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Implementation of Adobe Flash Based Electronic Learning Media on The Learning Outcomes of Fourth-Grade Students at SDN Banyu Urip IX Surabaya

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A B S T R A C T

This study aims to determine the learning outcomes of fourth grade students at SDN Banyu Urip IX Surabaya after the implementation of Adobe Flash-based electronic learning media, as well as to examine students' responses toward the use of this media in the topic of energy transformation. This research employed a quantitative descriptive method with fourth-grade students of SDN Banyu Urip IX Surabaya as the research subjects. Data were collected through observation, documentation, tests, and questionnaires. The Adobe Flash-based learning media were developed to present the material interactively using engaging animations and visuals designed to enhance students' conceptual understanding. Data analysis was carried out by calculating the percentage of learning outcomes and students' responses toward the use of the media. The findings indicate that the implementation of Adobe Flash-based learning media improved students' learning outcomes above the minimum standard and received positive responses from the students. The media were considered attractive, easy to use, and effective in helping students better understand the concept of energy transformation. In conclusion, the use of Adobe Flash based electronic learning media is effective in improving learning outcomes and student motivation in elementary science learning.

1. Introduction

The rapid advancement of digital technology has brought fundamental changes to various aspects of human life, ranging from how people work and communicate to how they learn. In the field of education, this transformation is no longer a matter of choice but an unavoidable necessity. Twenty-first century education demands approaches that are creative, effective, and responsive to the characteristics of digital-native learners. As emphasized in the basic principles of educational management, every learning process must be systematically planned and managed

to achieve the intended goals (Arikunto, 2015). This underscores that innovation in teaching is an essential effort to enhance the quality of human resources.

At the elementary school level, Natural Science (IPA) is one of the subjects that presents unique challenges. Many concepts in science are abstract, such as energy, energy transformation, and other scientific phenomena. When such material is presented without strong visual support, students often struggle to understand and quickly lose interest. In fact, science learning should cultivate curiosity, creativity, and critical thinking skills from an early age. Inappropriate teaching methods may lead students to memorize information without understanding its meaning, resulting in learning objectives that are not optimally achieved (Sudjana, 2022). Various previous studies also indicate that interactive media significantly improve conceptual understanding and engagement in elementary science learning (Harsiwi & Arini, 2020).

These conditions highlight the strategic role of instructional media. Media are not merely teaching aids but tools that reinforce the connection between teachers and students and create richer learning experiences. Arsyad (2022) states that instructional media play a crucial role in building engaging and effective learning environments. In his earlier works, Arsyad (2019, 2021) also affirms that media help clarify messages, increase student attention, and simplify the understanding of abstract concepts. Moreover, good instructional media must meet three essential characteristics: they must effectively transmit messages, stimulate mental activity, and provide meaningful learning experiences (Arsyad, 2020; Sari et al., 2025; Hasniar et al., 2025). Findings from Sukmaningrum et al. (2023) further strengthen this view by showing that interactive Flash-based media improve elementary students' conceptual mastery in science.

In today's digital era, ICT-based media serve as a highly relevant option for supporting various subjects, including science. The use of animation is an innovative step in transforming abstract concepts into more concrete and engaging forms. One software commonly used for creating animations is Adobe Flash. Chandra (2020) states that Flash has strong capabilities for generating interactive content through its flexible and easily developed Action Script. Furthermore, Madcoms (2022) explains that Flash-based animation uses vector graphics that maintain smooth visuals even when enlarged, making it ideal for illustrating scientific concepts that require dynamic visualization. Studies by Budi and Miaz (2023) also confirm that Adobe Flash CS6 based multimedia enhances student engagement and learning depth in thematic lessons, demonstrating its versatility across subjects.

Adobe Flash also enables teachers to build simulations of energy transformations, such as heat turning into motion or electricity becoming light. Such visualizations help students understand scientific processes gradually and more realistically. Additionally, the interactivity offered by Flash allows students to explore learning materials independently, making the learning process more meaningful rather than one-directional. The use of such technology aligns with the principle that

educational technology must facilitate effective instructional communication (Uno et al., 2021; Khayyirah et al., 2024; Hartati et al., 2025; Rosyida et al., 2025). Research on Flash-based science learning shows similar results; Nandari et al. (2023) found that Adobe Flash-based interactive media significantly improved the mastery of fifth-grade students in IPA, particularly in materials requiring strong visual representation. This effectiveness also appears in studies by Hasnanto and Kholifah (2022), who noted that Flash-based media enhanced student comprehension of human movement organs through interactive elements.

However, although animation technology has been widely applied across various educational levels, research on the use of Adobe Flash as a learning medium specifically for the topic of energy transformation in elementary schools remains limited. Many studies focus on other types of media or different animation platforms, but few have examined how the direct integration of Adobe Flash influences elementary students' understanding and learning motivation. In fact, the ability of Flash to deliver interactive and engaging animations makes it a potentially powerful tool for bridging students' comprehension gaps in science. Similar concerns were highlighted by Ridwan et al. (2022), who emphasized that Flash media with integrated ice-breaking techniques can significantly refresh students' focus and improve learning absorption.

Moreover, most previous studies have concentrated on improving learning outcomes, while student responses have not been explored in depth. Yet, student responses are an important indicator of learning effectiveness. Without understanding how students perceive and interpret their learning experiences, teachers and researchers cannot determine whether the media are truly relevant and engaging. Sadiman et al. (2020) emphasize that the success of educational media depends not only on its content but also on how learners respond to and process the information presented. This is supported by Sadira et al. (2023), who found that student responses strongly influence how effectively Flash-based digital card media facilitate understanding in language learning, proving that affective engagement plays a major role across learning contexts (Mastura et al., 2025; Ratnasari et al., 2022; Istiqomah et al., 2025).

Furthermore, the use of Adobe Flash in science learning aligns with the research and development (R&D) approach, a method commonly employed to produce technology-based instructional products (Sugiyono, 2021). Thus, this study not only provides insight into media effectiveness but also serves as a foundation for developing more innovative learning media in the future. Even more, the integration of Flash with other applications such as Dreamweaver or PHP has been explored in educational multimedia to produce more dynamic learning systems (Syafi'i & Pramono, 2025). Meanwhile, Azizah and Atmojo (2024) demonstrated that Flash-based media development significantly improved science achievement in sixth grade students, further supporting the feasibility of Adobe Flash in modern classroom environments.

Based on these considerations, this study aims to analyze the learning outcomes and responses of fourth grade students at SDN Banyu Urip IX Surabaya toward the implementation of Adobe Flash-based electronic instructional media on the topic of energy transformation. This objective is expected to make a meaningful contribution to the development of science learning that is more creative, interactive, and aligned with the needs of students in the digital era.

2. Methodology

This study is designed as a scientific journey aimed at exploring, understanding, and describing how electronic learning media can create a more engaging and effective learning experience for students. As emphasized by Sugiyono (2021), research is not simply the act of gathering information that happens to be available, but a deliberate effort to uncover unanswered questions and bring new knowledge into existence. Guided by this idea, the present study adopts a descriptive research design which focuses on presenting factual conditions as they naturally occur without controlling or administering specific treatments as explained by Arikunto in 2015. With this approach, the study seeks to gain a deep understanding of how multimedia based learning using Adobe Flash functions in the classroom while observing its benefits and effectiveness through quantitative descriptive analysis.

The research was conducted during the even semester of the academic year two thousand twenty five. The preparation of the proposal began in February two thousand twenty five followed by the development of instruments. The main stages of data collection, analysis, discussion, and report writing were carried out from August to November two thousand twenty five. Every step in this process was carefully arranged to build a complete picture of how electronic learning media is applied in the classroom and how students respond to its use.

Data collection was carried out through observation and documentation. Observations were conducted both directly and indirectly. Direct observation involved the researcher observing classroom activities as they took place without using any tool, while indirect observation relied on documentation such as photographs or recordings which served as additional support for the observation process as stated by Riyanto in two thousand twenty one. These observations were intended to identify the learning needs of students and evaluate the suitability of Adobe Flash based learning media in teaching the topic of energy transformation. Documentation was also used to collect information related to the curriculum, learning materials, and images capturing the learning activities, all of which supported the analysis with concrete evidence.

The research instruments consisted of a written test and a questionnaire. The written test in the form of multiple choice questions was created to measure students understanding of energy transformation after learning with Adobe Flash. The questionnaire was used to assess the feasibility of the learning media and to gather responses from media experts, material experts, and students. It applied a four point

rating scale ranging from very good, good, fair, to poor so that the quality of the media could be assessed in a systematic and quantitative manner.

The procedure of data collection began with preliminary observation of the school environment and the classroom atmosphere to understand the initial condition of the learning setting. During the learning process, documentation was conducted to record student activities and the actual use of multimedia learning tools. After the learning session, students were given the written test to measure their learning outcomes on the topic of energy transformation. The questionnaire was then distributed to students and experts to assess both the feasibility of the media and the clarity of the learning material. These steps were arranged to ensure that the data collected would be complete, objective, and representative.

Data analysis used quantitative descriptive techniques. The questionnaire results were analyzed using a percentage formula to determine the feasibility of the media and the responses of participants. The calculation followed the formula P(s) equals F divided by N multiplied by one hundred percent where F represents the total score obtained and N represents the maximum possible score. The percentages were then categorized into interpretation ranges such as poor, less good, fairly good, good, and very good. Meanwhile, the learning outcomes of students were analyzed by calculating the mean score using the formula M equals the sum of FX divided by N so that the level of student understanding after the learning process could be evaluated accurately. Together, these analyses provide a complete and meaningful description of the effectiveness of Adobe Flash based learning media in the classroom.

3. Results and Discussion

Well-prepared tables and figures must be a significant feature of this section because they convey the major observations to readers. Any information presented in tables or figures should not be repeated in the text; instead, the text should emphasize the importance and meaning of the principal findings. In general, journal papers contain three to seven figures and tables, and the same data should not be displayed in both forms. The results of the study are discussed to address the research problems, objectives, and hypotheses. It is strongly suggested that the discussion focuses on the *why* and *how* of the research findings and the extent to which the results can be applied to other relevant contexts.

Before presenting the findings, it is essential to describe the classroom conditions where the study was conducted. The research involved 25 fourth grade students, consisting of 13 male students and 12 female students, who were enrolled at SDN Banyu Urip IX Surabaya in the 2025 academic year. Prior to the implementation of Adobe Flash-based media, learning activities primarily relied on conventional teacher-centered methods, such as lectures, textbook explanations, and question-and-answer sessions without the use of interactive digital tools. This traditional approach often made abstract science concepts especially energy transformation

difficult for students to understand. The limited use of visual media in previous instruction also resulted in low learning motivation and uneven mastery among students. Therefore, the use of interactive multimedia was expected to help create a more engaging, visual, and student-centered learning environment to improve learning outcomes.

During the implementation phase, the learning process was carried out in two main sessions: the pre-media session and the multimedia-based learning session. In the first session, students were taught using conventional teacher explanations to obtain pre-test data as a baseline measurement. In the second session, the Adobe Flash-based learning media were integrated into classroom instruction. The teacher began by introducing the learning objectives, followed by presenting animated visualizations of energy transformation using the Flash media. Students observed the simulations, engaged in guided discussions, and interacted with the media through questions and exploration of the displayed animations. Throughout this session, the researcher conducted observations to record student engagement, participation, and difficulties encountered during learning. At the end of the lesson, students completed a post-test to measure learning outcomes and filled out a response questionnaire to evaluate the effectiveness, clarity, and attractiveness of the Adobe Flash media. This structured learning and data-collection process ensured that the results reflected authentic classroom conditions and valid student responses.

Students' Learning Outcomes

The study was conducted on 25 fourth grade students using a learning outcomes test consisting of a pre-test and post-test. The pre-test was administered before the implementation of the Adobe Flash-based learning media, while the post-test was given after students received instruction using the interactive multimedia. To illustrate the improvement in students' learning achievement, Table 1 presents the comparison of the average pre-test and post-test scores.

Table 1. Average Pre-Test and Post-Test Scores of Students

No.	Number of Students	Pre-Test Average	Post-Test Average	Percentage Increase	Description
1	25 students	57.6	83.2	25.6%	Increased

Source: Research Data (2025)

Based on Table 1, there is a significant improvement in students' average learning outcomes. The average score increased from 57.6 on the pre-test to 83.2 on the post-test after the use of Adobe Flash–based learning media. This 25.6% increase indicates that the media played an important role in helping students better understand the concept of energy transformation. In addition to the improvement in average scores, the students' mastery level also showed substantial progress. A total of 22 students (88%) achieved mastery because their scores met or exceeded the minimum mastery criterion (75). Meanwhile, the remaining 3 students (12%) who did not meet the mastery threshold still demonstrated an increase in their scores,

even though they did not reach the required level. This shows that the use of Adobe Flash had a positive effect on all student categories high, medium, and low achievers.

This improvement aligns with Arsyad's (2021) theory, which states that interactive learning media can clarify message delivery and enhance students' attention and interest. Adobe Flash offers a combination of animation, color, sound, and images that makes learning materials easier to understand, especially abstract concepts such as energy transformation. The animated visualizations make the learning process more concrete, enabling students not only to listen to the teacher's explanation but also to observe dynamic representations of the content being taught. These findings are also consistent with Sudjana's (2022) research, which found that interactive multimedia can enhance the effectiveness of learning through the integration of visual and audio elements. In this context, Adobe Flash functions as a bridge between theory and practice, allowing students to understand science concepts more deeply. Therefore, it can be concluded that the use of Adobe Flash provides a significant contribution to improving students' learning outcomes on the topic of energy transformation.

Students' Responses to the Learning Media

In addition to measuring learning outcomes, this study also examined students' responses toward the Adobe Flash–based learning media. Data were collected using a closed-ended questionnaire covering several assessment aspects, including students' interest, ease of use, clarity of material presentation, visual display, and the media's benefits for conceptual understanding. To provide an overview of students' perceptions, Table 2 presents the results of the questionnaire regarding students' responses to the Adobe Flash media.

Table 2. Students' Questionnaire Results on Adobe Flash Learning Media

No.	Assessment Aspect	Percentage (%)	Category
1	Interest in the media	92%	Very Good
2	Ease of use	88%	Good
3	Clarity of material presentation	90%	Very Good
4	Visual display and animations	94%	Very Good
5	Benefits for conceptual understanding	89%	Good
	Average	**90,6%**	**Very Good**

Source: Research Questionnaire Data (2025)

Based on Table 2, it can be seen that the average student response reached 90.6%, which falls into the "very good" category. This result indicates that the use of Adobe Flash media not only enhances students' understanding but also creates a more enjoyable learning experience. Most students stated that Adobe Flash was far more engaging compared with conventional learning methods because it features moving animations, bright colors, and interactive visuals that make the learning process more dynamic. Students also reported that the animated visuals in Adobe Flash greatly helped them understand the topic of energy transformation. Abstract concepts that are typically difficult to grasp became clearer because students could

observe simulations of energy-related phenomena, such as heat transfer, changes in energy forms, or object movement resulting from energy. This finding aligns with Madcoms (2022), who noted that Adobe Flash is a highly effective multimedia tool for delivering interactive learning through a combination of text, images, and animations. Furthermore, this result is consistent with the study by Uno et al. (2021), which stated that interactive media can enhance students' learning motivation and engagement. Therefore, the strong positive responses from students in this study indicate that Adobe Flash functions not only as a visual aid but also as a motivational tool that helps students stay focused and enthusiastic throughout the learning process.

Discussion

The improvement in students' learning outcomes, reflected by the increase in the average score from 57.6 on the pre-test to 83.2 on the post-test, provides strong evidence that Adobe Flash-based instructional media plays a significant role in enhancing students' understanding of energy transformation concepts. This condition aligns with the views of Arsyad (2021, 2022), who emphasizes that interactive learning media can clarify messages, capture students' attention, and help them grasp abstract concepts through visual representation. Adobe Flash integrates animation, images, text, and audio, allowing students to experience learning in a more concrete and meaningful way. The 25.6-point increase demonstrates that the integration of interactive multimedia has a tangible effect on facilitating the comprehension of science concepts that are visual and dynamic in nature.

These findings are reinforced by the assessment theory presented by Sudjana (2022), who states that improvements in student learning outcomes serve as indicators of an effective learning process, particularly when the assessment instruments can objectively capture students' cognitive development. In this study, the use of pre-tests and post-tests strengthened measurement validity because they clearly showed changes in students' abilities, consistent with the principles of research management described by Arikunto (2015). Thus, the score improvements did not occur by chance, but rather as a result of structured instructional treatment.

The mastery learning level, which reached 88 percent, also indicates that Adobe Flash is effective for students across different ability levels. This finding corresponds with the explanation from Sadiman et al. (2020), who note that learning media serves as a tool to clarify messages so they can be understood by students with diverse capabilities. The visualization of energy transformation through simulations allowed students who typically struggle with abstract concepts to observe concrete examples through animation. This provided a foundation for more evenly distributed competency achievement across learning groups.

When compared with previous studies, these findings also show strong consistency. Budi and Miaz (2023) found that Adobe Flash-based interactive media increased student engagement in thematic learning, positively contributing to higher

achievement scores. Similar results were reported by Nandari, Akhbar, and Tanzimah (2023), who developed Adobe Flash media for fifth grade science and concluded that students demonstrated better comprehension after using multimedia. These consistent findings reinforce the idea that Adobe Flash is not only effective for specific content but also relevant across various science topics at the elementary level.

In addition, research by Azizah and Atmojo (2024) provides similar evidence that Adobe Flash enhances students' academic achievement because it helps them understand concepts through interactive animation. Ridwan, Lokaria, and Kusnanto (2022) even found that combining Adobe Flash with ice-breaking techniques made learning more enjoyable, which increased students' concentration and participation. These similar patterns of results affirm that interactive media contributes significantly to creating a more effective and student-centered learning environment.

From another perspective, research by Hasnanto and Kholifah (2022) also shows that Adobe Flash helps students understand the human locomotor system through animated movement visualizations. This aligns with Uno et al. (2021), who explain that educational technology should enhance students' motivation and engagement two aspects that improved in this study, as evidenced by students' positive responses. The questionnaire results showed that 90.6 percent of students rated the media in the "very good" category, indicating that the animations and visual elements effectively increased learners' intrinsic motivation.

Sukmaningrum, Juniarso, and Wardani (2023) similarly support this conclusion, finding that Macromedia Flash–based interactive media significantly improved students' understanding of science concepts. The dynamic animations allowed students to clearly see cause-and-effect relationships in scientific events, making it easier for them to build conceptual understanding. Harsiwi and Arini (2020) also argue that interactive media greatly contributes to improved learning outcomes because it creates a more engaging atmosphere that encourages active student participation.

From a technical standpoint, theories regarding media characteristics proposed by Arsyad (2020) and Chandra (2020) assert that Adobe Flash has strengths in scripting and animation, making it highly suitable for learning materials that require detailed visual explanations. The Research and Development Department of Madcoms (2020) and Madcoms (2022) also emphasize Adobe Flash's flexibility in designing educational interactive media, enabling teachers to tailor materials to instructional needs. In this study, that flexibility supported the creation of accurate and easy-to-understand simulations of energy transformations. Overall, previous research findings, expert theories, and the results of the current study consistently indicate that Adobe Flash-based media is a highly effective instructional tool for improving conceptual understanding, motivating students, enriching the learning experience, and ensuring optimal mastery learning. Thus, the use of Adobe Flash

in science instruction is not only theoretically relevant but also strongly supported by empirical evidence.

4. Conclusion

Based on the results of the study on the implementation of Adobe Flash–based electronic learning media for fourth-grade students at SDN Banyu Urip IX Surabaya, it can be concluded that the use of this interactive media has a positive and significant impact on improving learning outcomes and student responses. The integration of Adobe Flash makes the learning process more engaging, communicative, and enjoyable, enabling students to better understand abstract concepts particularly the topic of energy transformation through clear animations and interactive visualizations. The test results from 25 students show that the students achieving scores above the minimum mastery criterion. In addition, student responses toward the media fall into the "very good" category, with an average score of almost perfect score, indicating that learners feel more motivated, interested, and actively involved in technology-based learning. These findings confirm that Adobe Flash–based learning media are effective in enhancing conceptual understanding and science learning outcomes at the elementary school level.

Based on these results, several recommendations can be offered. Teachers are encouraged to utilize technology-based learning media as an innovative alternative to increase students' interest and academic achievement. Schools should provide training and adequate facilities to support teachers in developing and implementing interactive media effectively. Future researchers may explore other technology-based platforms such as HTML5, Articulate Storyline, or Canva Education to compare effectiveness across digital media. Moreover, further studies may examine the influence of interactive media on affective and psychomotor domains to produce more comprehensive findings across all learning aspects. In conclusion, the use of Adobe Flash can serve as an important step toward fostering creative, interactive, and future-oriented digital learning practices in elementary education.

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