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Interactive Audio-Visual Learning Media Through Articulate Storylines Containing Problem-Based Contextual Learning to Improve Students' HOTS and Scientific Attitudes

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Abstract

This study examines the development of interactive audio-visual learning media using Articulate Storylines with problem-based contextual learning to improve students' higher-order thinking skills (HOTS) and scientific attitudes. Integrating Problem-Based Learning (PBL) with audio-visual media aims to address the challenges of modern education by encouraging critical thinking skills, creativity, and problem-solving in real-world contexts. The media design includes a login interface, learning materials on fluid dynamics, interactive quizzes, and evaluations. This study evaluates students' practicality, effectiveness, and scientific attitudes after using this media, with results showing moderate to high increases in HOTS. Validation tests show that this media is well-structured, engaging, and supports active learning, although the interactivity aspect can still be improved. N-Gain analysis shows that students improve their critical and analytical thinking skills per Bloom's Taxonomy and constructivist theory. These results indicate the potential of this media to enhance student learning outcomes.

Keywords: *Audio-Visual, Media, Problem, Contextual, HOTS, Scientific Attitudes*

INTRODUCTION

The rapid development of information and communication technology (ICT) has changed the approach in the world of education, providing enormous potential to improve student's learning experiences through interactive audio-visual learning media (Indarta et al., 2022). In today's digital era, interactive media development is significant for meeting compelling learning needs and supporting the achievement of expected learning outcomes (Ginting et al., 2023). Improving students' learning experiences is crucial because it helps them adapt to the rapid development of innovation and communication technology and develop the skills needed to succeed in an increasingly competitive environment (Sukaesih et al., 2017). Furthermore, technology-based learning in interactive learning media provides opportunities to overcome problems in the learning process related to differences in student learning styles (Liu & Ma, 2019). Students can learn from videos, animations, simulations, and sounds, as well as interact directly with learning materials on touch screens or other interactive devices. The combination of visual, auditory, and kinesthetic aspects in interactive learning media can help students understand the concepts taught in a more enjoyable way and in accordance with their respective learning styles (Yudi Hari Rayanto & Daryono, 2022). Technology development has helped teachers meet students' learning needs in the present and future.

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One of the main competencies emphasized in the modern education system, especially in the Independent Curriculum in Indonesia, is integrating 21st-century skills (Geisinger, 2016). 21st-century skills using the 4C framework: critical thinking, communication, collaboration, and creativity play a significant role in preparing students to face future demands. Higher Order Thinking Skills (HOTS) are also closely related to the 4C framework, reinforcing the need to develop critical thinking and problem-solving skills that are essential for academic and professional success(Ichsan et al., 2019; Silalahi et al., 2022).

HOTS competencies provide opportunities for students to engage in activities that require analysis, evaluation, and synthesis of information from various sources. These skills are essential in encouraging independent and continuous learning among students (Silalahi et al., 2022). However, in higher education, there are still challenges, such as the lack of improvement in HOTS skills and the low scientific attitude of students (Ichsan et al., 2019). This challenge is significant, especially in the context of the Industrial Revolution 4.0 and Society 5.0, which require students to have higher problem-solving skills and a solid scientific attitude to remain competitive in the job market (Rahayu et al., 2022; Silalahi et al., 2022)

One solution to overcome this challenge is the implementation of Problem-Based Learning (PBL), a learning approach that encourages students to engage in deep and meaningful learning experiences by solving real-world problems (James Bellanca and Ron Brandt, 2010). PBL provides opportunities for students to develop problem-solving, collaboration, and self-reflection skills that align with the Independent Curriculum's objectives, namely the importance of contextual and relevant learning experiences ((Hidayatullah et al., 2021; Khoiri et al., 2021)). Therefore, improving students' HOTS should be a priority in higher education because these skills enable them to analyze, evaluate, and create solutions to complex problems. In addition to HOTS, scientific attitudes are crucial for students, especially in developing curiosity, critical thinking, thoroughness, and openness to new knowledge(Zeidler, 1984). These attitudes play a significant role in the learning process. They encourage students to engage more deeply with the subject matter and develop a deeper understanding of the material being studied(Maretasari et al., 2012). By integrating problem-based learning into interactive audio-visual learning media, students will be involved in the learning process, allowing them to develop a solid scientific attitude (Jayadi et al., 2020).

In the context of the importance of interactive learning media, this study focuses on developing and evaluating an interactive audio-visual learning platform using Articulate Storyline software(Putra & Aisyah, 2021). This platform is designed to improve students' HOTS and scientific attitudes through the Problem-Based Learning approach in a digital learning environment (Hadza et al., 2020). *Articulate Storyline* is a tool that enables the creation of interactive and engaging learning experiences, providing a dynamic way to present educational content through a combination of text, images, audio, video, and animation. This tool is widely used because of its ability to create interactive media that users can control, which helps increase student independence and engagement in the learning process.

Integrating Problem-Based Learning in interactive audio-visual media can significantly improve HOTS and the scientific attitudes of students (Lye, 2013) (Indrianto & Shamilah, 2020) By answering the challenges of the rapid development of ICT, this study aims to provide a meaningful contribution to educational technology and pedagogy (Silalahi et al., 2022). Overall, this study seeks to answer the challenges of learning in the 21st century by developing interactive audio-visual learning media with problem-based learning content that supports the development of high-level thinking skills and students' scientific attitudes, as well as maximizing the application of technology in learning. The results of this study can be the basis for further studies on the use of interactive media in education and its effectiveness in encouraging critical thinking, problem-solving, and scientific attitudes in the context of higher education.

METHOD

The research was designed to develop interactive audio-visual learning media through an Articulate Storyline containing Problem-Based Contextual Learning to improve students' HOTS and scientific attitudes. The schematic design of this development model is described as follows:

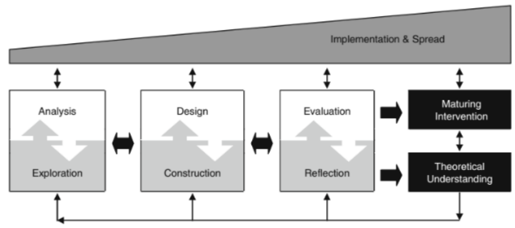

Figure 1. Step of Mc Kennys Model

Source: (McKenney & Reeves, 2021)

This development method has three stages:

- Analysis and exploration: This step begins with conducting field observations through interviews with lecturers and students in the Physics Education Study Program regarding problems in the learning process and learning outcomes. Problems in the learning process focus on the learning media applied during learning, student activities during learning, and the effectiveness and efficiency of time during the learning process. Problems in student learning outcomes focus on special abilities such as HOTS abilities and students' Scientific Attitudes. Furthermore, the problems identified are studied in the literature and analyzed regarding alternative solutions to problems relevant to the results of observations of problems in the field. Through the study of the literature and associated with field observations, a needs analysis will be carried out to determine solutions to overcome the problems that have been identified. Data from literature analysis and field studies will be the basis for deciding on the need to develop interactive audio-visual learning media through Articulate Storylines containing Problem-Based Contextual Learning.

- Design and Construction. At this step, the focus is on presenting a design framework that refers to the needs analysis results at the analysis and exploration stages. What is done is to design interactive audio-visual learning media through Articulate Storylines containing Problem-Based Contextual Learning. Several activities carried out at this stage are: the initial step of this stage is to review various materials to obtain information related to the focus of development, make general and specific designs of interactive learning media, validate/test the feasibility of the interactive learning media design; after being declared feasible, the researcher constructs interactive audio-visual learning media products through Articulate Storyline containing Problem-Based Contextual Learning; validating/testing the feasibility of the results of the construction of interactive audio-visual learning media products through Articulate Storyline containing Problem-Based Contextual Learning by experts.

- Evaluation and reflection, describing the practical and scientific implications resulting from formative evaluation and core arguments of the designed intervention. Several activities are carried out at this stage, such as testing interactive audio-visual learning media products through Articulate Storylines containing Problem Contextual Learning in the Vocational Physics Study class.Practicality assessment is done through questionnaires distributed to students and lecturers who have taught Vocational Physics courses. Assessment of the effectiveness of using interactive media by measuring HOTS and scientific attitudes of students before and after learning using interactive audio-visual learning media through Articulate Storyline containing Problem-Based Contextual Learning; reflection to review interactive audio-visual learning media products through Articulate Storyline containing Problem-Based Contextual Learning by referring to the results of the practicality test and effectiveness test assessments

RESULTS AND DISCUSSION

A. Analysis and Exploration

1. Identify the Learning Needs

In this step, observations were conducted on 2 lecturers and 28 students in the same course. The observation was carried out by giving a series of questionnaire questions to each group of respondents. The questionnaire questions covered three aspects: (1) the first aspect involved the Use of Technology and Media in Learning, which consisted of four questions; (2) the second aspect involved the Development of High-Level Thinking Skills and Scientific Attitudes; and (3) the third aspect involved gaps and recommendations.

The results of the analysis of the lecturers' responses are as follows. In the first aspect, both lecturers had applied technology and digital media in their teaching, with one reporting its use as "often" and the other "sometimes." They integrated videos, simulations, and problem-solving activities, but none mentioned the use of interactive problem-based learning media specifically designed to encourage active student participation. This indicates that technology and media have been applied, but there is a lack of targeted interactivity and engagement needed to promote high-level thinking skills . Furthermore, in the first aspect, when asked about the effectiveness of the learning media used so far, the lecturers expressed a "neutral" stance regarding its ability to increase student engagement. This suggests that the learning media currently applied is not sufficient to achieve the goal of developing high-level thinking skills and scientific attitudes, signaling a need for more dynamic and interactive media. The lecturers also mentioned that the challenges in integrating technology into learning media include a lack of time to develop new resources and insufficient institutional support. Additionally, there is a shortage of tools specifically designed to promote problem-based learning. These challenges highlight the need for institutional support and tools that are more focused on interactive, problem-based learning.

In the second aspect, related to the Development of High-Level Thinking Skills, the lecturers stated that the current teaching methods only support high-level thinking skills "to some extent." They pointed out issues such as over-reliance on memorization methods and a lack of sufficient practice opportunities as barriers to student development in this area. This indicates a clear gap where interactive learning media incorporating problem-based learning could provide much-needed opportunities that challenge students to apply their knowledge in critical and reflective ways. Furthermore, in the third aspect, both lecturers recommended the development of interactive problem-based learning tools that integrate real-world problem scenarios, simulations, and online collaborative platforms. They emphasized that such tools would better engage students in high-level thinking and scientific inquiry. These recommendations reinforce the need to develop interactive, problem-based learning media, which aligns with efforts to promote high-level thinking skills and scientific attitudes.

Next, the analysis of the student responses is as follows. In the first aspect, around 64.3% of students reported that the application of technology and media in the respective course was categorized as "sometimes," with the most common media used being videos and slides. However, only 32.1% of students felt that the media used helped them understand complex concepts. This response indicates that the current learning media (videos and slides) do not provide the level of engagement or interactivity needed to enhance critical thinking and problem-solving skills. Still, in the first aspect, regarding the question on challenges with current learning resources, 78.5% of students identified a lack of engagement and an overwhelming amount of information as the main challenges, with minimal opportunities for active problem-solving or scientific inquiry. This response suggests that students need more engaging and interactive resources, especially those that provide hands-on learning opportunities and allow them to apply their knowledge through problem-based scenarios.

In the second aspect, on Opportunities to Develop High-Level Thinking Skills and Scientific Attitudes, only 25% of students felt they had sufficient opportunities to develop high-level thinking skills, and 60.7% stated that the learning so far had been too reliant on memorization. They also mentioned a lack of feedback on their problem-solving process, which limits their ability to engage in reflective and critical thinking. These responses highlight the need for interactive learning environments that provide immediate feedback and challenge students to think critically rather than merely recall information. In the third aspect, 92.8% of students suggested integrating more technology and media that supports real-world problem-solving, group collaboration, and immediate feedback on decision-making processes.

Several findings were obtained from the analysis of the questionnaires from lecturers and students. First, both groups of respondents observed a significant gap in the current use of technology and media, particularly in promoting high-level thinking skills and scientific attitudes. Second, students expressed a strong need for more engaging and interactive learning media that would allow them to practice real-world problem-solving within an educational context. Current learning media, such as passive videos and slides, are insufficient in promoting critical thinking and scientific attitudes. Third, lecturers emphasized that students struggle to apply theoretical knowledge to real-world problems and to develop scientific inquiry skills due to a lack of appropriate resources. Fourth, both groups of respondents recommended the development of interactive, problem-based learning media that integrates real-world problem scenarios and provides immediate feedback, which can promote high-level thinking and scientific attitudes. The questionnaire results strongly indicate that interactive audio-visual media incorporating problem-based learning is not only necessary but also highly relevant for students. Both lecturers and students recognize the deficiencies in the current learning media and emphasize the importance of integrating interactive and problem-based elements to enhance critical thinking skills and scientific attitudes.

CONDUCT A LITERATURE REVIEW

a) Effectiveness of Problem Based Learning

Problem-Based Learning (PBL) emphasizes a complex problem-solving approach through collaboration, discussion, and reflection (Arends, 2012). Several relevant studies have shown that PBL is effective in improving higher-order thinking skills. (Heindl, 2019) argued that PBL encourages students to actively participate in the learning process through solving real problems, which require students to analyze, evaluate, and create innovative solutions. In another study by (Yu & Zin, 2022), students involved in PBL were better able to identify patterns, formulate hypotheses, and apply theories compared to students who learned through conventional approaches. This suggests that PBL accelerates the development of critical and creative thinking skills that are often associated with HOTS.

Scientific attitudes, such as curiosity, thoroughness, and skepticism, are essential to fostering scientific discovery and development abilities (Murtonen & Salmento, 2019). A study by (Hung & Amida, 2020) showed that PBL not only improves technical skills, but also encourages students to think like scientists, by adopting an evidence-based approach to problem solving. (Li et al., 2022) also support this claim, showing that students engaged in PBL exhibit more scientific behaviors, such as questioning assumptions and seeking additional information independently.

However, critics of PBL note that its effectiveness is highly dependent on task structure and instructional support. The study, (Suhirman et al., 2020) claimed that too high a cognitive load without sufficient direction can hinder deep understanding and result in failure in problem solving. This study highlights the importance of designing appropriate frameworks and media that can help reduce cognitive load while maintaining the essence of PBL.

Furthermore, a limitation of PBL, according to some studies, is that students who are not sufficiently motivated or do not have the ability to learn independently may not experience the same benefits from PBL (Kanyesigye et al., 2024; Shi et al., 2020). Therefore, it is important to consider ways in which the interactive audio-visual learning media developed can facilitate this process, provide appropriate feedback, and motivate students.

b) Interactive Audio-Visual Media in PBL

Interactive learning media has become a popular tool in modern learning because it provides facilities to present complex information in a way that is easier to understand. According to (Mayer, 2014), humans have dual cognitive channels, namely visual and auditory channels, which can be optimized to maximize information processing. Media that combines graphics, videos, animations, and audio narrations are able to utilize both channels so that they can increase the absorption of information compared to using text or audio alone. In a study by (Moreno & Mayer, 2007), it was found that the use of interactive media that combines audio and visuals helps students understand abstract concepts, especially in technical or scientific discussion topics. When integrated into the PBL approach, interactive media can provide a clearer visual context, allowing students to understand problem situations better and faster (Syahputra & Maksum, 2020).

However, one of the challenges of using interactive media is the potential for excessive cognitive load, especially if the media is not well designed. (Kolfschoten et al., 2014; Skulmowski & Xu, 2022; Sweller, 2020) in Cognitive Load Theory suggests that presenting too much information in a short time can cause overload, which actually hinders learning. Therefore, in developing interactive media to support PBL, it is important to consider the right information structure, use visuals and audio in a balanced way, and ensure that interactive elements provide added value to the problem-solving process. Other relevant research also shows that the most effective learning media are those that support user interaction and provide real-time feedback. (Roemintoyo et al., 2022) emphasize that media designed to actively engage students, for example through simulations or interactive quizzes, allows for deeper learning. This is especially important in PBL, where students need to test hypotheses and get immediate feedback on their solutions. In addition, navigation efficiency and ease of use are also important so that students can focus on the learning material, not on how to use the media.

c) Theoretical Framework for Learning Media Design

(Sweller, 2020) argued that when students are faced with complex problems, they are at risk of experiencing high cognitive load if information is presented in a way that is too complex or redundant. To reduce cognitive load, the design of interactive learning media should minimize intrinsic load and irrelevant load. For example, in media that combine audio and visuals, it is important to avoid redundancy, which is where the same information is presented in both visual and auditory forms without added value. Applying these principles will ensure that students can allocate more of their cognitive resources to problem solving rather than to understanding the media itself.

Furthermore, the results of a study developed by (Mayer, 2014), emphasize the importance of dual modality in learning, where information is presented in complementary audio and visual formats. In the context of PBL, this theory supports the use of demonstration videos, interactive animations, and audio narration to facilitate a deeper understanding of the problem situation. The principle of temporal contiguity, namely the simultaneous presentation of visuals and auditory can ensure that students receive information in a synchronous and integrated manner, thus facilitating problem understanding and resolution (Hadza et al., 2020). In addition, the segmentation principle suggests that information should be presented in smaller, more digestible chunks, so that students can process it gradually without feeling overwhelmed (Arifin et al., 2021).

Overall, the literature review of several relevant study results shows that PBL has consistently proven effective in improving students' higher-order thinking skills and scientific attitudes. However, to maximize its effectiveness, interactive learning media are needed that are designed by considering the principles of cognitive load theory and multimedia learning theory. The use of well-designed interactive audio-visual media can improve the problem-based learning process, provide better context, increase motivation, and facilitate the development of critical thinking skills and scientific attitudes.

Design and Construction

Design of Interactive Audio-Visual Learning Media

Interactive audio-visual media is developed using the Articulate Storyline application. Articulate Storyline is one of the leading software tools for creating learning content, mainly due to its ease of use. Storyline enables new and experienced users to quickly develop interactive learning content without requiring advanced technical skills (Maulidiyah et al., 2022). Additionally, this software is equipped with various interactive features, such as drag-and-drop activities, quizzes, interactive videos, and software simulations, which make the learning experience more engaging and improve retention (Hadza et al., 2020). Articulate Storyline is also compatible with e-learning standards such as SCORM and xAPI, facilitating content tracking and integration into Learning Management Systems (LMS) used by various organizations and institutions (Maulidiyah et al., 2022). Another significant advantage is its responsive design, which supports content display across various devices, from desktops to smartphones, thus expanding learning accessibility (Hadza et al., 2020).

Audio-visual media consists of several components: a sign-in stage, a collection of Audio-visual media menus, learning objectives, presentation of materials on static and dynamic fluids, student worksheets, interactive quizzes, and evaluation. The following are some excerpts from the interactive multimedia:

Figure 2 : Sign in Stage

Figure 3: Menu Stage

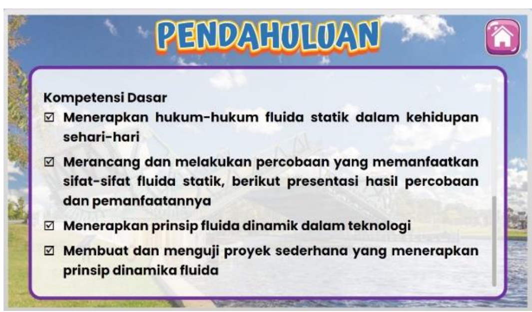

Figure 4 : Introduction (Learning Outcomes)

Figure 5: Learning Materials

Figure 6: Student Worksheet

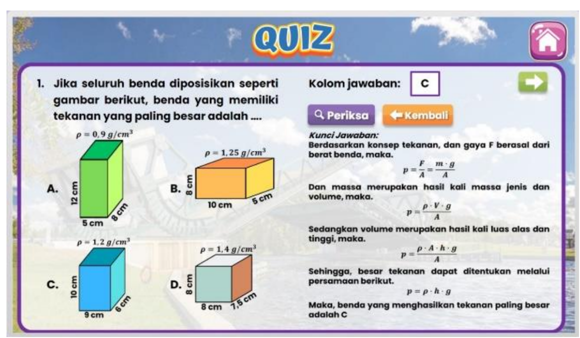

Figure 7: Interactive Quiz

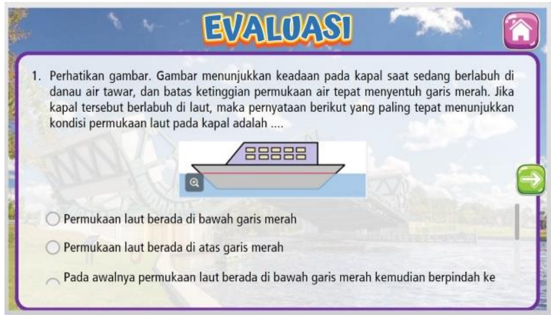

Figure 8: Evaluation

The interactive audio-visual learning media developed contains problem-based contextual learning to improve students' higher-order thinking skills (HOTS) and scientific attitudes. The initial part of this media is a login page designed to provide a personal experience for each user and make it easier to track students' learning progress. The interactive login process helps create better initial engagement in the learning process (Septikasari et al., 2021). After successfully logging in, students are directed to the main menu, which contains several options such as Introduction, Learning Materials, Worksheets, Interactive Quizzes, and Learning Evaluations. This clear structure makes it easy for students to access each part of the learning according to their needs.

This media explains clear learning objectives in the Introduction section, such as applying static and dynamic fluid laws in everyday life and fluid-related experimental designs. This aligns with the principle of competency-based learning that directs students to specific learning outcomes (Samsudin et al., 2023). The learning material is divided into two main parts: static fluids and dynamic fluids, which include subtopics such as Hydrostatic Pressure, Pascal's Law, and Bernoulli's Law. This material is presented visually and interactively, making it easier for students to understand complex concepts through a real-world problem approach. A critical part of this media is the interactive quiz, where students are given questions related to the material that has been studied. This quiz is accompanied by direct feedback, which allows students to understand mistakes and improve their understanding in real time. Providing direct feedback has increased student motivation and engagement in learning (Dzil Ikram et al., 2021). Furthermore, student worksheets provide tasks that encourage students to apply their knowledge in real-world scenarios, such as the sinking of the KMP Yunicee, which trains cognitive skills and students' scientific attitudes in solving problems.

Finally, the evaluation section aims to measure how students understand the material and can apply it in a broader context. This evaluation ensures that learning objectives are achieved and students can use the knowledge gained to solve more complex problems. Through these components, this interactive audio-visual learning media is designed to improve HOTS and foster scientific attitudes through contextual problem-based learning.

Expert Review (Validation)

Validation was conducted by one of the lecturers of Physics Education (Expert in Digital Learning Media). The Evaluation Components consist of content validation, construct validation, design validation, and language validation. The validation results are presented below:

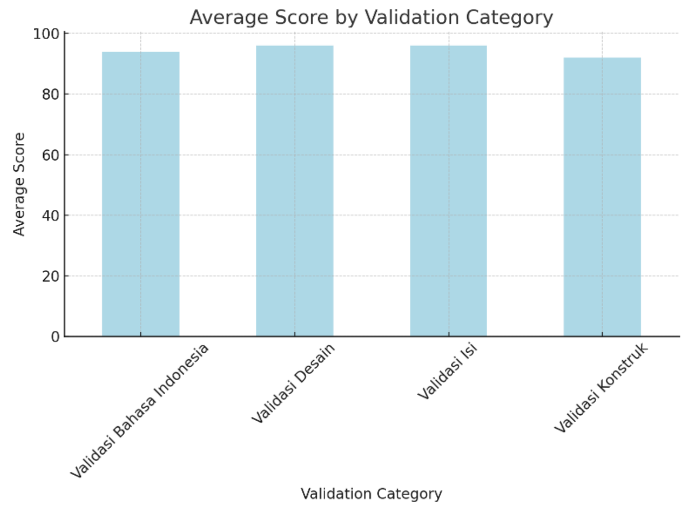

Figure 9:Validation Result

Based on the validation results of interactive audio-visual learning media based on Articulate Storyline, it can be concluded that the media has met the criteria needed to support the contextual problem-based learning process. In terms of content validation, interactive audio-visual media received relatively high scores, indicating that the content of the learning material is following the curriculum objectives and students' learning needs. The material presented is accurate and relevant to the development of students' HOTS (Higher Order Thinking Skills) (Indrianto & Shamilah, 2020). This is important, considering that the primary purpose of this media is to improve students' critical and analytical thinking skills through presenting material based on fundamental and contextual problems.

For construct validation, the validation results show that the material has been arranged logically and systematically. The presentation of material in the media follows a flow that is easy to understand and well-structured. This media successfully provides a learning experience that guides students through clear problem-solving stages, supporting students' active involvement in the learning process (Arif et al., 2024). The problem-based learning structure applied in this media can help students develop critical thinking and problem-solving skills more effectively.

The media received good ratings regarding visual appearance and interactivity in design validation. An attractive, user-friendly design and appropriate audio-visual elements can increase student motivation and engagement (Maemunah et al., 2021). The interactions provided in this media also help students to learn actively, allowing them to interact directly with the content through simulations, animations, and interactive questions. Finally, language validation shows that the use of language in the learning media is by good and correct Indonesian language rules. The validator assessed that the language used was simple and easy for students to understand, using appropriate and not excessive technical terms to ensure understanding. Overall, the validation results show that this learning media is suitable for use with some minor adjustments. Recommendations from the validator can be used to further refine certain aspects, especially regarding improving interactions in the media and presenting more in-depth content. With these improvements, it is hoped that this media can be more effective in improving HOTS and students' scientific attitudes and facilitating more meaningful and interactive learning in the classroom.

Evaluation and Reflection

Improving students' HOTS

At this stage, interactive multimedia trials were conducted on Physics Education Study Program students, Faculty of Teacher Training and Education. Pretests were given to students before they participated in learning using interactive multimedia. Students were also asked to do a posttest at the end of the learning. The purpose of giving this pretest and posttest was to see the effectiveness of interactive multimedia in improving students' HOTS. Comparison of pretest and posttest values produced the following N-Gain Score:

Tale 1: Descriptif Statistic for Pretest and Postest

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
N_Gain_SKor	29	.41	.79	.5315	.09739
Persen_NGain	29	41.38	78.72	53.1487	9.73854
Valid N (listwise)	29				

Figure 10: N-Gain Score

Based on the N-Gain results displayed in the descriptive table, the average N-Gain Score value of 0.5315 with a standard deviation of 0.09739 and the average N-Gain percentage of 53.15% with a standard deviation of 9.73854 indicate that the use of interactive multimedia based on contextual problem-based learning (PBL) is efficacious in improving students' higher order thinking skills (HOTS). The range of N-Gain values that vary from 0.41 to 0.79 indicates that most students experienced a significant increase, with the majority being in the moderate to high category. Based on the N-Gain classification, an average value above 0.5 is included in the mild category. This indicates that most students experienced increased analytical, critical, and evaluative thinking skills after using interactive multimedia. This increase aligns with Bloom's Taxonomy theory, where tasks that require problem-solving and applying concepts critically and analytically can develop students' HOTS (Silalahi et al., 2022).

In addition, the variation in results indicated by the relatively small standard deviation indicates that although there are differences in the level of initial understanding among students, in general, this PBL-based interactive multimedia can improve their thinking skills. The Problem-Based Learning (PBL) model, which emphasizes the contextualization of learning materials in real-world situations, has been proven effective in encouraging students to be actively involved in the problem-solving process. According to constructivism theory, learning will be more effective when students build knowledge based on relevant experiences and contexts (Nana & Surahman, 2019).

Overall, the N-Gain results show that the use of contextual PBL-based interactive multimedia positively impacts students' HOTS. The average increase in N-Gain, which is in the medium to high category, reflects the effectiveness of this approach in facilitating students' better understanding, analysis, and solving of complex problems. Thus, it supports the theory of Problem-Based Learning and constructivist learning, which are relevant to the development of higher-order thinking skills.

Students' Scientific Attitude

After learning with interactive multimedia was completed, scientific attitudes were measured using a questionnaire consisting of 20 statements covering the following indicators: curiosity, respect for facts/data, critical thinking, attitude of discovery and creativity, open-mindedness, cooperation, perseverance, discipline, accuracy, and self-confidenc:

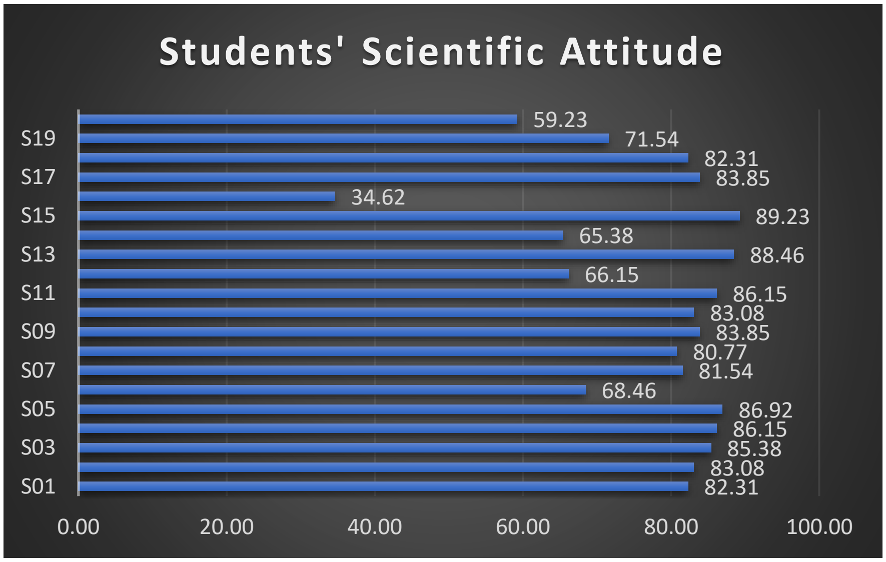

Figure 11: Students' Scientific Attitude

Based on the results of measuring students' scientific attitudes after participating in learning using interactive multimedia based on contextual problem-based learning (PBL), there was a significant increase in various aspects of scientific attitudes related to higher-order thinking skills (HOTS). Students' curiosity (S01-S02) was high, and they were encouraged to explore the material further, indicating the effectiveness of PBL in stimulating curiosity. Respect for facts and data (S03-S04) also increased, suggesting that students appreciate the relevance and accuracy of the information presented. Critical thinking skills (S05-S06) and creative attitudes (S07-S08) were shown to have developed, with most students reporting ease in analyzing and finding new solutions. Open-mindedness (S09-S10) also increased, with students willing to consider new perspectives, essential in group discussions. In addition, cooperation (S11-S12) was one of the prominent aspects of students' motivation to work together in completing tasks. Perseverance (S13-S14) in facing challenges also appeared strong, indicating that the PBL approach builds a persistent mentality in solving complex problems. Discipline (S15-S16) and thoroughness (S17-S18) aspects are increasingly developing, where students are more aware of the importance of following rules and checking solutions carefully before submitting them. Finally, students' self-confidence (S19-S20) increases, although some still feel less confident in conveying ideas. Overall, PBL effectively develops HOTS and relevant scientific attitudes for students, improving analytical skills, creativity, collaboration, and resilience in facing challenges.

Practicality of Audio-visual Media

The practicality test aims to assess how much audio-visual media can be applied quickly and effectively in real situations. The practicality test uses a questionnaire given to students during the learning process. The results of the practicality test can be seen in the following graph:

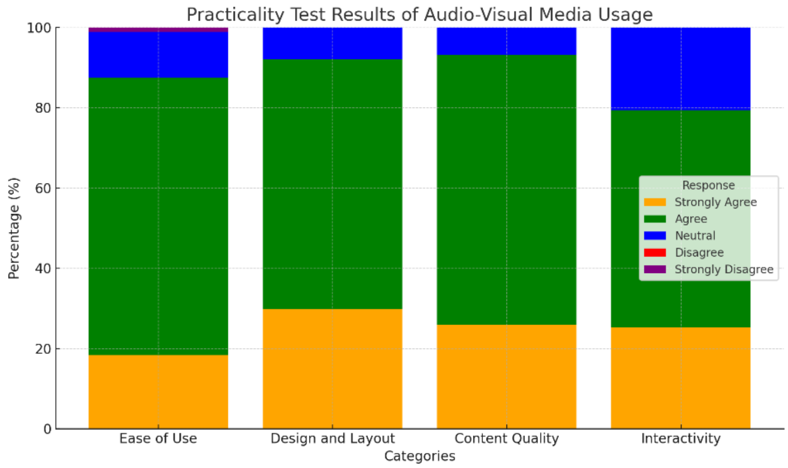

Figure 12:Practicality of Audio-Visual Media Usage

The graph above shows the results of the practicality test of using audio-visual media in four main categories: Ease of Use, Design and Layout, Content Quality, and Interactivity. Most respondents gave Agree responses for all four categories, with the highest percentage being around 60-70% in each category, indicating positive acceptance of this media. The Design and Layout category recorded the highest percentage of Strongly Agree, which was 29.89%, indicating that students highly value the visual and aesthetic aspects of the media. An attractive design and intuitive layout are essential factors supporting comfort in learning. Ease of Use also received a good rating, with 68.97% of respondents stating they agree that this media is easy to use. This indicates that the media is designed with an interface that is easy for students to understand and use, thus supporting learning effectiveness. However, there is an area that requires more attention, namely Interactivity. In this category, the percentage of Neutral responses reached 20.69%, which is higher than in other categories. This indicates that some students may feel that the interactive aspects of the media could be more optimal and support active involvement during learning. Increasing interactivity can enrich the learning experience and increase student involvement in the learning process. Overall, these results indicate that the audio-visual media used has good practicality. Most respondents felt this media was practical, easy to use, and visually appealing. However, there is still room for improvement in interactivity to support student involvement better.

CONCLUSION

This study shows the potential of using interactive audio-visual learning media, especially when integrated with the Problem-Based Learning (PBL) approach, to improve students' higher-order thinking skills (HOTS) and scientific attitudes. Based on the N-Gain results, there was a significant increase in students' HOTS, with an average N-Gain score of 0.5315, indicating that this media successfully facilitated critical and analytical thinking. In addition, the media design received high appreciation, especially regarding its visual and structural aspects that support learning. However, the interactivity aspect, although positive, still shows room for improvement, especially in increasing students' active engagement.

This study highlights the importance of real-world problem-solving tasks, which can arouse students' curiosity and open-mindedness, in line with the 21st-century learning framework. The application of Bloom's Taxonomy and constructivist learning theory further supports the effectiveness of this media. As educational technology advances, continuous interactivity, and contextual relevance improvements will ensure that learning media like this are increasingly impactful in developing critical and problem-solving students. This approach overall contributes positively to educational strategies in shaping deeper learning and more robust engagement.

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