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DEVELOPMENT OF INTERACTIVE MULTIMEDIA ASSISTED BY WEBSITE AT STATE ELEMENTARY SCHOOL 02 MULYOAGUNG

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Abstract

This study aims to develop a website-based interactive multimedia tool using the Genially platform and to test its feasibility and effectiveness in improving the analytical skills (C4) of fourth-grade students in the Natural Sciences (IPA) subject. The focus of this study stems from the low level of analytical skills among students at SDN 02 Mulyoagung, who have not yet met the Minimum Proficiency Criteria (KKM). The research method used was Research and Development (R&D), employing the Lee & Owens development model, which includes the stages of analysis, design, development, implementation, and evaluation. The data collection instruments consisted of an expert validation sheet, a student response questionnaire, and an analytical skills test. The results of the study indicate that this interactive multimedia is highly suitable for use, as evidenced by the expert validation results for both the content and the media. In addition, the N-Gain analysis demonstrated a significant improvement in students' analytical skills following the use of this medium. The conclusion of this study states that Genially-assisted interactive multimedia is effective as a science learning medium. The implications of this research contribute to the advancement of knowledge regarding the integration of technology in elementary education to stimulate students' higher-order thinking skills through innovative and accessible learning media.

Keywords: Interactive Multimedia; Genially; Analytical Ability (C4); Elementary School Science

1. Introduction

The transformation of education in the 21st century demands a paradigm shift in learning from merely mastering content to strengthening higher-order thinking skills. In the context of the Merdeka Curriculum, students are no longer viewed as passive recipients of information, but rather as active participants who are expected to analyze, reason, and solve problems independently. Isabirye et al. (2025) add that to foster creativity and innovation in the curriculum, students must be given the space to explore ideas, experiment, and take risks in their learning process. One of the cognitive skills that is a primary focus is the ability to analyze (C4) in the revised Bloom's Taxonomy, which emphasizes students' ability to distinguish, organize, and relate various components of knowledge into a meaningful structure (Anderson & Krathwohl, 2001). In science classes, analytical skills play a crucial role because science learning is not only oriented toward mastering facts but also toward understanding cause and effect relationships and the systems that occur in nature.

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However, these ideal conditions have not yet been fully achieved in elementary schools. Empirical findings at SDN 02 Mulyoagung indicate a gap between curriculum requirements and classroom teaching practices. Science instruction is still dominated by conventional, teacher-centered methods, such as lectures and written assignments, so that learning activities primarily stimulate lower-level cognitive skills (C1 and C2). The impact of this situation is evident in students' low analytical skills. The results of a preliminary study show that the average student score on analysis questions was only 45, far below the Minimum Passing Score (KKM) of 75, and the average pre-test score for analytical skills was only 6.43 out of a maximum score of 40. These data indicate that students have difficulty breaking down concepts, connecting the functions of different parts, and understanding science material in a systematic way.

A number of previous studies have confirmed that students' low analytical skills are closely related to the limitations of the instructional media used. Conventional methods are considered inadequate for facilitating higher-order thinking processes because they present material in a linear and abstract manner. Praja and Andriani (2025) emphasize that to overcome this barrier of abstraction, an interactive multimedia approach is needed that can visualize the relationships between variables that are not immediately apparent. A study by Avdiu et al. (2025) emphasizes that the integration of technology into learning is essential for building 21st-century skills. In line with this, Taufiqurrahman et al. (2025) show that learning not supported by visual and interactive media tends to fail to trigger analytical processes because it does not provide adequate cognitive scaffolding. Other research also reveals that interactive multimedia can enhance cognitive engagement and help students understand complex concepts through concrete visualizations and simulations.

In recent years, web-based platforms such as Genially have begun to be used as interactive learning tools. Genially allows for the integration of text, images, animations, videos, and interactive features such as hotspots, drag-and-drop, and gamification within a single digital learning environment. Research by Yuniarsih and Setiawan (2025) reported that the use of Genially has a positive effect on students' cognitive learning outcomes, while Sormin et al. (2025) found that Genially's visual and interactive features can improve concentration and motivation to learn. However, most of these studies still focus on improving general learning outcomes or learning motivation and have not specifically targeted the development of analytical skills (C4) in elementary school students, particularly in science education.

Based on this literature review, a research gap has been identified that forms the basis for the novelty of this study. To date, there have been only a limited number of studies that have developed and tested website-based interactive multimedia using Genially that are explicitly designed to develop elementary school students' analytical skills (C4) in science. Furthermore, there has not been much research linking the use of Genially to the implementation of the Merdeka Curriculum and the real-world conditions of elementary schools that face limitations in conventional learning but are supported by adequate digital infrastructure.

The scientific novelty of this study lies in the development of a website-based interactive multimedia tool using Genially, which is conceptually and operationally designed to stimulate students' analytical processes through interactive activities, systemic visualizations, and problem-solving-based quizzes. This medium serves not only as a tool for delivering content

but also as a digital scaffold that helps students gradually construct conceptual knowledge in science. This was corroborated by Pratiwi et al. (2025), who found that logic-based multimedia (such as that developed using Scratch or Genially) is more effective at fostering structural understanding than linear presentation media. In addition, this study presents empirical evidence regarding the feasibility and effectiveness of this interactive multimedia tool in improving the analytical skills (C4) of fourth-grade elementary school students, thereby making a tangible contribution to the development of technology-based instructional media.

Specifically, this study examines how the development of website-based interactive multimedia using Genially can produce appropriate and effective media for improving students' analytical skills. Based on this research question, the study indicates that the use of Genially-based interactive multimedia can significantly improve the analytical skills (C4) of fourth-grade students in science compared to conventional instruction. This is supported by Sitinjak et al. (2025), who expand on this definition by highlighting its psychological aspects. Genially is an interactive quiz platform that has been shown to significantly increase students' motivation to learn due to its engaging and responsive interface design.

Thus, the purpose of this study is to describe the development of website-based interactive multimedia using the Genially platform and to analyze its feasibility and effectiveness in improving the analytical skills (C4) of fourth-grade students in science classes at the elementary school level. This study is expected to make theoretical and practical contributions to the development of innovative learning media and to serve as a reference for educators in integrating technology to support learning based on higher-order thinking skills.

2. Method

This study employs a research and development (R&D) approach aimed at producing a website-based interactive multimedia product and testing its feasibility and effectiveness in improving students' analytical skills (C4). The development model used is the Lee & Owens (2004) model, which was selected because it is specifically designed for the development of technology- and web-based multimedia. Ranni and Romundza (2025) add that without standardized procedures, the risk of media failing to facilitate complex cognitive processes becomes very high.

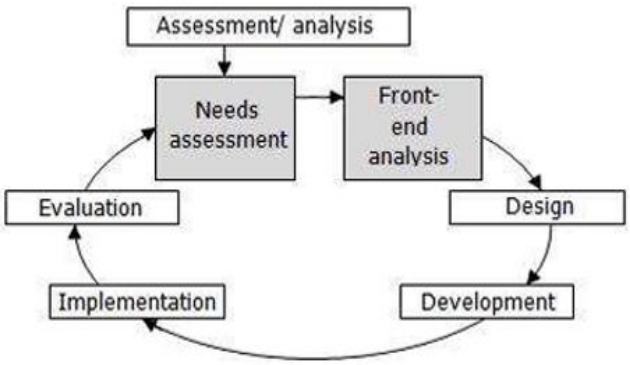


Figure 1. Diagram of the Lee & Owens Development Model

In the context of this study, Ayni (2025) reinforces this definition by stating that, in the context of developing STEM-based (Science, Technology, Engineering, and Mathematics) media, the Lee & Owens model provides a solid foundation for ensuring that every multimedia element is not only visually appealing but also educationally functional.

2.1. Subject of Research

The research subjects consisted of 21 fourth-grade students from SDN 02 Mulyoagung and a team of expert validators (for content and media). The selection of subjects was based on the results of a preliminary study that indicated low analytical skills among students in science, particularly regarding the topic of plant parts. The characteristics of students at the concrete operational stage of cognitive development are an important consideration in the design of interactive multimedia, so that the media developed is tailored to the visual and interactive needs and cognitive levels of elementary school students.

2.2. Instrument

The research instruments used in this study included validation instruments, user response instruments, and analytical skills test instruments. The validation instruments consisted of assessment sheets completed by media experts and subject matter experts, which were used to evaluate the product's suitability in terms of content, design, appearance, interactivity, and alignment with learning objectives. The user response instrument consists of a student response questionnaire designed to determine the level of practicality and acceptability of interactive multimedia in learning. Meanwhile, the analytical skills test instrument consists of pre-test and post-test questions developed based on analytical skills indicators (C4), including the ability to distinguish, organize, and connect concepts in science material.

2.3. Data Collection

The data collection procedure was carried out in stages in accordance with the development phases. During the analysis phase, data were collected through classroom observations and diagnostic tests to identify students' needs and gaps in their analytical skills. The design and development phases resulted in a web-based interactive multimedia product using the Genially platform, which was then validated by subject matter experts and media experts. After undergoing revisions based on expert input, the product was implemented in fourth-grade science classes. During the implementation phase, students used interactive multimedia in the learning process, they were then given a pre-test before using the media and a post-test after using it. In addition, student response questionnaires were administered to gather data on the practicality of the media and students' perceptions of it.

2.4. Data Analysis

Data analysis was conducted using quantitative descriptive methods. The data from the expert validation were analyzed by calculating the percentage of feasibility scores to determine the product's feasibility category. Student response data were analyzed using percentages to determine the level of practicality of the interactive multimedia. Meanwhile, data on students' analytical skills were analyzed by comparing pre-test and post-test scores

and calculated using the N-Gain formula to determine the extent of improvement in analytical skills following the use of interactive multimedia. The results of the N-Gain analysis were then classified into low, moderate, or high categories to assess the effectiveness of the instructional media developed. Through these stages of analysis, a comprehensive picture was obtained regarding the suitability, practicality, and effectiveness of website-based interactive multimedia in improving the analytical skills (C4) of elementary school students. Table 1 shows the criteria for interpreting scores based on the validity test, which allows for an assessment of the learning medium's suitability. The scoring criteria can be found in Table 1.

Table 1. Criteria for interpreting scores based on intervals (Riduan 2015)

No.	Achievement Level	Description
1	01,00% - 50,00%	Not Practical
2	50,01% - 70,00%	Not Very Practical
3	70,01% - 85,00%	Fairly Practical
4	85,01% - 100,00%	Practical

3. Results and Discussion

3.1 Result

The results of this study reflect the empirical findings obtained from the validation, practicality testing, and effectiveness testing phases of an interactive, website-based multimedia tool using the Genially platform in fourth-grade science instruction. The findings are presented to address the research questions regarding the feasibility, practicality, and effectiveness of the medium in improving students' analytical skills (C4). The results of the expert validation indicate that the interactive multimedia developed meets very high feasibility criteria. Validation by media experts yielded a feasibility score of 96.25%, which falls into the "highly feasible" category. This assessment covered aspects such as visual presentation, navigation, design consistency, text readability, and the level of media interactivity. Experts note that interactive features such as hotspots, drag-and-drop, and interactive quizzes have been systematically designed and are capable of supporting students' active engagement in learning. Cherif (2025) emphasizes that interactivity in the form of drag-and-drop or hotspots (as found in Genially) requires physical engagement that maintains students' attention, unlike passive videos that lead to boredom. Meanwhile, validation by subject matter experts also yielded excellent results, with the suitability score falling into the "highly suitable" category. The "Parts of Plants" material was assessed as aligned with the core competencies for fourth grade, conceptually accurate, and presented in a coherent and contextual manner. These validation results indicate that Genially-based interactive multimedia is suitable for use as a science learning medium in elementary schools. Table 2 shows the results of the validity test or the assessment results from media experts.

Table 2. Results of the Media Experts' Evaluation

No.	Aspect	Score	Maximum Score	Percentage of Score
	GENERAL STATEMENT			
1	Visual Design Aspects	20	20	100%
2	Accessibility	22	24	95%
3	Content Delivery	3	4	95%
4	Student Motivation	8	8	100%
	SPECIAL STATEMENT			
1	Teacher	12	12	100%
2	Stundets	12	12	100%
	Average Percentage			96,25%

3.1.1. The Practicality of Media

The practicality of the media was assessed based on the results of student response questionnaires administered during individual, small-group, and large-group pilot tests. In the individual pilot test, students gave very positive feedback regarding the media's ease of use, the clarity of the instructions, and the appeal of the visual presentation. The results of the small-group pilot test showed an increase in positive feedback, particularly regarding interactivity and student engagement during learning. In a large-scale pilot study, the majority of students reported that the interactive multimedia was easy to use, enjoyable, and helped them better understand science concepts. The overall percentage of student responses fell into the "very practical" category. These findings indicate that the developed media is not only theoretically sound but also practical and can be used effectively in real-world learning situations.

3.1.2. The Effectiveness of Media

The effectiveness of interactive multimedia in improving students' analytical skills was assessed based on pre-test and post-test results. The pre-test results showed that students' analytical skills prior to the use of the media were in the low category, with an average score of 6.43 out of a maximum score of 40. These findings reinforce the results of a preliminary study indicating that students still have difficulty distinguishing plant parts, relating the functions of different parts, and understanding cause-and-effect relationships within plant systems. After using Genially-based interactive multimedia, the post-test results showed a significant improvement. Students' average scores improved significantly compared to their initial performance, indicating that they were better able to organize information, identify relationships between concepts, and analytically explain the functions of plant parts.

3.1.3. Analysis of Improvements in Analytical Skills

An analysis of the improvement in analytical skills was conducted using the N-Gain calculation. The results of the calculation showed that the N-Gain values fell into the moderate-to-high range, indicating an improvement in students' analytical skills after participating in lessons using interactive multimedia. An analysis of effectiveness using the N-gain test yielded highly convincing results: a score of 0.98, which falls into the "High" category ($g > 0.7$). The dramatic increase from a pre-test average of 52.1 to a post-test average of 99.2 is not merely a statistical figure but concrete evidence of the instructional impact of the media on students' cognition. An N-gain score approaching the maximum value of 1.00 indicates that nearly all of the material taught was successfully absorbed and understood by the students. These results reinforce the findings of the study by Lathifah et al. (2025), which concluded that the use of problem-based interactive multimedia is highly effective in improving students' analytical skills. Thus, the finding that website-supported interactive multimedia can improve the analytical skills of fourth-grade science students is valid. This is supported by Volvacea et al. (2025), who note that this feature is highly effective in IPAS materials for information grouping or mapping tasks, in which students must drag function labels to the correct organs a process that requires analysis of cause-and-effect relationships.

Overall, the results of the study indicate that Genially-based interactive multimedia not only meets the criteria for feasibility and practicality but is also effective in improving students' analytical skills. This is consistent with Cherif's (2025) research, which found that in a student-centered learning environment, interactive multimedia is defined as a "catalyst for academic behavior" that significantly improves learning outcomes by giving students the autonomy to explore the material at their own pace. Rahmawati et al. (2025) also note that gamification in Genially can be designed as problem-solving missions, in which students must complete case analysis challenges to unlock the next level. These findings confirm that the development of website-based interactive multimedia is a relevant and effective solution to address the issue of elementary school students' low analytical skills in science learning.

3.2 Discussion

This discussion provides an in-depth analysis of research findings regarding the feasibility, practicality, and effectiveness of website-based interactive multimedia using the Genially platform in enhancing the analytical skills (C4) of fourth-grade students in science. The research results indicate that the interactive multimedia developed is not only feasible and practical to use but also effective in enhancing students' higher-order thinking skills, particularly in the domain of analysis. These findings support the research hypothesis that the integration of interactive multimedia into science education can be a solution to the problem of low analytical skills among elementary school students.

From the perspective of suitability, the validation results from media experts and subject matter experts which fell into the "highly suitable" category indicate that the interactive multimedia product meets pedagogical, technical, and substantive standards. The suitability of this media can be explained through Mayer's theory of multimedia learning, which states that learning is more effective when information is presented through a coherent combination of text, images, and animations. In his book *Principles of Multimedia*, Parekh (2025) emphasizes that the essence of multimedia is not merely the accumulation of media elements,

but rather an integration that adheres to the principles of cognitive psychology to facilitate deep understanding. Interactive multimedia based on Genially enables the presentation of science material through various visual and interactive representations, thereby helping students build a deeper conceptual understanding. This is consistent with the findings of studies by Arum et al. (2025) and Putri et al. (2023), who also reported in their research that Genially-based learning materials consistently received a "Very Good" rating from media experts.

In addition, the high quality of the material indicates that the learning content has been developed in accordance with the science competencies and learning indicators for fourth grade. The presentation of the material on "Parts of Plants," accompanied by illustrations, animations, and interactive simulations, helps students systematically understand the relationship between structure and function. These findings support the view of Volvacea et al. (2025) regarding the development of IPAS media, which asserts that Genially is not merely a linear presentation tool, but rather an interactive learning media ecosystem capable of combining text, images, and animations into a single cohesive interface. Genially's strength lies in its "all-in-one tool" concept, which transforms static content into an immersive digital experience. The interactive multimedia developed in this study facilitates these three stages, thereby making learning more meaningful.

From a practical standpoint, the students' very positive response indicates that Genially-based interactive multimedia is easy to use and engaging for students. This practicality is important because learning materials that are complex and difficult to operate can actually increase students' extraneal cognitive load. According to Cognitive Load theory, instructional media should be designed to minimize irrelevant cognitive load so that students can focus their cognitive resources on processing core information. The simple navigation features, clear instructions, and consistent visual design of this interactive multimedia resource support Silmi et al. (2025), who provide a theoretical foundation stating that differentiated instruction requires media capable of simultaneously accommodating various learning styles (visual, auditory, kinesthetic) to prevent gaps in understanding.

The findings regarding the practicality of the medium are also consistent with previous research indicating that website-based media with visually appealing designs can enhance students' motivation and engagement in learning. Yuniarsih and Setiawan (2025) found that the use of Genially in instruction provides an interactive and enjoyable learning experience, resulting in students being more active participants in the learning process. The study by Sormin et al. (2025) also shows that technology-based interactive media can increase student participation and promote student-centered learning. Thus, the findings of this study reinforce the empirical evidence that Genially is a promising platform for use in science education in elementary schools.

The effectiveness of interactive multimedia in improving students' analytical skills was the most significant key finding of this study. The increase in post-test scores compared to pre-test scores, as well as N-Gain values in the moderate-to-high range, indicate that the use of Genially-based interactive multimedia has a positive impact on students' analytical skills. This indicates that students not only demonstrated improved mastery of the material but also enhanced higher-order thinking skills. These findings can be explained by constructivism, which posits that knowledge is actively constructed by students through interaction with their

learning environment. Interactive multimedia provides a learning environment rich in visual and interactive stimuli, encouraging students to explore, analyze, and connect science concepts on their own.

Improvements in students' analytical skills are also linked to the design of learning activities integrated into interactive multimedia. Interactive quizzes and problem-solving exercises are designed to help students identify plant parts, organize information, and understand the functions of different plant parts. Gufran et al. (2025) state that C4 serves as the gateway to critical thinking, without the ability to construct information, students will not be able to evaluate or generate valid new ideas. These activities align with the indicators of analytical skills (C4) in the revised Bloom's Taxonomy. Anderson and Krathwohl (2001) assert that analytical skills require students to break down information into parts and understand the relationships among those parts. The interactive multimedia developed in this study explicitly trains these cognitive processes, thereby improving students' analytical skills.

The results of this study are also consistent with the findings of Taufiqurrahman et al. (2025), who stated that the use of technology-based interactive media can enhance students' higher-order thinking skills. However, this study has an advantage over previous research because it specifically targets analytical skills (C4) in elementary school students and integrates instructional media with the context of the Merdeka Curriculum. Thus, this study not only confirms previous findings but also expands the body of research on the use of interactive multimedia in science education at the elementary school level.

From a pedagogical perspective, the effectiveness of Genially-based interactive multimedia can also be understood through the concept of scaffolding. This medium serves as digital scaffolding that helps students understand concepts step by step, starting with an introduction to plant parts and progressing to an analysis of the relationship between structure and function. Knowledge must be actively constructed through scaffolding that is relevant to students' zones of development (Vygotsky, 1978; Wibowo et al., 2025). With the support of interactive multimedia, students can learn independently yet in a guided manner, making the learning process more effective.

The implications of these research findings are quite significant for science education practices in elementary schools. The findings indicate that website-based interactive multimedia can serve as an alternative solution to address the limitations of conventional teaching methods, which tend to be teacher-centered. Isabirye et al. (2025) add that to foster creativity and innovation in the curriculum, students must be given the space to explore ideas, experiment, and take risks in their learning process. The use of these media promotes more active, interactive, and student-centered learning, thereby aligning with the demands of 21st-century learning and the Merdeka Curriculum. In addition, web-based media offer flexibility in use, both in the classroom and as a tool for independent learning outside the classroom.

Nevertheless, this study also has limitations that need to be considered. The study sample was limited to a single class with a relatively small number of students, so the findings should be generalized with caution. In addition, this study focused only on one science topic the parts of plants so the effectiveness of interactive multimedia for other science topics cannot yet be determined. These limitations open up opportunities for future research to develop and test similar interactive multimedia tools for different subject matter and educational levels.

Overall, the discussion of these research findings indicates that interactive, website-based multimedia using the Genially platform is a viable, practical, and effective learning medium for improving the analytical skills (C4) of fourth-grade students in science. These findings reinforce theories of multimedia-based learning and constructivism, and support the results of previous studies on the effectiveness of interactive media in learning. Thus, this study makes a meaningful scientific contribution to the development of innovative instructional media and can serve as a reference for educators and researchers in developing science instruction focused on higher-order thinking skills.

4. Conclusion

Based on the research objective to develop and test the feasibility and effectiveness of website-based interactive multimedia using the Genially platform in improving the analytical skills (C4) of fourth-grade students in science learning, it can be concluded that the research hypothesis is accepted: the use of Genially-based interactive multimedia significantly improves students' analytical skills. The research findings indicate that the developed teaching materials meet the criteria for high quality based on validation by media and subject matter experts, are practical for students to use in learning, and are effective in improving analytical skills, as demonstrated by improved learning outcomes from the pre-test to the post-test and N-Gain scores in the moderate to high range. This interactive multimedia tool facilitates students' analytical process by presenting material in a visual, interactive, and structured manner that aligns with the characteristics of elementary school science education, so that students not only understand concepts factually but are also able to organize and connect the relationships between concepts. Thus, interactive website-based multimedia created using Genially can serve as a relevant alternative learning medium to support science education focused on higher-order thinking skills. As a suggestion for further development, future research could examine the effectiveness of similar interactive multimedia tools on different science topics, involve a broader sample of participants, and combine them with specific learning models to obtain a more comprehensive understanding of the impact of media on various aspects of students' cognitive abilities.

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