouTube and websites, despite the fact that almost all students are familiar with technology due to their habit of using smartphones. This presents a great opportunity to integrate more advanced interactive multimedia, such as interactive mobile applications, educational games, and virtual reality, which can redefine how students access and interact with the material. This integration of technology is not only relevant but also highly potential in enhancing the effectiveness of learning, allowing students to explore social concepts in a more dynamic and interactive format. Furthermore, by combining this multimedia with an inquiry-based learning approach - which prioritizes student engagement in exploring information - it can create a deep and engaging learning experience, enrich learning resources, and support the development of critical and analytical skills in understanding sociological issues more effectively.

After that, the next stage to go through is the design stage, during this stage the successful findings identified in the planning stage are being realized in the form of a simple flowchart as the flow of the developed inquiry-based interactive multimedia product. It should be noted that the flowchart is developed as a manifestation of ideas in an effort to solve the problems that have been identified in the planning stage. Here is the developed flowchart of the inquiry-based interactive multimedia.

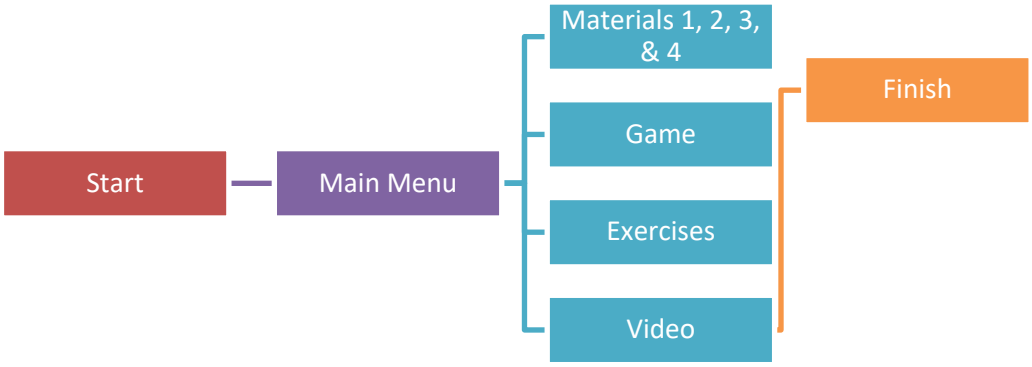

Figure 2. Flowchart Multimedia Interaktif

After developing ideas and flowcharts, the next step is development, at this stage contains the process of developing inquiry-based interactive media. This stage begins with preparing the material. The material prepared is of course not only based on narrative text, but also material in the form of videos, graphics and practice questions that are relevant to achieving learning objectives. Interactive multimedia products are then tested by experts and practitioners through alpha testing. The results of the validation carried out by these experts are explained in the following table.

Table 6. Alpha Test Results

No	Validator	Average Validation Results (%)	Qualification	Decision
1.	Media Expert I	88%	Very good	Eligible
2.	Media Expert II	90%	Very good	
3.	Material Expert I	81%	Very good	Eligible
4.	Materials Expert II	78%	Good	
5.	Practitioner I	92%	Very good	
6.	Practitioner II	88%	Very good	Eligible
7.	Practitioner III	95%	Very good	
Average Total Alpha Test		87%	Very good	Eligible

This alpha test focuses on the characteristics of the media and materials in depth to minimize errors or mistakes during the students' future testing. Based on Table X. Alpha Test Results, the validation conducted by seven validators showed excellent results. Media Expert I obtained a validation result of 88%, Media Expert II 90%, Material Expert I 81%, Material Expert II 78%, Practitioner I 92%, Practitioner II 88%, and Practitioner III 95%. All validators gave the qualification "Very Good" except for Material Expert II, who received the qualification "Good". The average total validation result in this alpha test is 87% with the qualification "Very Good", indicating that through the alpha test results, interactive multimedia based on the inquiry approach is considered suitable for further testing. However, some suggestions for development were provided by the validators through the assessment sheet. Several suggestions that need to be accommodated to improve the quality and suitability of the product according to the validators are summarized in several points, namely: 1) add icons to buttons to indicate that the icon is a button that will lead to a specific menu, 2) categorize or add buttons to videos to make

them more focused, 3) add an icon when starting a quiz. Some of the suggestions from the validators have been accommodated before proceeding to the next stage, namely the beta test. Meanwhile, in the beta test, a number of students were involved to assess the suitability level of the interactive media developed in each testing stage. The following are the results of the beta test for interactive multimedia based on inquiry.

Table 7. Beta Test Results

No	Test Type	Average Validation Results (%)	Qualification	Decision
1.	Individual Test (3 Students)	88%	Very good	Eligible
2.	Small Group Test (15 Students)	90%	Very good	
3.	Large Group Test (42 Students)	81%	Very good	Eligible
Average Total Beta Test		87%	Very good	Eligible

Based on Table 7. Beta Test Results, students' assessment of inquiry-based interactive multimedia was carried out in three different types of tests, namely individual tests, small group tests, and large group tests, with the aim of assessing the effectiveness and suitability of the media being tested. Individual tests involving 3 students showed validation results of 88%, with the qualification "Very Good" and the final decision that this media was "Appropriate" to use. In a small group test involving 15 students, validation results reached 90%, also with a qualification of "Excellent" and a final decision of "Decent." A large group test involving 42 students provided a validation result of 81%, which, although slightly lower than other tests, still received the qualification of "Very Good" and was declared "Appropriate" for use. The total average beta test results from these three types of tests was 87%, with the qualification "Very Good," indicating that the inquiry-based interactive multimedia products validated or assessed by the students had a high level of feasibility and quality. Thus, the final decision states that the inquiry-based interactive multimedia is "Appropriate" for use in classroom learning activities. The following is the final appearance of an interactive multimedia product with an inquiry approach that has been declared feasible based on alpha testing and beta testing.

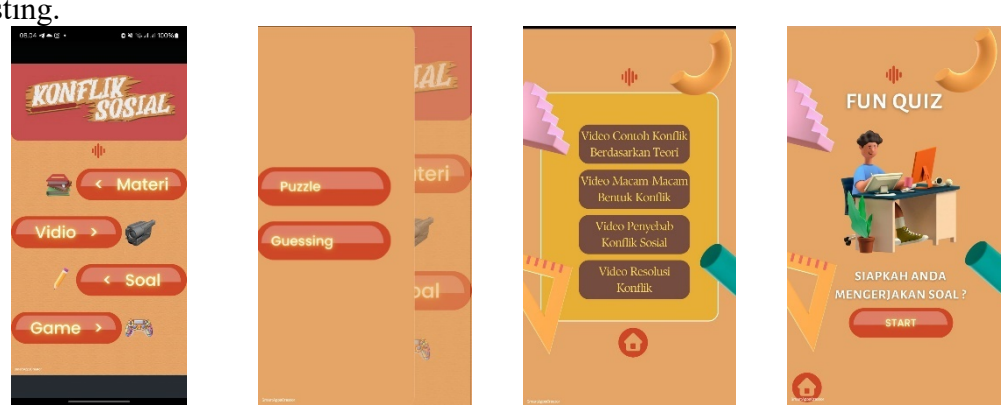

Figure 3. Interactive Multimedia Products with an Inquiry Approach

Based on the analysis of needs and assessments from experts, practitioners, and students, the interactive multimedia with an inquiry-based approach for sociology learning in grade XI of high school has been proven valid and deemed suitable for use in the learning process. This media deserves the category of suitability due to several factors. Firstly, this inquiry-based multimedia is unique and different from any previous ones. This is because there has never been a learning media specifically developed for sociology topics in grade XI with an inquiry-based approach. Secondly, this multimedia utilizes animation, colors, backgrounds, and background sounds that are appealing to students. Thirdly, this media is developed based on needs analysis, thus it may become a solution to existing learning problems, making it easier for students to understand the material and assisting teachers in delivering the material more effectively.

Discussion

As there are several experts who validate or assess interactive multimedia, for example the evaluation results from material and learning media experts which empirically show that interactive multimedia is included in the feasible category, the validators assume that interactive multimedia products that contain elements of interactivity are considered to be able to improve student motivation to learn (Aurum & Surjono, 2021; Djamas et al., 2018). Furthermore, in the development process of this interactive multimedia, great attention is given to the learning characteristics that adopt an inquiry-based approach. This approach provides stimuli for students to actively engage in scientific and critical thinking (Rejekiningsih et al., 2022; Rachmadtullah et al., 2018). As identified, the implementation and integration of inquiry-based approaches in sociology learning at high schools have advantages in developing and shaping students' critical and scientific thinking characters (Swandi et al., 2020; Komalasari & Rahmat, 2019). This is in line with research Sutiani et al. (2021) showing that the inquiry approach can enhance students' critical thinking skills, where critical thinking ability is one of the characteristics of a thinker embedded in learners. In line with this, research on the implementation of inquiry as one of the approaches in learning is also conducted by Rosdiana (2020), in her research, she successfully demonstrated that the application of the inquiry method can improve students' critical thinking skills in physics learning. Relevant studies indicated that the integration of technology through the Inquiry approach have many benefits for students.

It cannot be denied that the acquisition of feasibility values through analysis results shows that good learning media must meet several aspects to be declared feasible and valid. Firstly, from the learning aspect, the learning objectives must be clearly conveyed in multimedia. The material presented in various formats must support each other and be easily understood by students. Exercises and games relevant to the material and learning objectives are also important aspects. All of these aspects have been considered by the developers, so this media is considered feasible and valid (Octavyanti & Wulandari, 2021; Nurwati et al., 2022). In addition, this feasibility result is also based on the quality aspects of the media, ranging from graphic quality, layout composition, selection of supporting icons in the media, color arrangement, and media navigation that connect one menu to

another, where all of these components have been assessed by media experts that fall into the good category (Kusuma et al., 2022; Yanita et al., 2022).

It is known that one of the advantages of this developed interactive multimedia product is that, in addition to being integrated with an inquiry-based approach, it also includes material components that are not only text but also graphics, videos, exercises, and even puzzle games to facilitate students in learning the material and motivate them to study. The findings of this research are supported by several studies stating that interactive multimedia is one solution to improve students' soft skills in high school (Budiastuti et al., 2018), where the use of interactive multimedia in sociology learning has been proven to significantly enhance students' scientific thinking abilities. As research conducted by Sekarwangi et al. (2021) found that multimedia learning media enhances understanding of concepts and science process skills. In line with this, (Syawaludin et al., 2019) developed interactive multimedia based on augmented reality, which enhances critical thinking skills, a component of scientific thinking. Melumad & Pham (2021) in their research successfully demonstrated the effectiveness of interactive learning multimedia that can be operated on smartphones, which has been proven to enhance science process skills. Furthermore, within the multimedia, there are video and animation components that have a greater impact on students' critical thinking skills (Setyowati et al., 2021; Sarwinda et al., 2020). In general, these collective studies highlight the potential of using inquiry-based interactive multimedia to enhance students' scientific thinking skills through sociology learning.

The successful development of interactive multimedia with an inquiry-based approach in this research is certainly not separate from the contributions of relevant research that has been conducted, where the focus of the research highlights the potential and usefulness of multimedia learning for a wider scale. Nevertheless, this research has implications where the developed inquiry-based interactive multimedia can facilitate students in developing scientific thinking skills in sociology lessons, both during independent and classical learning in the classroom.

CONCLUSION

Based on the findings presented and a review of the problems raised, it can be concluded that this development research has succeeded in achieving its objectives by creating interactive multimedia with an inquiry approach for learning sociology in high school. The feasibility of this product cannot be separated from the support of supporting elements in the development of interactive multimedia, as well as constructive input from experts. In the end, it is hoped that this product can make a significant contribution in stimulating students' scientific thinking skills.

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