

Effectiveness of Interactive Learning Media Development Based on Articulate Storyline 3 in Elementary School Education

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ABSTRACT

The development of learning media, such as interactive media involving animation, quizzes, and videos, facilitates the understanding of learning materials through two-way communication between the media and students, making the material more concrete and easier to understand. This study aimed to develop interactive learning media products using Articulate Storyline 3 for magnet material in grade V Science in private elementary schools and to describe the feasibility of interactive media in elementary education. The method used is Research and Development (R&D) with the ADDIE development model, which includes the stages of analysis, design, development, implementation, and evaluation. The result of product development is interactive media based on articulate Storyline on IPAS class V magnet material at private elementary school. The products' specifications are web browser, APK, and HTML. The feasibility results based on the validation test showed the percentage of media experts at 94%, material experts at 98%, learning experts at 98%, and student response at 92%. The effectiveness test results show a t-count value of 8.93 with a comparison of t-count (8.93) > from t-table (1.71), which indicates that H_a is accepted and H_o is rejected. Thus, interactive learning media has developed significantly and improved elementary school students' learning outcomes. This research contributes to developing interactive learning media with Articulate Storyline in private elementary schools, improving student learning outcomes and improving the learning process at the elementary level.

Keywords: Interactive Learning Media, Articulate Storyline, Elementary School.



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INTRODUCTION

The problem with learning in the Merdeka Curriculum is how to create learners who are more independent and active in seeking knowledge without relying entirely on teachers (Kalyani & Rajasekaran, 2018; Andersson, 2019; Siregar et al., 2023). The passive lecture method is no longer relevant to the demands of modern learning, so there is a need for learning media that can support process skills and active learning (Nurfadhillah et al., 2021; Winarti et al., 2023; Situmorang et al., 2024; Nisa et al., 2024). Thus, it is essential to use technology and interactive media to create two-way interaction between teachers and students so that learning becomes more effective and exciting. One solution is the use of e-learning software such as Articulate Storyline 3, which can combine various media elements such as visual, audio, and video and supports publication in an easily accessible format (Darnawati et al., 2019; Ifani et al., 2021; Azzahra et al., 2023; Kurniawati et al., 2024). For example, these innovations have increased student engagement, motivation, and interest in learning (Charline et al., 2023; Ndraha & Harefa, 2023; Ansori et al., 2024). Interactive learning media like this can make the learning atmosphere more active and help students understand the material better. Therefore, technological innovation in the form of interactive learning media is

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significant in creating learning that is more effective and relevant to current educational needs.

Based on several research findings, the challenge in the Merdeka Curriculum lies in fostering learners who are independent and active in seeking knowledge, without fully relying on teachers (Kalyani & Rajasekaran, 2018; Andersson, 2019; Siregar et al., 2023). Passive lecture methods are no longer relevant to modern learning demands, requiring media that promote process skills and active engagement (Nurfadhillah et al., 2021; Winarti et al., 2023; Situmorang et al., 2024; Nisa et al., 2024). Technology and interactive tools, such as Articulate Storyline 3, offer solutions by integrating visual, audio, and video elements and providing easily accessible formats (Darnawati et al., 2019; Ifani et al., 2021; Azzahra et al., 2023; Kurniawati et al., 2024). These innovations have proven to boost student engagement, motivation, and learning interest (Charline et al., 2023; Ndraha & Harefa, 2023; Ansori et al., 2024). Studies reveal its effectiveness in improving learning outcomes. Putwain et al., (2024) highlighted its role in enhancing motivation and achievement in science subjects. Yin, (2022) found it effective for thematic learning, while Hippisley & Douglas, (2002) confirmed its reliability as an interactive tool. van Laar et al. (2020) demonstrated its capacity to develop 21st-century skills, and showed positive responses to its use. This study will further explore its application in primary schools and its impact on learning outcomes.

This research aims to explore the application of interactive learning media based on Articulate Storyline 3 in assisting elementary schools' teaching and learning process, especially in the subjects of Natural and Social Sciences (IPAS). Through this research, it is expected to know how much the media can increase students' motivation, interest, and learning achievement. In addition, this research also aims to assess the effectiveness of Articulate Storyline 3 in supporting the development of critical, creative, collaborative, and communicative thinking skills (4C), which are very important in facing the challenges of 21st-century learning. More than just theory, this research is expected to provide practical benefits for teachers in creating a more active, interactive, and fun learning atmosphere, where students not only passively receive material but are also actively involved in the learning process. The results are expected to guide curriculum development that is more innovative and in line with the needs of modern education.

The use of interactive learning media based on Articulate Storyline 3 in elementary schools, especially in Natural and Social Sciences (IPAS) subjects, shows a very positive impact on the learning process. This media not only succeeds in increasing students' motivation and interest in learning but can also make learning materials more accessible. With its interactive and engaging design, Articulate Storyline 3 encourages students to be more involved in the learning process, making learning feel more fun and dynamic. Students who previously may have felt bored or less interested in conventional lecture methods are now more enthusiastic about participating in lessons. In addition, this media also plays a vital role in developing 21st-century skills, namely critical, creative, collaborative, and communicative thinking (4C). Articulate Storyline 3 allows students to be more active in thinking and solving problems, collaborating with classmates, and honing communication skills. Combining visual, audio, and interactive elements facilitates more comprehensive and holistic learning.

RESEARCH METHODS

The research method used in this study is the development research method or Research and Development (R&D), which aims to produce certain products and test their effectiveness in an educational context (Busetto et al., 2020; Foster, 2023). This research uses the ADDIE development model, which is one of the models often used in development research. According to Sarpong et al., (2023), the ADDIE model consists of five stages, namely: (1) Analysis, where learning problems and needs are identified; (2) Design, the stage of designing a solution or product in accordance with the results of the analysis; (3) Development, where the design is transformed into a real product or learning media; (4) Implementation, which involves applying the product in an actual learning situation; and (5) Evaluation, which aims to assess the effectiveness of the product and make improvements if necessary.

In this study, the trial was conducted by involving four validators who are experts in their respective fields, namely material expert validators, teaching material experts, language experts, and learning experts. These validators provided important input regarding the feasibility and quality of the products developed (Thiagarajan et al., 1974). Data collection techniques in this study included observation, interviews, documentation, and tests. The data obtained were divided into two types: qualitative data and quantitative data. Qualitative data was collected through descriptions from observation sheets, interviews, and documentation, which described the views and feedback from validators and learners. Meanwhile, quantitative data was obtained from the pre-test and post-test results, which were used to measure the improvement of learning outcomes after the use of interactive learning media.

For data analysis, a Likert scale was used as a tool to measure perceptions and attitudes towards the developed learning media. According to Zakariah, the Likert scale is very effective for measuring attitudes, opinions, and perceptions of a person or group towards social phenomena. The use of this scale allows researchers to obtain data in numerical form which is then analyzed quantitatively. To determine the effectiveness of the developed product, a t-test is used, which serves to compare the results of the pre-test and post-test, so that it can be assessed whether there is a significant increase in students' understanding and learning outcomes after the use of learning media (Swiatek et al, 2016).

The formula used to calculate the percentage results of product feasibility also uses a Likert scale, where respondents' answers are categorized into a scale that maps the level of agreement or disagreement with certain statements. Thus, the Likert scale makes it easy to assess and validate research results related to perceptions and acceptance of the interactive learning media developed (Mishra et al., 2018). Here's the formula:

$$P = \frac{\sum x}{\sum xi} \times 100\%$$

Description:

- P : Percentage score of each research aspect
- $\sum x$: The number of respondents' answer values in one item
- $\sum xi$: Number of ideal scores in one item

According to Umakantha (2016), the t test is used to determine whether the independent variable has a partial influence on the dependent variable. One of the methods used to test the effectiveness of development products is through the t test. The analysis technique in the t test is based on the results of the pretest and posttest of grade V students, which were carried out as part of the experiment using interactive learning media. This t-test produces a t-count value that shows a significant difference between student learning outcomes before and after the use of the learning media, which proves that the media is effective in improving learning outcomes. Here is the formula:

$$t_{hitung} = \frac{\bar{x}_D}{\sqrt{\frac{\sum d^2}{N(N-1)}}$$

\bar{x}_D = respondent average (differentiation)

D = D- \bar{x}_D

N = number of respondents

The pretest was conducted before the interactive learning media was applied, to determine the initial condition of student learning outcomes. After the treatment, which is the use of interactive media, a posttest is conducted to measure the improvement of learning outcomes. The results of the t-test then produce a t-count value, which is an indicator of whether there is a significant difference

between learning outcomes before and after the use of the learning media. If the t-count shows a significant difference, this means that the interactive learning media has a real influence in improving student learning outcomes. Thus, the t-test not only helps measure the success of the treatment, but also provides quantitative evidence of the effectiveness of the media in supporting the improvement of learning quality.

RESULTS AND DISCUSSION

Results

Condition of Learners Before Using Interactive Learning Media

Based on observations and interviews at Al-Qodiri Plus Private Elementary School in Jember, it was found that the learning process is still dominated by the use of printed media, pictures, and textbooks, as well as conventional methods such as lectures interspersed with discussions. Some identified obstacles include students' lack of focus, classroom noise, sleepiness, and low motivation to learn, mainly caused by personal problems. In addition, many educators have yet to be able to design interactive learning media, which results in boredom and a lack of student attention during learning. This condition impacts the low achievement of student learning outcomes, as evidenced by the average daily test score of 66%, where 15 out of 24 students have yet to reach the Minimum Completion Criteria (KKM). Although facilities such as Chromebooks, projectors, and Wi-Fi are available, their use could be more optimal due to the limited technological skills of educators and the lack of training to create interactive learning media. In class V, Chromebooks are only used for Computer-Based National Assessment (ANBK) and have not been utilized in daily learning. Therefore, it is necessary to develop more effective interactive learning media, such as Articulate Storyline 3, to help students understand abstract concepts more concretely and improve the overall quality of learning.

Before applying interactive learning media based on Articulate Storyline 3, researchers first conducted observations, interviews, and documentation with VA class students. From the results of these activities, it was found that there were several obstacles in the learning process, especially in the subjects of Natural and Social Sciences (IPAS). One indicator is the results of students' daily tests, which show an average score of 65.8, which indicates that students' understanding of the material provided by IPAS could be more could be more optimal. Based on these findings, researchers sought to assess how students' competence and learning outcomes could be improved after using interactive learning media. For this reason, researchers conducted a pre-test before learning media was applied to measure students' initial understanding of the material. After applying Articulate Storyline 3-based media, researchers conducted a post-test to see changes in students' understanding and mastery of the material. Through the comparison of the pre-test and post-test results, researchers can evaluate how much the learners' understanding has improved after using the interactive learning media, as well as the effectiveness of the media in helping them master the material more deeply. The following are the results of the learners' pre-test obtained through the formula:

$$P = \frac{\Sigma x}{\Sigma x_{ideal}} \times 100\%$$

$$P = \frac{1380}{2400} \times 100\%$$

$$P = 58\%$$

Based on the analysis of pre-test results in Natural and Social Sciences (IPAS) for 24 students, only two students successfully met the Minimum Completion Criteria (KKM), while the remaining 22 students still fell short of the KKM. Overall, the percentage of pre-test scores reached 58%, indicating that the majority of students had not achieved the established passing standard. This data was derived from the pre-test results, where the symbol "x" represents the pre-test scores, and "P (100%)" indicates the scores in percentage form. The accompanying table description illustrates the students' passing status, showing that most students fall into the "did not pass" category.

These results indicate that students' understanding of the IPAS material is inadequate, and the majority of students have not been able to master the concepts taught. Based on this condition, researchers see an urgent need to develop more effective learning media to help students improve their understanding. Therefore, the development of interactive learning media based on Articulate Storyline 3 is expected to provide a solution in overcoming this gap. The interactive media is designed to make learning more interesting and easily understood by students, so that it can help them master the material better and improve their learning outcomes significantly.

Media Feasibility Trial in Learning for Learners

Based on the assessment results from experts, the developed learning media is considered highly suitable for use. The evaluation was conducted by media experts, material experts, and learning experts, who assessed the validity of the media from various aspects. The following are the results of the validity test conducted:

Table 1. Media Expert Validity Test Results

No	Area of Expertise	Score	Criteria
1.	Media Expert	94%	Very Decent
2.	Material Expert	98%	Very Decent
3.	Learning Expert	96%	Very Decent

Based on Table 1, the assessment results from each expert show that the media expert scored 94%, the material expert 98%, and the learning expert 96%. According to the established criteria, all scores are classified as "Very Feasible," indicating that this learning media demonstrates excellent quality and is highly suitable for implementation in the learning process.

Table 2. Categories Of Learning Media Feasibility

No	Percentage	Interpretation Criteria
1	$81\% \leq P \leq 100\%$	Very Decent
2	$61 \leq P < 81\%$	Feasible
3	$41\% \leq P < 61\%$	Decent Enough
4	$21\% \leq P < 41\%$	Not Decent
5	$0\% \leq P < 21\%$	Very less worthy

Table 2 outlines the interpretation of learning media feasibility categories based on percentage ranges, where scores between 81% and 100% are classified as "Very Feasible," 61% to 80% as "Feasible," and 41% to 60% as "Feasible Enough." Scores below 41% fall into the "Less Feasible" or "Very Less Feasible" categories. Based on this table, the tested learning media, with a score exceeding 81%, is categorized as "Very Feasible." This high score demonstrates that the media meets or exceeds the required criteria, reflecting its exceptional quality, functionality, and suitability for supporting effective learning processes in educational settings.

Discussion

Application of Interactive Learning Media to Learners

Teachers' use of learning media with Articulate Storyline 3 presents significant advantages as software similar to Microsoft PowerPoint, but with much more interactive features. Articulate Storyline 3 allows teachers to create slides that are not only visually appealing, but can also engage learners in a more active learning process. These interactive features, such as quizzes, animations, and audio-visual elements, are designed to increase student engagement in learning, so they more easily understand the material presented (Rianto, 2020; Firdawela & Reinita, 2021; Mustajab et al., 2023). The development of learning media based on Articulate Storyline 3 was carried out using the Research and Development (R&D) method, which includes systematic stages ranging from needs analysis to product evaluation (Yuliawati et al., 2020; Nurcahyanto et al., 2023; Ananda et al., 2023). This method aims to produce products that are effective and suitable for learning needs, and test how the media can significantly affect learners' understanding and learning outcomes

([Abdulrahaman et al., 2020](#); [Sivakumar et al., 2023](#)). With features that support interactive learning, Articulate Storyline 3 provides an innovative solution for teachers to present complex material in a way that is easier for students to understand.

The process of developing this learning media follows the ADDIE model, which consists of five main stages. The first stage is Analysis, which includes three important aspects: needs analysis, teaching material analysis, and learner analysis. The second stage is Design, where the researcher begins to develop the Media Content Outline (GBIM) which summarizes the important elements that will be presented in the interactive learning media. Furthermore, at the Development stage, interactive learning media is made based on the script that has been compiled at the design stage. The fourth stage is Implementation, where the learning media is tested to identify deficiencies and weaknesses that may exist. Finally, the Evaluation stage is conducted to assess the quality of the product and the effectiveness of the learning process. In this study, a pre-test was conducted before the use of the media to measure students' initial understanding, and a post-test was conducted after the use of the media to determine the effectiveness of the developed product. This research was conducted at Islamic Elementary School Al-Qodiri Jember, located in Gebang, Patrang sub-district, Jember regency, by taking data from class VA. The material chosen based on the results of the analysis of teaching materials is the subject of Natural and Social Sciences (IPAS) with the topic "Magnetism".

The application of interactive learning media based on Articulate Storyline 3 to VA class students shows a strategic approach in increasing student engagement in the learning process ([Hadjileontiadou et al., 2015](#); [Chanchumni & Mangkhang, 2021](#)). The use of Chromebooks as a technology support tool in the classroom allows students to interact with the learning media directly, and the HTML format used facilitates access and flexibility in running the content. This step shows a good integration of technology, in accordance with the demands of 21st century learning that is increasingly digitalized. The division of students into small groups, each consisting of four members, is also an effective approach ([Ramadhani & Asrul, 2024](#)). The division of students into small groups, each consisting of four members, is also an effective approach. It promotes collaborative learning that encourages students to share knowledge and discuss the material they are learning. In addition, this strategy helps encourage students who may feel less confident to be more actively involved in group activities. The use of interactive media rich in visual features and direct interaction through Articulate Storyline 3 also makes it easier for students to understand abstract material such as magnets and their working principles ([Mayer, 2008](#)).

However, a challenge that may arise from this implementation is the ability of teachers and students to utilize the technology effectively. While Chromebooks and interactive learning media have been provided, the understanding of technology by teachers and students is key to successful implementation ([Haleem et al., 2022](#); [Mhlanga, 2024](#); [Li et al., 2024](#)). If technology usage skills are inadequate, the maximum benefits of this medium may not be achieved. Teacher assistance, therefore, becomes very important to ensure the process runs smoothly. The experiment of creating magnets through induction directed by the researcher is one example of experiment-based learning that allows students to put theory into practice. This not only assesses the understanding of theory, but also measures students' skills in applying science, which is an important part of competency-based learning. Combining theory with hands-on practice provides students with a more meaningful and in-depth learning experience ([Albanese et al., 2010](#); [Acikgoz & Babadogan, 202](#)).

From a skills assessment standpoint, these experiments allow teachers and researchers to evaluate more than just academic outcomes; they can also measure students' attitudes, group collaboration, and problem-solving abilities. The direct involvement of students in conducting magnet experiments demonstrates the effectiveness of active learning, where students do not just sit passively listening, but are also physically and mentally involved in the learning process ([Dori & Belcher, 2005](#); [Lombardi et al., 2021](#); [Yen & Thao, 2024](#)). However, some things that need further consideration are infrastructure readiness as well as possible technical barriers during the use of

technology-based media. For example, internet connectivity or technical obstacles in the operation of Chromebooks may hinder the smooth learning process.

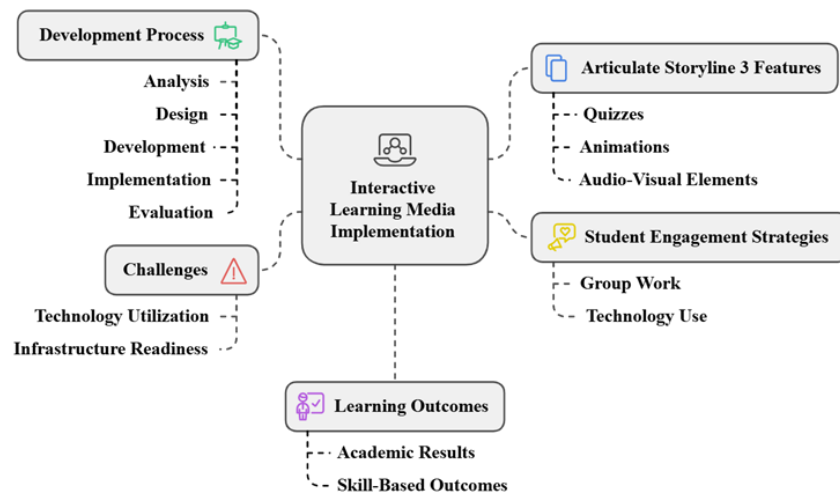


Figure 1. Framework for Implementing Interactive Learning Media Using Articulate Storyline 3

The image illustrates the implementation of interactive learning media, consisting of several interconnected elements. The development process is the initial step, encompassing planning, designing, content development, and evaluation to ensure the learning media meets students' needs. A core component of this implementation is the features of Articulate Storyline 3, which seamlessly integrates visual, audio, and video elements while supporting publication in easily accessible formats. To ensure the success of the learning media, student engagement strategies are also a primary focus. These strategies involve interactive approaches, gamification, and personalized learning experiences to boost students' motivation and active participation.

Learning outcomes are the main objective of this implementation, as interactive media is expected to enhance students' understanding and academic performance, which can be measured by comparing pre-test and post-test scores. However, certain challenges, such as limitations in technology utilization and infrastructure readiness, must be addressed. By identifying and overcoming these challenges, the implementation of Articulate Storyline 3-based interactive learning media can be carried out effectively, yielding positive impacts on students' learning outcomes while creating a more engaging and relevant learning experience.

This application embodies a comprehensive approach that integrates technology, interactive learning, and experimental methods. Adopting this approach fosters the development of multiple dimensions of students' competencies. These include enhancing their technological proficiency, promoting collaborative skills, deepening their understanding of subject material, and improving their hands-on practical abilities in science. Such a holistic learning framework equips students with essential academic and technical knowledge and prepares them to engage effectively in problem-solving and teamwork, necessary for real-world challenges.

Effectiveness of Using Interactive Learning Media for Learners

The experimental results at Islamic Elementary School Al-Qodiri Jember demonstrated that interactive learning media based on Articulate Storyline 3 significantly improved students' understanding, regardless of whether they initially met the Minimum Competency Criteria (KKM) or had already surpassed it. This improvement was evident from the comparison of pre-test and post-test scores, with post-test results showing a substantial increase after students engaged with the interactive media. Specifically, post-test analysis in the Natural and Social Sciences (IPAS) subject revealed that all 24 students exceeded the KKM, achieving a passing rate of 91%.

To validate the media's effectiveness, a t-test was conducted to compare pre-test and post-test scores. The statistical results confirmed that the differences in learning outcomes were significant, providing strong evidence for the media's impact. The t-test analysis showed a t-count value of 8.93, which exceeded the t-table value of 1.71, leading to the acceptance of the alternative hypothesis (H_a) and the rejection of the null hypothesis (H_0). These findings confirm that the improvement in post-test scores is directly attributed to the use of Articulate Storyline 3-based interactive media. The analysis underscores the media's effectiveness in enhancing learning outcomes, particularly for VA class students studying magnetic materials in the IPAS subject at Islamic Elementary School Al-Qodiri Jember.

In terms of effectiveness, the results of this statistical test show that the interactive learning media developed succeeded in significantly improving student learning outcomes. The use of Articulate Storyline 3 makes it easier for students to understand abstract concepts, such as magnetism, with the help of visualization and interactive features. This helps to overcome the understanding gap between students who have not reached the KKM and students who have excelled, because this media is able to bridge differences in learning styles, so that students are more involved and understand the material more deeply (Jainuri et al., 2023; Hendra & Kurniati, 2024; Yusuf et al., 2024).

Researchers also distributed questionnaires to measure students' responses to this learning media, and the results showed that 92% of students gave positive responses. This indicates that the Articulate Storyline 3-based interactive media is very feasible to use in learning. This high response also reflects students' comfort and motivation in using the interactive media, which certainly contributes to their increased interest and engagement in the learning process.

These results not only show short-term effectiveness in the form of improved grades, but also demonstrate the potential of this media in creating a more meaningful learning experience (Schindler et al., 2017; Rahmi & Samsudi, 2020). By using interactive media, students can learn more independently and actively and have a more concrete understanding of the material. However, the success of this media also depends on teachers' skills in managing technology and their ability to continuously update the materials presented in the learning media (Salam et al., 2018; Parmaxi & Zaphiris, 2019; Islami & Dafit, 2023). Therefore, continuous training for teachers in using interactive media such as Articulate Storyline 3 is essential so that the effectiveness of this media can continue to be optimized.

Overall, this experiment shows several important points regarding the effectiveness of using Articulate Storyline 3-based learning media. First, this interactive media is effective in bridging the understanding gap between students who have not reached the KKM and those who have excelled. The visual and interactive features help students in understanding difficult concepts, such as magnetism, as supported by the cognitive theory of multimedia (Song et al., 2014; Maroungkas et al., 2023), which states that the combination of text, images, and interaction can improve student understanding. Second, active learning involving experiments, such as the creation of magnets by induction, improves students' understanding because they are directly involved in the learning process (Simic et al., 2021; Dubinsky & Hamid, 2024). Thirdly, it creates inclusivity in learning, giving all students, both lagging and excelling, the opportunity to learn according to their own style and pace (Holly et al., 2021; Farhana et al., 2021; Yoesdiarti et al., 2022).

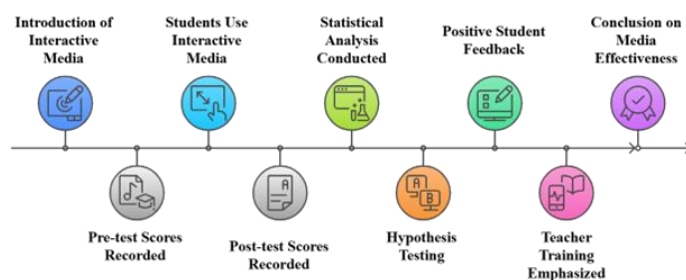


Figure 2. Effectiveness of Interactive Learning Media

The image outlines a systematic process for developing and implementing interactive learning media. It begins with planning and conceptualization to align objectives with learning needs, followed by development, where interactive elements like visuals and audio are integrated. After development, initial testing ensures functionality and effectiveness before moving to experimental implementation in real learning environments. Next, the assessment phase evaluates learning outcomes to measure the media's impact. Based on the results, revisions and refinements are made to optimize the product. The media is then published and distributed for broader use, followed by final validation to ensure it meets educational standards. This process ensures the media is engaging, effective, and pedagogically sound.

Although the post-test results showed significant improvement, other factors such as students' motivation and enthusiasm in using new technology may also play a role. Therefore, further research is needed to evaluate the long-term impact of using this media, as well as ensuring continued support for teachers in using this learning technology effectively. Thus, Articulate Storyline 3-based learning media is proven to be effective in improving students' understanding and learning outcomes, as well as being able to create a learning environment that is interactive, inclusive, and relevant to the development of current educational technology.

CONCLUSION

This research successfully developed interactive learning media based on Articulate Storyline 3 for IPAS subjects in elementary schools. This media is published in HTML, web, and Android applications, measuring 73 MB. Expert validation showed high feasibility with a score of 94% from media experts, 98% from material experts, and 96% from learning experts, indicating that this media is feasible to use in learning. The effectiveness test results also showed a significant increase in student understanding, with a t-count of 8.93, more significant than the t-table of 1.71, proving that this media is efficacious in improving student learning outcomes.

This research provides theoretical and practical contributions to technology-based learning in elementary schools. Theoretically, the findings support the cognitive theory of multimedia, which states that visual, audio, and interactive elements can improve students' understanding, especially in abstract materials such as magnetism. Practically, the interactive learning media based on Articulate Storyline 3 has proven effective and feasible for teachers to improve the quality of learning. It is easily accessible in HTML, web app, and Android formats and helps to create a more interactive and engaging learning experience for students. Teacher training in the use of this technology needs to be considered so that its benefits can be maximized in learning.

Further research is recommended to test the effectiveness of Articulate Storyline 3-based learning media in various other subjects and education levels, such as in secondary schools. In addition, a long-term evaluation of the impact of this media is needed to see if the improvement in learning outcomes can be sustained. Research could also focus on developing additional interactive features, such as augmented reality (AR) or virtual reality (VR), to improve student motivation and understanding. Qualitative studies on teachers' and students' experiences using this media are also essential to deepen insights into technical and pedagogical aspects that could be improved.

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