Development of Genially-Assisted Interactive Learning Media to Improve Students' Mathematical Problem-Solving Abilities at SMP Negeri 2 Satu Atap Patumbak

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Abstract. The study aims to develop and examine the feasibility, practicality, and effectiveness of an interactive Genially-based learning media designed to enhance students' mathematical problem-solving skills at SMP Negeri 2 Satu Atap Patumbak. The research employed a Research and Development (R&D) approach using the ADDIE model. Data were obtained through observations, interviews, questionnaires, and tests. The feasibility assessment indicated that the developed media met the criteria of high validity. Practicality evaluation showed scores of 84% from the teacher and 81% from students, both categorized as practical. Effectiveness was demonstrated through improvements in pretest–posttest results and an independent t-test, where t_{count} 2.55 greater than t_{table} 2.05, confirming the acceptance of H_1. Additionally, the posttest mean score of the experimental class using Genially was higher than that of the conventional class. Overall, the findings affirm that the Genially-based interactive media is feasible, practical, and effective for enhancing students' mathematical problem-solving abilities.

Keywords: Interactive learning media, genially, problem-solving skills, problem-based learning.

1 Introduction

Education functions as an adaptive system that continuously adjusts to societal transformation and emerging demands. In the context of the 21st century, problem-solving and life preparedness are increasingly grounded in the development of knowledge-based competencies. The National Education Association emphasizes that educational practices once regarded as effective are no longer adequate to ensure success in contemporary professional and social environments. As a result, educational quality is reflected in the extent to which learning experiences foster essential skills required in the modern era. Accordingly, improvements in an education system are strongly influenced by the quality of instructional processes and the learning outcomes they produce.

Mathematics holds a strategic position in 21st-century scientific development as it connects diverse disciplines and provides precision, structure, and conceptual clarity [1]. Many advances in science and technology rely heavily on mathematical approaches; therefore, proficiency in mathematical concepts and their application is essential across most professional domains. Mathematics is also closely linked with various fields such as art, design, language, history, geography, economics, science, music, and physical education, creating challenges for curriculum design and instructional strategies. Consequently, educational quality is now

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measured by how well learning experiences foster essential skills, particularly in Science, Technology, Engineering, and Mathematics (STEM) fields, where mathematics serves as the bedrock for innovation and problem-solving [2]. Furthermore, mathematical learning fosters logical, analytical, and systematic thinking skills that are valuable beyond academic settings. Within mathematics itself, problem-solving ability plays a central role in understanding advanced concepts and applying knowledge effectively in real-world situations.

Based on analysis the initial activity was carried out at SMP Negeri 2 Satu Atap Patumbak with give initial diagnostic test for see ability solution problem students, results from stage indicators Understand problem obtained results percentage by 65.6% which if interpreted is in the “Enough” category. In the 2- stage indicator Make plan settlement obtained results calculation percentage by 63.3% which if interpreted is in the “Enough” category. In the 3- stage Indicator Finish problem obtained results calculation by 52.2% which if interpreted is in the “Less” category. Then in the 4- stage Indicator Inspect results settlement obtained results calculation percentage by 38.9% which if interpreted is in the "Very Less" category.

Problem Based Learning (PBL) emphasizes student engagement with authentic, real-life problems as a means to construct knowledge, stimulate learning motivation, and develop higher-order thinking skills. Through this approach, students are encouraged to become more independent and confident in the learning process [3].

In addition, the characteristics of mathematics as a subject demand continuous practice to ensure that students are able to internalize concepts and apply appropriate problem-solving strategies. Repeated exposure to mathematical tasks, accompanied by reflection and correction of errors, plays an important role in strengthening conceptual understanding. However, limited instructional time and restricted opportunities for repetition during classroom activities often hinder this process, particularly when students lack access to independent learning support outside the classroom. Critical thinking abilities do not necessarily emerge through prolonged instruction alone but can develop progressively through meaningful understanding and sustained practice [4]. The implementation of repetition in learning aims to deepen students’ comprehension by reinforcing previously learned material through structured questioning and systematic review, thereby supporting long-term retention and understanding [5].

Interactive learning media that can be accessed at any time allows students to learn independently at their own pace, reinforce their understanding of concepts, and practice solving problems more effectively. The integration of educational technology, including digital applications and interactive learning modules, has demonstrated a positive impact on students’ academic achievement by allowing flexible repetition of learning materials according to individual learning needs. Previous studies indicate that interactive instructional media can significantly enhance students’ mathematical problem-solving abilities by supporting active engagement and repeated practice [6].

Mathematics instruction frequently involves abstract concepts, which require appropriate media capable of transforming these abstractions into concrete visual representations. Interactive learning media that incorporate animations, dynamic illustrations, and manipulable visual elements enable students to better comprehend complex mathematical ideas [7]. Moreover, such media should support independent and repeated use, allowing learners to progress at their own pace without continuous dependence on teacher assistance. Within the Problem Based Learning (PBL) framework, interactive media also play a crucial role in facilitating collaboration and communication. Features such as virtual discussion spaces or shared digital work areas can encourage students to exchange ideas and collaboratively present problem-solving strategies.

One digital platform that supports the development of interactive instructional content is Genially. This platform is specifically designed to assist educators in producing engaging and interactive multimedia learning materials through a user-friendly interface. Genially enables the creation of visually rich and interactive learning experiences that can increase students’ motivation and learning enthusiasm. Its diverse interactive tools such as clickable elements, simulations, animations, quizzes, and game-based activities are particularly suitable for implementing PBL oriented mathematics instruction. These features allow students to actively explore content, visualize abstract concepts, and reinforce understanding through repeated interaction [8]. Interactive learning media, such as the Genially platform, offers a dynamic solution by integrating animations, gamification, and scaffolded feedback into the learning process. Recent studies have shown that Genially-based interventions significantly improve student motivation and measured problem-solving performance, particularly when paired with Problem-Based Learning (PBL) or flipped classroom models [9,10].

Considering the identified instructional challenges and the potential of interactive digital media, this study focuses on the development of Genially-assisted interactive learning media aimed at improving students' mathematical problem-solving skills at SMP Negeri 2 Satu Atap Patumbak. Accordingly, the research addresses three main aspects: (1) the feasibility of the developed media based on evaluations by media experts, subject matter experts, and instructional design experts; (2) the practicality of the media as reflected in teachers' and students' responses; and (3) the effectiveness of the media in enhancing students' mathematical problem-solving performance.

This study distinguishes itself by integrating Genially-based interactive media with the Problem-Based Learning model structured according to Polya's problem-solving stages [11]. Unlike previous studies that focused on media or PBL separately, this research embeds interactive features to support each problem-solving phase. The study also applies a comparative experimental approach to examine feasibility, practicality, and effectiveness.

2 Theoretical Review

2.1 Mathematical Problem-Solving Ability

Problem-solving is not merely about an answer but is a process invloving high-level cognitive engagement. Problem-solving skills refer to an individual's capacity to resolve non-routine problems encountered in daily life contexts. These skills can be fostered through learning approaches that actively engage students in identifying and resolving problems. In mathematics education, problem-solving competence is a fundamental ability that learners must develop [12]. It is defined as students' capability to overcome obstacles and find appropriate solutions to mathematical tasks.

Polya proposed a structured framework consisting of four main stages of problem-solving: (1) comprehending the problem, (2) formulating a solution strategy, (3) executing the planned strategy, and (4) evaluating the obtained results. These stages serve as indicators for assessing students' mathematical problem-solving abilities [11,13].

The first indicator, understanding the problem, involves recognizing relevant facts, concepts, and information required for solving the task. At this stage, students identify known data, determine what is being asked, and interpret the given conditions.

The second indicator, planning a solution, refers to constructing a mathematical representation or strategy. This includes analyzing the problem, recalling similar problems, applying prior knowledge, and adapting known methods when direct solutions are not immediately apparent.

The third indicator, implementing the solution plan, focuses on applying the chosen strategy accurately by carrying out calculations and procedures step by step while ensuring correctness throughout the process.
The final indicator, reviewing the solution, involves re-examining the results to verify accuracy, consider alternative solutions, and evaluate the overall reasonableness of the answer.

2.2 Problem-based learning

A learning model can be understood as a structured scheme used to plan long-term instructional programs, develop learning resources, and direct instructional activities in classroom settings or other learning environments [14]. In this context, a learning model functions as a conceptual guide that outlines systematic steps for arranging learning experiences in order to achieve predetermined educational goals, and it serves as a reference for educators and instructional designers when planning teaching and learning processes.

Problem-Based Learning (PBL) is an instructional approach that begins by presenting learners with meaningful problems that stimulate active engagement. Through this approach, students are encouraged to collaborate, think critically, and work collectively to find solutions, resulting in interactive learning processes driven by continuous stimulus–response interactions [15]. PBL emphasizes problem-solving as a central learning activity, enabling students to construct knowledge through shared inquiry and discussion.

The Problem Based Learning (PBL) model is an instructional approach that places real-life problems at the center of the learning process. Through this model, students' higher-order thinking skills, creativity, and problem-solving abilities are actively fostered, as learners are required to examine problems critically, organize relevant information, and construct conceptual understanding to generate solutions. Rather than passively receiving knowledge, students engage in meaningful cognitive processes that support deeper learning. Consequently, PBL is considered effective in enhancing problem-solving skills, which is consistent with research findings indicating that the implementation of the PBL model positively contributes to students' problem-solving abilities [16]. By integrating Problem-Based Learning (PBL) with digital media, students can explore solutions in a virtual environment that offers immediate feedback and visualization [2].

2.3 Learning Media

Learning media refer to various forms, channels, or tangible tools used to deliver information or messages from educators to students in order to facilitate the learning process. These media encompass a wide range of resources, including printed materials, audiovisual tools, digital applications, and computer-based technologies, which function not only as carriers of instructional content but also as stimuli to enhance students' motivation and learning engagement. In this regard, learning media contribute to improving the effectiveness of information delivery and supporting students' understanding of learning materials.

Learning media also have significant potential to enhance the quality of instruction, as they are able to attract students' interest and actively involve their cognitive, emotional, and attentional aspects during learning activities. The media employed may take the form of physical learning aids or digital applications capable of conveying information efficiently, while simultaneously supporting creativity throughout the learning process [17].

Furthermore, learning media provide several benefits in the teaching and learning process. These benefits include increasing students' attention and learning motivation, presenting instructional materials in a clearer and more structured manner to facilitate understanding and achievement of learning objectives, and promoting the use of more varied teaching methods beyond verbal explanation alone, thereby reducing student boredom and minimizing teacher fatigue [18].

2.4 Genially

Genially is a digital platform designed to assist educators in developing interactive learning experiences. It operates under a freemium model, where basic features can be accessed free of charge, while more advanced functionalities require a subscription. Previous studies have indicated that genially fulfills the criteria of effective learning media by being able to attract and maintain students' attention, thereby creating a more engaging and enjoyable learning environment [19].

The use of Genially in instructional activities encourages active student participation. Learners are not limited to passively listening to teacher explanations, but are also involved in various learning activities such as observing, practicing, demonstrating, and interacting directly with the learning content. This interactive approach supports a more meaningful learning process. Genially is an all-in-one web tool for creating interactive and animated content. It supports gamification and multimedia integration, which are proven to reduce math anxiety and increase engagement [20]. Its ability to facilitate independent repetition of materials makes it particularly effective for mastering complex topics like geometry [21].

In addition, genially is equipped with analytics feature that enables the collection of data related to student interactions with learning materials. Through this feature, educators can identify which sections of the content are most frequently accessed, which parts receive less attention, and the duration of student engagement with each section. Such data are valuable for evaluating and improving the effectiveness of multimedia-based learning, as they provide deeper insights into students' learning behavior and highlight areas that require improvement.

Several advantages of Genially have been reported in previous research, including the availability of diverse templates, animations, and text elements that can be easily customized, user-friendly content creation, flexible button customization, unlimited versions and design variations, support for collaboration between teachers and students, an active community of content creators, and automatic saving features [22].

Despite its advantages, genially also has certain limitations. Access to more comprehensive features requires a paid subscription, and the platform currently supports only a limited number of languages, namely English, Spanish, and French. Moreover, as an online-based platform, genially requires a stable internet connection to be used effectively.

3 Methodology

3.1 Research methods

This research employed a research and development (R&D) approach using the ADDIE development model. The product developed in this research was Genially-assisted interactive learning media designed to enhance students' mathematical problem-solving abilities. The research was conducted at SMP Negeri 2 Satu Atap Patumbak. The research subjects consisted of Grade VIII-E students as Experimental Class I and Grade VIII-C students as Experimental Class II. The object of the study was the developed Genially-assisted interactive learning media. The research sample included students from classes VIII-C and VIII-D, with each class consisting of 30 students.

3.2 Data collection and analysis techniques

Data in this study were collected using several complementary techniques, namely observation, interviews, questionnaires, and tests. Observations were conducted to obtain an initial overview of the learning conditions, teaching methods, and media used in mathematics instruction prior to the implementation of the developed interactive media.

Interviews were carried out with teachers to identify learning needs, constraints encountered during instruction, and students' characteristics related to mathematical problem-solving abilities.

Questionnaires were administered to media experts, subject-matter experts, and learning design experts to evaluate the feasibility of the developed Genially-assisted interactive learning media.

In addition, practicality questionnaires were distributed to teachers and students to assess the ease of use, attractiveness, and usefulness of the media during classroom implementation. Meanwhile, tests in the form of pretests and posttests were used to measure students' mathematical problem-solving abilities before and after the use of the interactive learning media, as well as to determine the effectiveness of the developed product.

The media validity sheet was measured based on a semantic differential scale with 5 scales using a Likert scale to measure the validity of the developed learning media. The percentage of results obtained was then calculated using the equation (1):

$$V_a = \frac{total\ score\ obtained}{maximum\ score} \times 100\% \tag{1}$$

Description: V_a= Validity Results

Then, for the expert validation sheet, the results of the calculation of each aspect of the questions on the instrument are interpreted in Table 1 below to see the validity of the learning media product developed by adapting from Damayanti et al. (2018) [23].

Table 1. Criteria Interpretation Validity

Score (%)	Valid Categories
$80\% < V_a$	Very Valid
$60\% < V_a \leq 80\%$	Valid
$40\% < V_a \leq 60\%$	Quite Valid
$20\% < V_a \leq 40\%$	Less Valid
$V_a \leq 20\%$	Invalid

To assess the product's practicality, a questionnaire was administered to students and subject teachers while using the product, then analyzed. The following formula was used to determine the product's practicality score using equation (2):

$$P = \frac{total\ score\ obtained}{maximum\ score} \times 100\% \tag{2}$$

After that, the data is interpreted using the assessment criteria in Table 2 below [24]:

Table 2. Criteria interpretation practicality product

Percentage (%)	Category
$80 < P \leq 100$	Very Practical
$60 < P \leq 80$	Practical
$40 < P \leq 60$	Enough Practical
$20 < P \leq 40$	Less practical
$0 < P \leq 20$	Impractical

After that, the students' answer tests were scored for each indicator of mathematical problem solving according to the scoring guidelines that had been previously conveyed, then the total scores of all students for each indicator were added up to be analyzed using the following equation (3):

$$N = \frac{score\ obtained}{maximum\ score} \times 100 \tag{3}$$

With N as the final value

The problem-solving ability scores obtained from the calculations are then categorized based on the assessment criteria adapted from Rianti (2018) as shown in Table 3 [25]. To determine the effectiveness of the product, a hypothesis test was conducted. Hypothesis testing in this study was conducted using a t-test by comparing the *posttest scores* between experimental class

I and experimental class II, as shown in Figure 1. Before conducting the t-test, normality and homogeneity tests were first performed on the data.

Table 3. Criteria interpretation results test

Score	Category
85.00 – 100	Very good
70.00 – 84.99	Good
55.00 – 69.99	Enough
40.00 – 54.99	Not enough
0 – 39.99	Very less

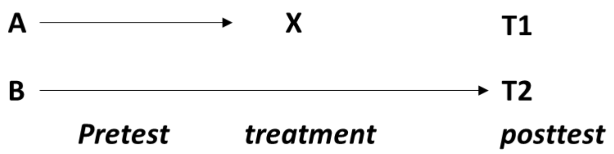

Fig.1. Design model experiment

Information:

A = Experimental class I
B = Experimental class II
X = Treatment
T1 = Experimental class test I
T2 = Experimental class test II

Group A is the experimental class I that will be given treatment using interactive learning media assisted by *Genially* in the mathematics learning process in class, while group B is the experimental class II where learning is carried out without additional treatment (conventional). Learning outcome tests are given to both groups to determine the difference in average learning outcomes between the experimental class I and the experimental class II. The study will be conducted in 5 meetings.

The research hypothesis to be tested is:

$H_0 = \mu_1 \leq \mu_2$

$H_1 = \mu_1 > \mu_2$

Information:

μ_1 =average learning outcomes of students who use *Genially assisted learning media*

μ_2 =average learning outcomes of students who do not use *Genially assisted learning media.*

For hypothesis testing, the t-test formula is used equation (4), namely [26]:

$$t = \frac{x_1 - x_2}{s\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} \quad (4)$$

Where S is the combined variance calculated using equation (5):

$$S^2 = \frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2} \quad (5)$$

Information:

t = calculated t value obtained
$\underline{x_1}$ =average score of experimental class sample
$\underline{x_2}$ =average score of control class sample
n_1 =number of experimental group samples
n_2 =number of control group samples
S_1^2 =standard deviation of the experimental group
S_2^2 =standard deviation of the control group
S =combined variance.

The test criteria H_1 are accepted if $t_{count} > t_{table}$ the results obtained from the t-distribution list with degrees of freedom dk = n1 + n2 – 2, and a significance level of 5%. One indicator of learning effectiveness is student learning outcomes.

A class is considered to have achieved learning mastery when at least 75% of the students attain scores equal to or higher than the minimum mastery criterion (KKM) established by the school, which in this study was set at 70 [27]. Accordingly, the effectiveness of the developed learning media was evaluated based on the results of the t-test analysis as well as the improvement in students' pretest and posttest scores in Experimental Class I, which implemented Genially-assisted interactive media, and Experimental Class II, which applied conventional learning media.

4 Results and Discussion

4.1 Analyze

The process of learning mathematics in schools, which affects the learning process, students, and supporting facilities. Details of these problems are as follows:

1) Low levels of student engagement and enthusiasm.

Students show limited participation, especially when faced with material that is considered difficult or abstract. They often wait for explanations from the teacher rather than trying to think critically or solve problems independently.

2) Students have difficulty understanding abstract mathematical concepts.

One of the main difficulties students is understanding concepts that require visual thinking skills, especially in material related to shapes and space. Students have difficulty visualising the concrete shapes of geometric figures, which results in poor conceptual understanding and incorrect application of formulas.

3) Limited learning media.

Teachers traditionally use conventional media such as textbooks, blackboards, and simple PowerPoint presentations. This makes the learning process less interesting and does not help students understand concepts concretely.

4) Limited time and resources hinder learning variety.

Teachers acknowledge that limited face-to-face time and limited availability of digital media make it difficult to provide student-centred learning. As a result, students' opportunities to explore and solve problems independently are limited.

5) Interactive digital media that supports independent learning is not yet available.

Students lack access to media that can be used independently and repeatedly outside of class hours. Mathematics learning is more effective when students can practise and visualise concepts directly.

6) There is a high need for interactive, visualisation-based learning media.

Teachers believe that interactive learning media that combine text, images, animations, and digital interactions are very important. This type of media can help students understand abstract mathematical concepts, increase learning motivation, and support technology-based learning.

4.2 Design

The learning objectives are formulated based on the results of the analysis of needs and basic competencies that apply to the mathematics curriculum for grade VIII junior high school, namely:

3.9 Differentiate and determine the surface area and volume of flat-sided geometric shapes (cubes, cuboids, prisms and pyramids)

4.9 Solve problems related to the surface area of the volume of flat-sided geometric shapes (cubes, blocks, prisms and pyramids), as well as their combinations.

From these basic competencies, specific learning objectives are formulated, including enabling students to:

1) Students are able to determine solutions to contextual problems using the concept of surface area of flat-sided geometric shapes correctly.
2) Students are able to determine solutions to contextual problems using the concept of volume of flat-sided geometric shapes correctly.
3) Students can develop strategies to calculate combinations of geometric shapes.
4) Develop mathematical problem-solving skills according to Polya’s four-stage problem-solving framework [11].

This objective serves as a reference in determining the content, flow, and interactivity of learning media.
Based on the analysis results, the material is focused on flat-sided geometric shapes which include:

1) Introduction elements get up flat-sided geometric shapes (cubes, cuboids, prisms, and pyramids).
2) Calculation surface area of flat-sided geometric shapes
3) Calculation of volume of flat-sided geometric shapes.

4.3 Development

The expert validation stage was conducted to evaluate the feasibility and quality of interactive learning media developed with the assistance of Genially during the initial design and production stages of the product. This validation aimed to ensure that the resulting media met content, instructional design, technical feasibility, and aesthetic standards before being used in student trials. The validation was conducted jointly by media experts, content experts, and instructional design experts. The validation results are presented in Table 4 below:

Table 4. Validation results expert

Validation expert	Score	Category
Media expert	81%	Very valid

Subject Matter Expert	89%	Very valid
Design expert learning	91%	Very valid

Based on the assessment results from three assessment aspects, namely media experts, subject matter experts, and learning design experts, it can be concluded that the learning media supported by Genially in the Problem-Based Learning model is deemed suitable for use in mathematics learning.

4.4 Implementation

After the developed learning media was validated by media, material, and learning design experts, and revised according to the experts' suggestions, the learning media was then tested by several students, including individual group trials consisting of 3 students, small group trials consisting of 6 students, and field trials consisting of all students in experimental class I.

The test results can be seen in the following Table 5.

Table 5. Results of the learning media trial

Trials	Score	Category
Trials individual	80.5%	Good
Trials group small	83%	Very good
Trials field	86%	Very good

Overall, the evaluation results indicate that the developed learning media is of excellent quality in terms of content, presentation, language, and graphics. The media has the potential to be an effective tool in improving students' problem-solving skills.

The practicality test was conducted to determine the level of practicality of using Genially-assisted learning media based on the Problem Based Learning (PBL) model in the mathematics learning process. This test was carried out at the product implementation stage, namely when the media was used directly in teaching and learning activities in experimental class I. The instrument used was a practicality questionnaire given to subject teachers and all students in experimental class I. The results of the practicality test can be seen in the following Table 6:

Table 6. Results of media practicality tests

No	Response	Percentage	Category
1	Teacher	84%	Practical
2	Student	81%	Practical

Overall, the results of the practicality test from teachers and students show that the Genially-assisted learning media developed has met the criteria for high practicality based on three main assessment aspects.

4.5 Evaluation

The effectiveness of Genially-supported learning media based on the Problem-Based Learning (PBL) model in flat-sided geometric shapes subjects was measured using a validated learning outcome assessment instrument. Student learning outcomes were obtained through two stages, namely pre-tests and post-tests. The pre-tests and post-tests used the same instrument, namely descriptive questions that measured students' ability to solve mathematical problems based on Polya's problem-solving framework [11]. The use of the same questions was intended to enable a direct comparison of test results to see the improvement in students' abilities after using interactive learning media supported by Genially.

The pretest and posttest results for experimental class I can be seen in Figure 2 below.

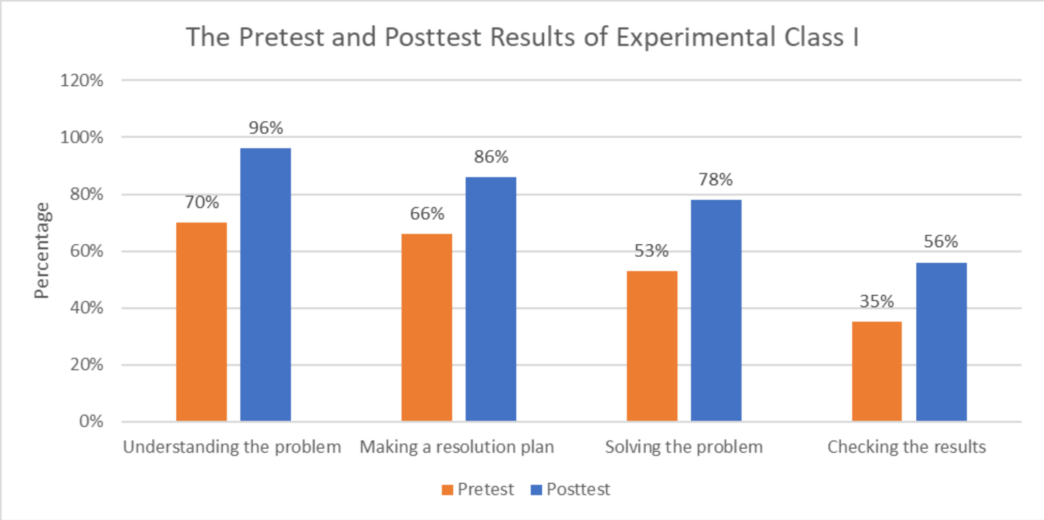

Fig. 2. Pretest and posttest graph for experimental class I

Based on Figure 2, the indicator of understanding the problem increased from 70% to 96%, the indicator of making a resolution plan increased from 66% to 86%, the indicator of solving the problem increased from 53% to 78%, and the indicator of checking the results of the resolution increased from 35% to 56%.

Overall, this improvement shows that the use of learning media supported by Genially with the Problem-Based Learning (PBL) model can help students understand problems, develop solution strategies, implement plans with systematic steps, and re-evaluate their solutions [3,6].

Then, in experimental class II, the pretest and posttest results can be seen in Figure 3 below:

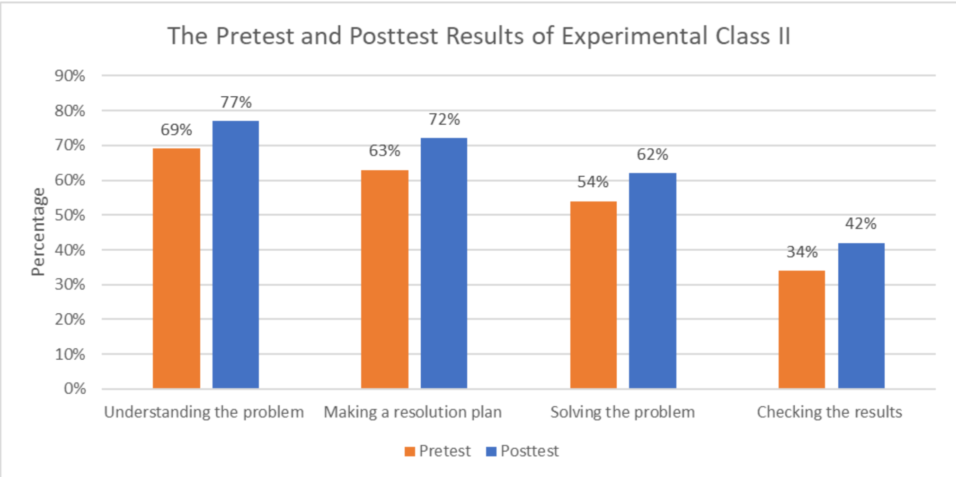

Fig. 3. Pretest and posttest results of experimental class II

Based on the results in the Figure 3, there was an increase in learning outcomes across all indicators compared to the pretest results. The indicators for understanding the problem increased to 77%, developing a solution plan to 72%, solving the problem to 62%, and checking the solution results to 42%.

Although there was an improvement from the pretest to the posttest, the improvement was not very significant, especially in terms of problem comprehension. This shows that conventional media-based learning is still not optimal in stimulating students' comprehensive mathematical problem-solving abilities. Therefore, it can be concluded that conventional learning can improve student learning outcomes, but its effectiveness is still lower than learning that utilizes Genially-based interactive media, which was applied in experimental class 1.

Then, the posttest results in experimental class I and experimental class II were used to test the hypothesis. Before that, normality and homogeneity tests were conducted on the data before the t-test. The normality test was conducted to determine whether the learning outcome data of students in experimental class 1 and experimental class 2 were normally distributed or not. This test is a prerequisite before conducting parametric statistical analysis, such as the t-test. The normality test in this study used the Lilie for test with a significance level of 0.05. The decision-making criteria were if $L_{count} < L_{table}$, then the data is declared normally distributed.

The results of the normality test for experimental class I and experimental class II can be seen in Table 7 below:

Table 7. Results of normality test

Class Experiment I		Class Experiment II	
Average	78.94	Average	63.11
Std Deviation	5.813	Std Deviation	6.379
L_{count}	0.081	L_{count}	0.060
L_{table}	0.161	L_{table}	0.161
Conclusion	Normal	Conclusion	Normal

The calculation results show an average value of 78.94 with a standard deviation of 5.813. The values L_{count} are 0.081 and L_{table} 0.161. $L_{count} < L_{table}$(0.081 < 0.161), it can be concluded that the learning outcome data in experimental class I is normally distributed.

The calculation results show an average value of 63.11 with a standard deviation of 6.379. The values L_{count} are 0.060 and L_{table}0.161. Since $L_{count} < L_{table}$(0.060 < 0.161), the learning outcome data in experimental class II is also normally distributed.

A homogeneity test was conducted to determine whether the learning outcome data from the two classes, namely experimental class I and experimental class II, had the same variance. This test was conducted as one of the requirements for continuing the analysis using the t-test.

In this study, the significance level was 0.05. The decision-making criteria were:

If $F_{Count} < F_{Table}$, then the data is declared homogeneous.

If $F_{Count} > F_{Table}$, then the data is declared non-homogeneous.
Based on the results of the homogeneity test calculations, the results obtained are in Table 8 below:

Table 8. Results of homogeneity test

No	Class	Variance	F_{Count}	F_{Table}	Conclusion
1	Experiment I	33.793	1.204	1.861	Homogeneous
2	Experiment II	40.691			

Based on table 9, the results of the homogeneity test of variance between experimental class 1 and experiment 2 obtained a value F_{Count} of 1.204 while the value F_{Table} was 1.861. According to the homogeneity test criteria, the data is said to be homogeneous if $F_{Count} < F_{Table}$. Because $F_{Count} < F_{Table}$ (1.204 < 1.861), it can be concluded that both data groups have homogeneous variance.

A t-test was conducted to determine whether there was a significant difference between student learning outcomes in experimental class I and experimental class II after being given different learning treatments. This test used an Independent Sample t-test with a significance level of α = 0.05.
The decision-making criteria are:
$H_0 = \mu_1 \leq \mu_2$

$$H_1 = \mu_1 > \mu_2$$

Information:

μ_1 = average learning outcomes of students in experimental class I who used *Genially assisted learning media*

μ_2 = average learning outcomes of students in experimental class II using conventional learning media.

The results of the t-test in experimental class I and experimental class II can be seen in table 9 below:

Table 9. Results of the t-test

t-test	t_{Count}	t_{Table}	Conclusion
Independent sample t-test	2.55	2.05	H_1 accepted

Based on the analysis results, the values obtained are t_{Count}= 2.55 and t_{Table}= 2.05. Since $t_{Count} > t_{Table}$(2.55 > 2.05), it can be concluded that H_1 it is accepted and H_0 rejected.
Thus, there is a significant difference between the learning outcomes of experimental class I and experimental class II. These results indicate that learning using Genially-assisted learning media with the Problem Based Learning model has a significant effect on improving students' mathematical problem-solving abilities compared to learning that does not use these media.

This indicates that the use of Genially-assisted learning media in the Problem-Based Learning (PBL) model is able to provide a more meaningful learning experience, as students can interact directly with the learning content, access visualizations of flat-sided geometric shapes concepts, and review the material independently without complete reliance on the teacher.

5 Conclusion

The feasibility test results show that interactive learning media supported by Genially is classified as 'highly valid' for use in mathematics learning about flat-sided geometric shapes. This assessment was obtained from validation by subject matter experts, media experts, and learning design experts with a highly valid average feasibility score. The aspects evaluated included content suitability with the curriculum, conceptual accuracy, clarity of display, and media interactivity. Thus, the media has met the feasibility criteria in terms of content, presentation, and learning design.

The effectiveness of the media can be seen from the t-test results and the increase in pre-test and post-test scores in experimental class I (using Genially media) and experimental class II (using conventional media). The analysis results show that the average post-test scores of experimental class I are higher than those of experimental class II, and the t-test results show that H_1 is accepted. This proves that the use of interactive learning media supported by Genially has a significant effect on improving students' mathematical problem-solving abilities, compared to conventional learning.

A practicality test was conducted on teachers and students in experimental class I during the implementation phase, both included in the "Practical" category. Aspects assessed included ease of use, design appeal, and media usefulness. These results indicate that the interactive learning media assisted by Genially is practical to use, visually appealing, and supports the learning process effectively.

Overall, it can be concluded that the interactive learning media assisted by Genially developed is feasible, practical, and effective in improving students' mathematical problem-solving abilities in the material of flat-sided geometric shapes at SMP Negeri 2 Satu Atap Patumbak.

This study focused on only one topic and one learning model. Therefore, future research is recommended to develop similar media for other mathematics topics or at different levels of education, thereby broadening the reach of the media's use. Longitudinal research can also be conducted to assess the media's continued impact on improving students' mathematical problem-solving abilities.

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