



Development of Genially-Based Interactive Learning Media for Science Education 4th Grade of Elementary School

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ABSTRACT

IPAS learning on landform topics in Grade IV elementary schools requires learning media that can transform abstract visual concepts into concrete, visual, and contextual learning experiences. Preliminary analysis showed that teachers and students had a high need for technology-based learning media, with teacher needs reaching 86% and student needs reaching 84%. This study aimed to develop, validate, examine the practicality, and evaluate the initial effectiveness of Genially-based interactive learning media integrated with Problem-Based Learning. This research employed a research and development method using the ADDIE model, consisting of analysis, design, development, implementation, and evaluation. The study was conducted at SDN 10 Airpura, SDN 11 Airpura, and SDN 12 Airpura. Data were collected through needs-analysis questionnaires, expert-validation sheets, teacher and student practicality questionnaires, and pre-test–post-test learning-outcome tests. The developed media integrated visual materials, instructional videos, audio, interactive navigation, group discussion activities, quizzes, and educational games. Expert validation showed that the media was highly valid, with scores of 96% for material, 98% for media design, and 91% for language, resulting in an overall validity score of 95%. Practicality testing yielded highly positive results, with teacher responses at 97% and student responses at 93%. The pre-test and post-test results increased from 55.0 to 91.1, with an N-Gain score of 0.836 (83.6%). These findings indicate that Genially-based interactive media is feasible, practical, and has strong initial effectiveness in supporting visual, contextual, and problem-oriented IPAS learning in Grade IV elementary schools.

Keywords: *genially, interactive learning media, IPAS, ADDIE, elementary school*

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INTRODUCTION

Media is essential in science education in elementary schools because it can connect students' real-world experiences with visual natural and social concepts, particularly in topics related to landscapes and their connection to community livelihoods (Fareara & Hidayati, 2020). Information and Communication Technology is one of the 21st-century competencies in the Merdeka Curriculum that students can use to develop digital literacy, critical thinking, and problem-solving skills (Anggraeni et al., 2025). The Merdeka Curriculum emphasizes diverse learning approaches to produce more optimal learning content and provide students with sufficient time to understand concepts and strengthen their competencies (Muthmainnatun & Hidayati, 2023). This curriculum enables students to experience an interactive and enjoyable learning process. One innovation in this curriculum is IPAS learning. IPAS learning combines the natural sciences (IPA) and the social sciences (IPS) and studies living organisms and their interactions with the environment and the universe (Meylovia & Julianto, 2023). It is hoped that through IPAS learning, students' knowledge, skills, and scientific and social attitudes will improve, enabling them to understand and apply IPAS principles in daily life. This aligns with the findings of who state that IPAS learning plays a crucial role in transforming students' perceptions of the natural and social world around them. One of the IPAS topics is landforms, and the learning objective for this topic is for students to identify the variety of landforms in Indonesia, both on land and in water, and to understand their relationship to people's livelihoods.

Based on a preliminary study conducted in one cluster in Airpura District on September 8, 2025, at SDN 03 Airpura, SDN 04 Airpura, SDN 10 Airpura, SDN 11 Airpura, and SDN 12 Airpura, various issues

were identified in the IPAS physical geography curriculum. Students have not adequately grasped this material during instruction due to its inherently abstract nature. The difficulties students face in understanding the material stem from a learning process dominated by lecture-based methods and teacher guides that provide only brief content. In addition, teachers have not fully utilized the school's facilities. This is evidenced by the lack of visual, creative, and innovative learning tools, making it difficult for students to visualize the actual forms of the landscapes they are studying. The learning media used are still conventional, resulting in lower student engagement in the learning process, decreased motivation, and a less engaging learning experience.

During the analysis phase, the author also conducted a preliminary study comprising curriculum analysis, analysis of teaching modules, analysis of teacher and student needs, analysis of student characteristics, and analysis of the availability of facilities and infrastructure. In the curriculum analysis, the author examined the teachers' teaching modules and concluded that their components do not yet fully align with the requirements of the Merdeka Curriculum or meet students' needs. The results of the teacher needs study showed a very high level of need at 86%. Meanwhile, students' needs were also very high, at 84%. This means that both teachers and students require media in the learning process. Students become more enthusiastic when learning with media that present diverse visual elements, such as images, videos, and audio, which can boost their motivation and learning outcomes.

In line with this, an analysis of the characteristics of fourth-grade students shows that the physical aspect received an average score of 85.61 (very good), the intellectual aspect 78.58 (good), the emotional aspect 77.07 (good), the social aspect 79.39 (good), the moral aspect 88.89 (very good), and the interest aspects 86.87 (very good). These results indicate that student characteristics fall into the "good" category, but they still require appropriate learning media to ensure optimal development. Furthermore, an analysis of facilities and infrastructure revealed that the schools already possess devices supporting digital learning, such as laptops/Chromebooks, projectors, speakers, and internet access across all five schools. This underscores the need for teachers to develop learning media to facilitate content delivery and make learning easier for students, thereby ensuring that learning objectives are met. (Herlisti & Ningsih, 2025) state that the use of learning media can help students understand the material more easily. The appropriate learning media used in today's technological era is interactive learning media that utilizes computers and the internet (Juhaeni et al., 2021). One interactive medium is the web-based platform Genially.

Genially is a digital platform that enables teachers to create unique and innovative instructional media such as presentation materials, educational films, educational games, and various other teaching media. This platform offers a range of advanced features, including presentations, animations or films, digital posters, infographics, gamification, quizzes, and games (Rizaldi et al., 2024) (Aprilia et al., 2024). (Mejía et al., 2020) In their research, the authors stated that Genially is a highly capable platform for creating presentations, infographics, and engaging interactive content, as it allows integration of features such as videos, animations, links, and quizzes, making it a versatile tool for interactive content creation. The platform aims to provide an interactive learning experience to enhance student learning outcomes (Anggrayni et al., 2025).

The novelty in this research lies in the application of a problem-based learning model combined with Genially media. Genially media is easily accessible by both students and teachers, and its use is not restricted to the classroom; students can use it outside of class at any time and from anywhere as long as they are connected to the internet. Unlike previous studies that used Genially media separately, this research combines both aspects to create a more engaging and effective learning experience for students.

Based on the description above, interactive learning media using Genially can serve as an effective alternative to optimize the learning process, especially in IPAS lessons on natural landscapes. Therefore, the researcher is interested in conducting a study entitled "Development of Interactive Learning Media Using Genially in IPAS Instruction for Fourth Grade Elementary School Students."

METHODS

Design Research

This research uses the research and development (R&D) method with the ADDIE model. This model consists of five stages, namely analysis, design, development, implementation, and evaluation. The ADDIE model was chosen because it provides a systematic workflow for developing instructional media, beginning with needs analysis and product design, moving through media development, and ending with evaluation of the media's quality and impact on student learning outcomes.

Development Procedure

Media development was carried out through the five stages of ADDIE. In the analysis stage, the researcher examined the curriculum, teacher and student needs, student characteristics, and the availability of school facilities and infrastructure. This stage forms the basis for determining the needs for developing interactive instructional media based on Genially for the topic of landforms. In the design stage, the researcher prepared learning outcomes, learning objectives, learning materials, a flowchart, a storyboard, validation instruments, practicality instruments, and pre-test and post-test instruments. The media was designed to include materials, images, videos, audio, quizzes, educational games, and group discussion activities based on Problem Based Learning. In the development stage, the Genially media was developed according to the prepared design. Content, media, and language experts then validated the product. The validation results were used to revise the content, appearance, layout, font consistency, color, and linguistic aspects. After revision, the media was discussed with teachers through a Focus Group Discussion before being used in learning. In the implementation stage, the media was applied in the IPAS class IV learning. A small-scale trial was conducted at SDN 10 Airpura. Wider scale implementation was carried out at SDN 11 Airpura and SDN 12 Airpura. Learning began with a pre-test, followed by Genially media, group discussions, and quizzes, and concluded with educational games and a post-test. In the evaluation stage, the researcher assessed the media's validity, practicality, and effectiveness, as well as obstacles to its use. Validity was assessed through expert review, practicality through teacher and student response questionnaires, and effectiveness by comparing pre-test and post-test scores using N-Gain.

Research Instruments

The research instruments consisted of subject matter expert validation forms, media expert validation forms, language expert validation forms, a teacher practicality questionnaire, a student practicality questionnaire, and a learning outcome test. Expert validation was used to assess the product's suitability before implementation. The practicality questionnaires were used to determine how easy the media was to use for teachers and students. The learning outcome tests, consisting of pre-tests and post-tests, are used to assess improvements in student understanding after using the Genially media.

Data Analysis Techniques

The research data were analyzed using descriptive quantitative methods. Expert validation and practicality data were analyzed using percentage scores to determine the media's suitability and ease of use. The validity percentage results were used to determine the media's suitability in terms of content, medium, and language. The practicality percentage results were used to determine the media's ease of use based on responses from teachers and students. The result categories refer to the rating intervals used in the study, meaning that the higher the percentage score, the higher the media's validity or practicality.

The effectiveness of the media was analyzed using the N-Gain based on a comparison of students' pre-test and post-test scores. This analysis was used to measure improvements in learning outcomes after students participated in IPAS lessons using Genially-based interactive media. In this study, Genially served as the primary medium for organizing content presentation, concept visualization, discussion activities,

quizzes, and educational games. Therefore, the N-Gain results were used to assess Genially's effectiveness in improving fourth-grade elementary school students' understanding of IPAS material.

RESULTS AND DISCUSSION

Results of the Needs Analysis

The results of the needs analysis indicate that teachers and students have a very high need for technology-based learning media in fourth-grade IPAS instruction at the elementary school level. The teachers' needs score reached 86%, while the students' needs score reached 84%. These findings reveal a gap between the learning characteristics students require and the media currently used in the classroom. Teachers stated that the available IPAS learning media tend to be monotonous, unengaging, and do not make optimal use of technology. On the other hand, students demonstrate a stronger learning tendency when material is presented through images, animations, videos, quizzes, and educational games.

The results of the curriculum analysis and student characteristics further support this need. An analysis of the teaching modules revealed that some learning components have not been optimally structured, particularly regarding the derivation of learning objectives from learning outcomes, the use of operational verbs, and the comprehensiveness of methods, strategies, and learning approaches, as well as diagnostic, formative, and summative assessments. In terms of student characteristics, the physical aspect scored 85.61, the intellectual aspect 78.58, the emotional aspect 77.07, the social aspect 79.39, the moral aspect 88.89, and the interest aspect 86.87. These data indicate that students have good learning readiness but still require concrete, visual, and interactive media that align with the cognitive development of fourth-grade elementary school students.

Table 1. Needs Analysis Summary

Analysis Aspects	Key Findings	Implications for Media Development
Teacher needs	86%	Teachers need technology-based science learning materials that are easy to use and engaging for students.
Student needs	84%	Students need materials that include images, animations, videos, quizzes, and educational games.
Course module	Not yet fully optimized	Media must be aligned with learning outcomes, learning objectives, methods, strategies, and assessments.
Student characteristics	Physical, moral, and interests are rated as excellent; intellectual, emotional, and social are rated as good.	The media should be designed to be concrete, visual, collaborative, and easy to use.
Facilities	Three schools have digital support devices	The technical implementation of Genially is feasible in schools.

Table 1 shows that the development of the Genially platform is not based solely on the assumption of technology use, but on actual learning needs. The high scores for teacher and student needs indicate that the IPAS platform should be designed to be more visual, user-friendly, and better at transforming abstract geography content into a more concrete learning experience. The availability of digital devices in schools also supports the implementation of the platform in the classroom.

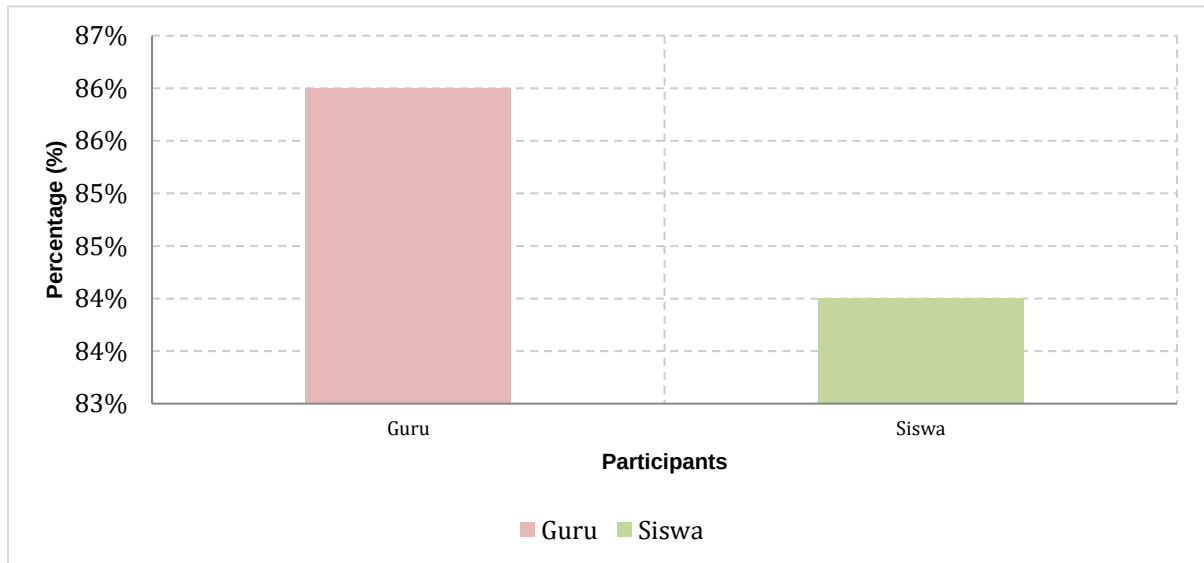


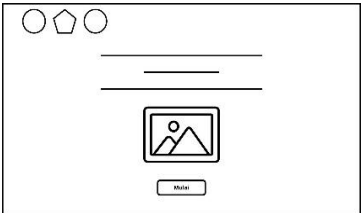
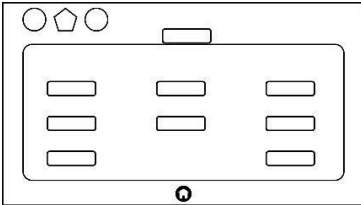
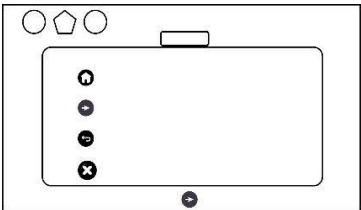
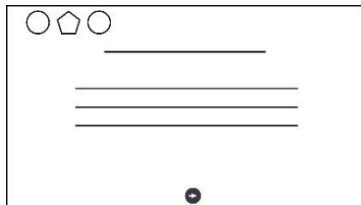
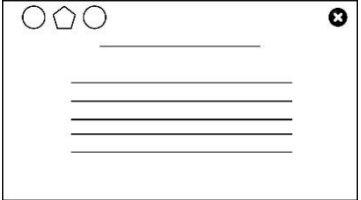
Figure 1. Teacher and Student Needs Analysis

Product Design and Features

The product developed is an interactive learning resource based on Genially for fourth-grade elementary school science (IPAS) lessons on landforms. This resource was designed through a series of stages that included developing content, learning outcomes, learning objectives, images, videos, audio, flowcharts, storyboards, and research instruments. The included content covers the definition of landforms, the formation process of landforms, terrestrial landforms, aquatic landforms, and the relationship between landforms and the occupations of communities in lowland, highland, and coastal regions. This product also features 31 images, 2 educational videos, the researcher's voice recordings, and audio files available on the Genially platform.

The Genially platform consists of a home page, main menu, user guide, learning objectives, content, instructional videos, group discussions, quizzes, games, and the creator tool. The home page displays the subject, class, and content information. The main menu serves as the navigation hub, connecting students to eight main features: guide, introduction, creator, content, instructional videos, group discussions, quizzes, and games. The content section presents the concept of landscape through text, images, and interactive buttons. The video section reinforces students' understanding through visualizations of the material. The group discussion section includes Problem-Based Learning activities, while the quizzes and games reinforce understanding and increase student engagement. The product structure is presented in Table 2, which shows how each media component is designed according to its pedagogical function.

Table 2. Genially Media Product Architecture

No	Scene	Gambaran Visual	Isi
1	Cover		<i>Background</i> in green and turquoise. The cover features the UNP logo, the "Merdeka Belajar" slogan, the "Tutwuri Handayani" motto, images of two students, the sun, rocks, mountains, trees, and flowers, as well as subjects, classes, and course material.
2	Main Menu		The main menu page contains eight options: Help, Introduction, Creator, Materials, Instructional Videos, Group Discussions, Quizzes, and Games.
3	Instructions for Use		Home button: to return to the main menu Button Next: To proceed to the next page Previous button: to go back to the previous page Exit button: to return to the main menu.
4	Learning Outcomes		This page lists the learning objectives that students are expected to achieve.
5	Learning Objectives		This page lists the learning objectives, organized by KKO level, that students are expected to achieve.

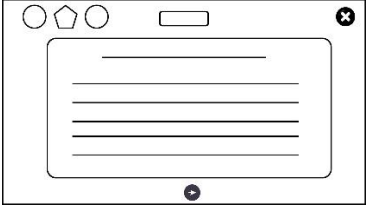
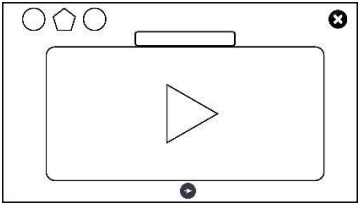
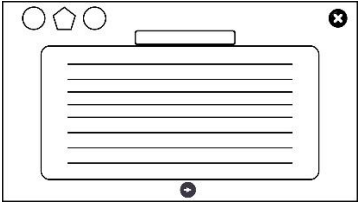
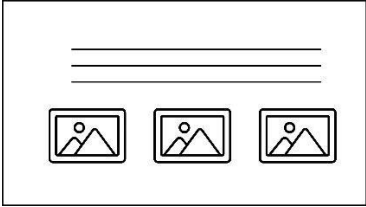
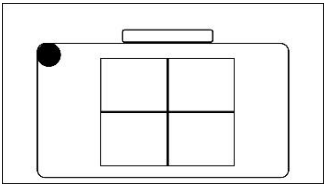
6	Materi		Explaining landscape material accompanied by images with explanations.
7	Educational Video		This page contains videos related to the material.
8	Group Discussion		This page outlines the PBL framework, which includes problem orientation, organizing students for learning, facilitating group investigations, developing and presenting work, and analyzing and evaluating the process problem-solving.
9	Quiz		This page contains quizzes consisting of single-choice, multiple-choice, true-false, and image-selection questions, as well as short answer.
10	Game		This page contains a puzzle game. This game has several difficulty levels: very easy (10 seconds to complete), easy (25 seconds), medium (50 seconds), and hard (1 minute and 15 seconds).

Table 2 shows that Genially is designed as a structured learning environment, not merely as a presentation tool. Each component serves a distinct function, ranging from learning orientation and content exploration to concept visualization, problem-based discussions, formative assessment, and reinforcement through educational games. This structure supports IPAS learning, which requires visual and contextual understanding. After the product architecture is explained, the media's navigation flow must be visualized so that readers can understand the relationships between pages within the Genially platform.

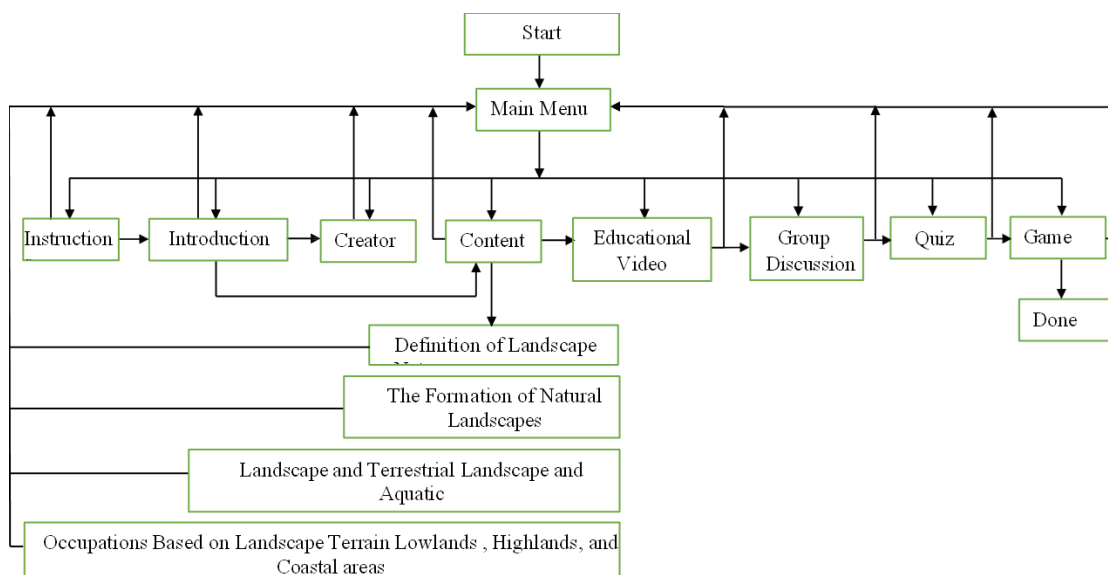


Figure 2. Genially Media Navigation Flowchart

Figure 2 shows that the main menu serves as a navigation hub that connects students to user guides, learning objectives, course materials, videos, group discussions, quizzes, games, and creator information. This flow allows students to move between features in a structured way without losing their way in the learning process.

Expert Validation Results

Expert validation was conducted to assess the suitability of the Genially-based interactive learning media before its use in the implementation phase. The assessment involved three validators: a subject matter expert, a media expert, and a language expert. The validation results showed that the developed media met the criteria for high validity across all assessment aspects. The subject matter expert assigned a score of 96%, the media expert 98%, and the language expert 91%. The overall average validity reached 95%, so the Genially-based interactive learning media was deemed suitable for use in fourth-grade elementary school IPAS instruction.

Table 3. Expert Validation Results

Validation Aspect	Score	Category	Revision
Material	96%	Very valid	The proportion of questions is tailored to students' cognitive levels: C1 = 10%, C2 = 30%, C3 = 30%, and C4 = 30%.
Media	98%	Very valid	The font type, logo layout, color scheme, and layout consistency were improved to make the media interface look neater and more user-friendly.
Language	91%	Very valid	Capitalization, prepositions, spelling, and punctuation have been corrected to make the language clearer, more effective, and grammatically correct.
Overall Average	95%	Very valid	The material was deemed suitable for use after being revised based on expert input.

Table 3 shows that the media meet the criteria for content, design, and language. Revisions to the content enhance the cognitive depth of the questions, so they measure more than just recall. Revisions to the media aspect improve readability, visual consistency, and ease of navigation. Revisions to the language aspect

make the instructions and content clearer for fourth-grade elementary school students. Thus, validation not only yields a suitability score but also substantively improves the product's quality.

The validation results show that the quality of the instructional materials is determined not only by the final score but also by targeted revision. In terms of content, revisions focused on increasing the depth of the questions to ensure that low-level questions did not dominate. Adjustments to the proportions of C1, C2, C3, and C4 indicate that the materials are designed to support students' comprehension, application, and analytical skills. Regarding the media, revisions focused on readability, visual consistency, and ease of navigation. In terms of language, improvements were made to avoid ambiguity, clarify instructions, and ensure compliance with Indonesian language conventions.



Figure 3. Beginning Display in Genially

The home page of the interactive learning platform is the first page that appears when you click the *Genially* link. The home page displays the courses, classes, and materials available for study. In the top-right corner, an interactive button indicates which sections are clickable. Clicking the desired menu button will take you to that menu.



Figure 4. View of the main menu

Thus, the Genially-based interactive learning material developed meets quality standards for content, visual design, and language. Expert validation also indicates that the material has a structure aligned with the learning objectives, a design that supports student engagement, and language that is sufficiently clear and accessible for use by fourth-grade elementary school students. These results provide the basis for proceeding to the practical testing and instructional implementation phases.

Results of Media Practicality

The results of the practicality test showed that teachers and students could easily use Genially-based interactive learning media at the three schools where the study was conducted. Teacher responses received very high scores: 96% at SDN 10 Airpura, 100% at SDN 11 Airpura, and 96% at SDN 12 Airpura, with an overall average of 97%. Student responses also fell into the "very practical" category, with scores of 93% at SDN 10 Airpura, 95% at SDN 11 Airpura, and 92% at SDN 12 Airpura, resulting in an overall average of

93%. These findings indicate that the Genially platform is not only conceptually viable but also operationally effective for fourth-grade elementary school IPAS instruction. The practicality results from the three schools are presented in Table 4 to illustrate the platform's ease of use from both teachers' and students' perspectives.

Table 4. Practicality Results Across Schools

School	Teacher Practicality	Student Practicality	Category
SDN 10 Airpura	96%	93%	Highly Practical
SDN 11 Airpura	100%	95%	Highly Practical
SDN 12 Airpura	96%	92%	Highly Practical
Average	97%	93%	Highly Practical

Table 4 shows that the Genially platform can be used effectively across three schools. Teacher scores ranging from 96% to 100% indicate that the platform is easy to manage during the learning process. Student scores ranging from 92% to 95% indicate that the platform can be understood and used by fourth-grade students without requiring complex procedures. The consistency of scores across the three schools suggests that the platform has the potential for replication in elementary schools with similar facility infrastructure.

From the students' perspective, an average practicality score of 93% indicates that the Genially platform is easy to understand and engaging for fourth-grade students. The slight variations across schools 93%, 95%, and 92%, suggest that the user experience with the platform is relatively consistent across the three school settings. This is important because good media is not only visually appealing but must also be operable by students without complicated procedures. Navigation elements, visual materials, instructional videos, quizzes, and educational games serve as components that enhance student engagement in the learning process.

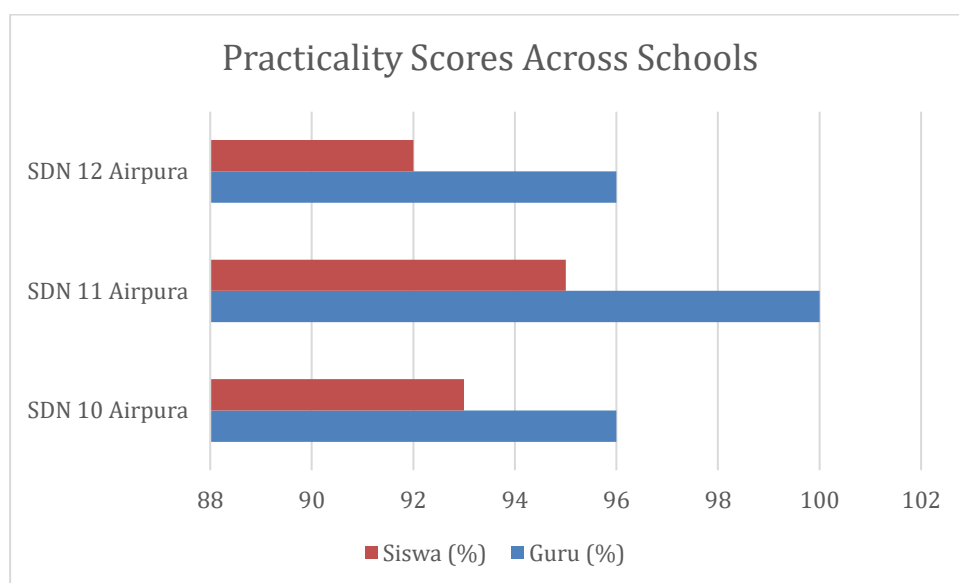


Figure 5. Comparison of Pre-Test and Post-Test Scores Across Schools

Figure 5 shows a clear difference between pre-test and post-test scores across all schools. The similar upward trend indicates that the Genially platform provides a consistent learning experience across the three elementary school contexts. Within the scope of this development study, this improvement in learning outcomes demonstrates the effectiveness of Genially-based interactive media in supporting fourth-grade elementary school students' understanding of science education.

Effectiveness Based on Student Learning Outcomes

The effectiveness of Genially-based interactive learning media was analyzed by comparing students' pre-test and post-test scores at three schools. The analysis showed a consistent improvement in learning outcomes after students participated in IPAS lessons on physical geography delivered using Genially. At SDN 10 Airpura, the average score increased from 52.1 to 90.0, with an N-Gain of 0.825 (82.5%). At SDN 11 Airpura, the average score increased from 55.7 to 92.1, with an N-Gain of 0.845 (84.5%). At SDN 12 Airpura, the average score increased from 56.2 to 91.2, with an N-Gain of 0.838 (83.8%). Overall, the students' pre-test average of 55.0 increased to 91.1 on the post-test, with an N-Gain of 0.836 (83.6%), which falls into the high and highly effective category. These findings indicate that the Genially platform provides strong support for improving student understanding, particularly because the physical geography material is presented through visuals, videos, interactive navigation, quizzes, educational games, and problem-solving activities.

Table 5. Students' Pre-Test, Post-Test, and N-Gain Results

School	Pre-Test Score	Post-Test Score	Difference Values	N-Gain	N-Gain (%)	Category
SDN 10 Airpura	52.1	90.0	37.9	0.825	82.5%	High/Very Effective
SDN 11 Airpura	55.7	92.1	36.4	0.845	84.5%	High/Very Effective
SDN 12 Airpura	56.2	91.2	35.0	0.838	83.8%	High/Very Effective
Average	55.0	91.1	36.1	0.836	83.6%	High/Very Effective

Table 5 shows a consistent improvement in learning outcomes across the three schools. The pre-test average of 55.0 increased to 91.1 on the post-test, with an N-Gain of 0.836 (83.6%). The score differences of 35.0 to 37.9 points indicate that the improvement did not occur in just one school but was relatively stable across all implementation sites. Thus, the Genially platform demonstrates strong indications of effectiveness in supporting students' understanding of physical geography material.

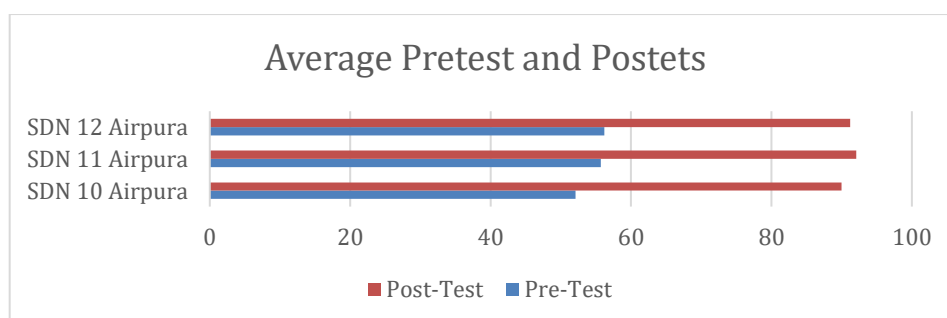


Figure 6. Average Pre-Test and Post-Test Scores at Three Schools

Discussion

From Needs-Based Design to Pedagogical Relevance

The findings of this study indicate that the development of Genially media is not based on technological assumptions, but on measurable pedagogical needs. The needs scores of 86% for teachers and 84% for students reveal a clear gap between IPAS teaching practices, which still rely heavily on textbooks, and students' needs for more visual, interactive, and concrete learning experiences. This situation is relevant

to the nature of physical geography content, which demands spatial representation, comparisons of natural features, and an understanding of the relationship between the geographical environment and people's occupations. Therefore, media that present only text are often insufficient to help fourth-grade students construct a complete mental picture of the lowlands, highlands, coasts, rivers, and other landforms. This finding expands upon the results of (2021), which showed that elementary school teachers view Genially as a medium that supports technology-based learning; however, this study goes further by directly linking the need for such media to the characteristics of the IPAS curriculum and school readiness.

Data on student characteristics further support the media's pedagogical suitability. Students' physical, moral, and interest aspects fall into the "very good" category, while their intellectual, emotional, and social aspects fall into the "good" category. This pattern suggests that students are ready to engage in active, collaborative, and task-based learning but still require concrete representations to ensure their thinking does not stop at mere memorization of concepts. In this context, the design of Genially becomes relevant because it transforms geography content from a verbal-abstract form into a visual-interactive form that is more appropriate for the developmental stage of elementary school students. This aligns with (2024), which emphasizes that learning becomes more robust when verbal information is combined with purposeful visual representations, and with Dulyapit et al. (2023), which demonstrates that interactive instructional materials can enhance students' cognitive engagement in science learning. Thus, the pedagogical validity of this medium lies not only in the sophistication of the platform but in the alignment between field needs, student characteristics, content characteristics, and the design of the learning experience.

Multimedia, Interactivity, and PBL Integration

The primary strength of the media developed in this study lies not merely in the use of Genially as a digital platform, but in integrating multimedia, interactive navigation, Problem-Based Learning activities, quizzes, and educational games into a single learning pathway. This structure ensures that students do not merely view the material but actively progress through a more comprehensive learning process: identifying objectives, exploring concepts, watching videos, reading case studies, engaging in discussions, testing their understanding through quizzes, and reinforcing their memory through games. This approach is crucial because landscape geography requires both visual understanding and contextual reasoning. It is not enough for students to know the definitions of a coastline or a highland; they must also understand how landscape features influence people's livelihoods, lifestyles, and local economic activities.

The integration of multimedia in this medium aligns with the principles of the cognitive theory of multimedia learning, which posits that text, images, audio, and video are channels of representation that can reinforce one another when organized in a targeted manner (Mayer, 2024). However, this study does not stop at presenting multimedia. The PBL element provides students with the opportunity to connect visual information to real-world problems. This is the key distinction from several previous studies. (2023) emphasized teachers' acceptance of Genially; Malik et al. (2022) highlighted Genially's role in fostering learning engagement, while Sitinjak et al. examined Genially-based interactive quizzes for learning motivation. This study expands on that direction by positioning Genially as a holistic learning environment that integrates content, navigation, problem-solving, formative assessment, and game-based activities. In other words, Genially is not treated as a presentation tool, but as a structured learning space.

The integration of PBL also makes an important conceptual contribution. Hendarwati et al. (2021) demonstrate that collaborative PBL can enhance problem-solving and learning interactions. In this study, these principles were translated into group discussion pages that included problem orientation, student organization, group investigation, presentation of results, and evaluation of problem-solving. This design shifts students' roles from information recipients to active participants who process visual information into arguments and solutions. Therefore, the increase in student engagement cannot be explained solely by the media's attractive appearance, but rather by the media's provision of a learning structure that demands observation, discussion, decision-making, and reflection.

Product Quality: Validity and Revision Logic

An overall validation score of 95% indicates that the material falls into the "highly valid" category; however, this figure is not the sole indicator of product quality. Under stricter material development standards, product quality must be assessed by evaluating the relationship between the validation results and the rationale for revisions made in response to expert feedback. Regarding content, the validator found that formative questions remained too dominant at the C1 level. Revisions subsequently adjusted the question composition to 10% C1, 30% C2, 30% C3, and 30% C4. This change is important because media that integrate PBL should not stop at recall questions. It must foster understanding, application, and analysis in accordance with the demands of problem-based learning. Revisions to the media aspects also indicate that visual quality is systematically controlled. Expert input on font type restrictions, typographic consistency, logo layout, and color consistency demonstrates that media validity is not merely a matter of the presence of images or videos but of readability, visual stability, and ease of navigation. This aligns with Yulianti et al. (2025) who emphasize the importance of aligning media design with student characteristics, as well as Rahman et al., (2025), who identify the alignment of content, objectives, and presentation as the primary principles of educational media.

Regarding language, revisions to capitalization, prepositions, punctuation, and sentence clarity enhance the media's function as a tool for self-directed learning. Imprecise language hinders comprehension, particularly among elementary school students who are still developing academic literacy. Compared to previous research on interactive media development, this study has the advantage of documenting cross-aspect revisions. Many R&D studies stop at reporting validation scores but fail to demonstrate how those scores translate into design improvements. This study is stronger because it demonstrates that the final product emerged from substantive revisions: the cognitive depth of the items was improved, the visual presentation was stabilized, and the language was simplified without compromising conceptual accuracy. Thus, the product's validity is not merely administrative but reflects quality assurance grounded in expert input.

Practicality Across Schools

An overall validation score of 95% indicates that the material falls into the "highly valid" category; however, this figure is not the sole indicator of product quality. Under stricter material development standards, product quality must be assessed by evaluating the relationship between the validation results and the rationale for revisions made in response to expert feedback. Regarding content, the validator found that formative questions remained too dominant at the C1 level. Revisions subsequently adjusted the question composition to 10% C1, 30% C2, 30% C3, and 30% C4. This change is important because media that integrate PBL should not stop at recall questions. It must foster understanding, application, and analysis in accordance with the demands of problem-based learning. Revisions to the media aspects also indicate that visual quality is systematically controlled. Expert input on font type restrictions, typographic consistency, logo layout, and color consistency demonstrates that media validity is not merely about the presence of images or videos but also about readability, visual stability, and ease of navigation. This aligns with Putra et al. (2025), who emphasize the importance of aligning media design with student characteristics and identify content, objectives, and presentation as the primary principles of educational media.

Regarding language, revisions to capitalization, prepositions, punctuation, and sentence clarity strengthen the media's function as a tool for self-directed learning. Imprecise language hinders comprehension, particularly among elementary school students who are still developing academic literacy. Compared to previous research on interactive media development, this study has the advantage of documenting cross-aspect revisions. Many R&D studies stop at reporting validation scores but fail to demonstrate how those scores translate into design improvements. This study is stronger because it demonstrates that the final product emerged from substantive revisions: the cognitive depth of the items was improved, the visual presentation was stabilized, and the language was simplified without compromising

conceptual accuracy. Thus, the product's validity is not merely administrative but reflects quality assurance grounded in expert input.

Learning Outcome Improvement and Methodological Caution

The average score increased from 55.0 on the pre-test to 91.1 on the post-test, with an N-Gain of 0.836 (83.6%), indicating a significant improvement in learning outcomes after using Genially. Pedagogically, this improvement can be explained through a combination of three mechanisms. First, visualization helps students understand landscape concepts that are difficult to imagine if explained solely through text. Second, interactive navigation allows students to access the material more independently and progressively. Third, PBL, quizzes, and games provide students with opportunities to process information through discussion, practice, and reinforcement of concepts. This pattern aligns with (2021), which demonstrated that ADDIE-based interactive media can support science learning, as well as with Azhar et al. (2021), which emphasized that integrating words and images can strengthen information processing when organized according to the principles of multimedia learning.

These findings also build upon the results of previous research. Genially Curi et al. demonstrated that Genially can support web-based learning and enhance teachers' competencies in using digital media. Ayuningtyas et al. (2024) confirmed that Genially-based quizzes can increase students' motivation to learn. This study provides evidence that Genially, designed as a learning ecosystem rather than merely a quiz or presentation tool, is associated with improved learning outcomes in the elementary school IPAS curriculum. This improvement in learning outcomes indicates that Genially-based media that utilize Problem-Based Learning play a significant role in supporting students' understanding of physical geography concepts. The combination of concept visualizations, interactive navigation, educational videos, quizzes, educational games, and problem-solving activities makes it easier for students to connect IPAS concepts with real-world contexts. In this development research design, the increase in scores from the pre-test to the post-test serves as evidence that Genially media makes a positive contribution to the learning outcomes of fourth-grade elementary school students.

The interpretation of learning outcomes in this study is based on a developmental design that used pre-tests and post-tests with the same group of students. In this design, the PBL-based Genially platform served as the primary intervention during the IPAS learning process. All learning activities, from material presentation and concept visualization to problem-based discussions, interactive quizzes, and educational games, were developed and implemented through the Genially platform. The increase in post-test scores and N-Gain scores indicates that the use of the Genially platform is effective in helping students understand physical geography material. These findings reinforce the conclusion that the PBL-based Genially platform makes a tangible pedagogical contribution to improving the learning outcomes of fourth-grade elementary school students. Future research could expand testing through quasi-experimental designs, retention tests, and measures of critical thinking and problem-solving skills to further strengthen evidence of the platform's effectiveness.

CONCLUSION AND RECOMMENDATIONS

This study produced Genially-based interactive learning media integrated with Problem-Based Learning through the systematic ADDIE model, ranging from needs analysis, design, development, and implementation to evaluation. The developed product was deemed valid based on assessments by subject-matter, media, and language experts, with an overall validity of 95%. The media was also rated as practical by teachers and students at three elementary schools, with an average practicality score of 97% from teachers and 93% from students. Evaluation results showed an improvement in learning outcomes, from a pre-test average of 55.0 to a post-test average of 91.1, with an N-Gain of 0.836 (83.6%). These findings suggest that the PBL-based Genially media can serve as a model for designing interactive visual IPAS media tailored to the real learning needs of elementary schools. However, the media's effectiveness still requires further evaluation, as certain

conditions must be met, such as a stable internet connection, content that extends beyond just physical geography topics, and a testing context that includes more than just a few elementary schools.

Limitation

This study produced Genially-based interactive learning media integrated with Problem-Based Learning through the systematic ADDIE model, from needs analysis, design, and development to implementation and evaluation. The developed product was deemed valid based on assessments by subject-matter, media, and language experts, with an overall validity of 95%. The media was also rated as practical by teachers and students at three elementary schools, with an average practicality score of 97% from teachers and 93% from students. Evaluation results showed an improvement in learning outcomes, from a pre-test average of 55.0 to a post-test average of 91.1, with an N-Gain of 0.836 (83.6%). These findings suggest that the PBL-based Genially media can serve as a model for designing visual-interactive IPAS media tailored to the real learning needs of elementary schools. However, the media's effectiveness still requires further evaluation, as certain conditions must be met, such as a stable internet connection, content that extends beyond just physical geography topics, and a testing context that includes more than just a few elementary schools.

Credit authorship contribution statement

Yolly Desnita : Conceptualization, methodology, investigation, data collection, product development, formal analysis, data curation, writing original draft, and revision of the manuscript.

Abna Hidayati: Supervision, methodology validation, conceptual review, research design refinement, academic guidance, and manuscript review.

Yeni Erita : Supervision, validation of pedagogical content, review of learning design, interpretation of findings, and manuscript editing.

Desyandri : Supervision, theoretical review, validation of the elementary education context, critical revision of the manuscript, and final approval of the article.

Declaration of competing interest

The authors declare that they have no known financial interests, personal relationships, or other competing interests that could have influenced the research, analysis, interpretation, or reporting of this study.

Ethical Declaration

This study was conducted in accordance with ethical principles in educational research. Prior to data collection, permission was obtained from the schools involved in the study. Teachers and students were informed about the purpose, procedures, and scope of the research. Student participation was carried out with school approval and under teacher supervision. All data were collected only for academic purposes, and participants' identities were kept confidential. The research activities did not involve physical, psychological, social, or academic risks to the participants.

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