

THE DEVELOPMENT OF MATHEMATICS LEARNING MEDIA BASED ON MOBILE LEARNING THROUGH SMART APPS CREATOR TO IMPROVE MATHEMATICAL PROBLEM SOLVING SKILLS

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Article history: received 01 August 2025; revised 12 September 2025; accepted 24 October 2025

DOI : <https://doi.org/10.33751/jmp.v13i2.12881>

Abstract. In the contemporary education system, integrating technology is paramount in fostering student's problem-solving abilities. This research focuses on developing learning media that ensures validity, practicality, and effectiveness based on mobile learning through Smart Apps Creator to improve mathematical problem-solving skills. The research follows a Research and Development (R&D) approach, employing the ADDIE model for its development. The study involved 30 students in tenth grade from SMA Dharma Pancasila Medan. The research results obtained include the average percentage validation by the media expert 85.17% and the material expert 87%, which are highly valid criteria. The percentage of practicality used with an average rate of teacher response questionnaire is 97.89%, and the student response questionnaire is 84.81%. Learning media developed using Smart Apps Creator (SAC) effectively improves problem-solving skills, as shown by the classical student learning completeness reaching 90% with effective criteria. The increase in problem-solving skills was an increase in the medium category, with an average N-gain score of 0.68. As a result, this study shows that creating learning media based on mobile learning through Smart Apps Creator is an effective educational tool that significantly improves student problem-solving skills..

Keywords: Learning Media, Smart Apps Creator, mobile learning, problem-solving skills

I. INTRODUCTION

Education is not merely a process of transferring knowledge but a lifelong journey that shapes human character, nurtures values, and builds responsibility. Through education, individuals learn to develop awareness, cultivate moral understanding, and grow into responsible members of society. In accordance with the function of national education stated in Law No. 20 of 2003, education aims to develop students' potential so that they become intelligent, skillful, and ethical individuals capable of contributing to national progress. Therefore, the quality of education plays an essential role in preparing a generation that is resilient and adaptive in the midst of rapid advancements in science and technology.

Among the many disciplines taught in schools, mathematics holds a central role as the foundation of logical thinking and analytical reasoning. Cockcroft (1982:1) stated that it would be very difficult, perhaps even impossible, to live a normal life in many parts of the world without using some form of mathematics. Mathematics is not simply a collection of numbers and formulas; it is a language of logic that helps people interpret and understand various aspects of life. Through learning mathematics, students develop reasoning abilities, improve decision-making, and strengthen systematic thinking skills. Moreover, mathematics functions as a universal language that connects different scientific disciplines across the world.

Carl Friedrich Gauss once described mathematics as the queen of the sciences, emphasizing its role as the basis of all knowledge. Siagian (2017:62) also explained that the growth of science and technology is inseparable from mathematics. Understanding mathematical concepts allows individuals to design innovations and create solutions for technological development in the future.

The National Council of Teachers of Mathematics (NCTM, 2000:7) introduced five important standards in mathematics learning, which are problem solving, reasoning and proof, connection, communication, and representation. Among these, problem solving becomes the most crucial ability because it allows students to apply their mathematical understanding to real situations.

This goal is also emphasized in the Regulation of the Ministry of Education and Culture Number 58 of 2014, which underlines the importance of reasoning and problem-solving abilities as core objectives in mathematics learning.

Polya (1985:5) proposed four main stages of problem solving: understanding the problem, devising a plan, carrying out the plan, and looking back at the process. However, in real classroom conditions, many students are still unable to perform these stages effectively. Interviews at Dharma Pancasila High School showed that students often experience difficulties in understanding mathematical problems due to low interest in the subject and limited use of learning media. Teachers also reported that many students are unfocused and tend to perceive mathematics as confusing and intimidating. This issue is worsened by the lack of technological media that can support meaningful learning.

A diagnostic test conducted by the researcher on 30 students of class X-3 at Dharma Pancasila Medan High School showed that 60 percent of the students were categorized as very low in problem-solving ability, 23.34 percent as low, 13.33 percent as medium, and only 3.33 percent as high (Arifin, 2010). These findings indicate that most students struggle to identify the given data, design plans, perform accurate calculations, and formulate logical conclusions.

Similar results were also reported by Amallia and Unaenah (2018:130), who found that monotonous teaching methods make students lose interest in mathematics because they see it as a difficult and boring subject. Therefore, teachers need to create a learning atmosphere that is more engaging and enjoyable. Masykur et al. (2017:178) emphasized that the use of technological resources in the learning process can help overcome these challenges and make learning more interactive and effective.

In the modern digital era, mobile technology has become an inseparable part of human life. Data from the Central Bureau of Statistics (Badan Pusat Statistik, 2022:55) shows that 67.88 percent of the Indonesian population used smartphones in 2022, increasing from 65.87 percent in the previous year. This trend demonstrates that mobile devices hold enormous potential to be used as flexible and accessible learning tools. By implementing mobile learning, students can access materials anywhere and anytime, making the learning process more dynamic and personalized.

One technological innovation that supports this approach is Smart Apps Creator (SAC). This software enables teachers to design interactive multimedia learning content without the need for programming skills. According to Susanti et al. (2021:180), Smart Apps Creator provides features such as animations, videos, music, and text that are easy to operate and appealing to students. Nengsih et al. (2022:1745) proved that mathematics learning media based on mobile learning assisted by Smart Apps Creator are effective in improving students' problem-solving skills and are feasible and practical to use. Likewise, Yuberti et al. (2021:90) found that Smart Apps Creator can enhance student motivation and learning interest significantly.

Based on these findings, the development of mathematics learning media based on mobile learning through Smart Apps Creator is an innovative strategy to meet the demands of twenty-first century education. This digital-based learning approach not only functions as a visual tool but also as an interactive environment that allows students to explore, create, and think critically. Therefore, this research aims to design, validate, and test the practicality and effectiveness of mathematics learning media based on mobile learning using Smart Apps Creator to improve students' mathematical problem-solving abilities at Dharma Pancasila Medan High School.

II. RESEARCH METHODS

This study was conducted at Dharma Pancasila Senior High School, located at Dr. T. Mansyur Street No. 71C, Medan Selayang, Medan City, North Sumatra, during the odd semester of the 2024/2025 academic year. The school was selected because it offers a lively and forward-looking learning environment, showing strong enthusiasm for integrating digital technology into teaching practices. The research applied a Research and Development approach, which focuses on both creating and testing an educational innovation. The development process followed the ADDIE model, consisting of five stages known as Analysis, Design, Development, Implementation, and Evaluation. This model, introduced by Dick and Carey in 1990, provides a structured and effective framework for developing learning media that truly respond to the needs of students.

The participants in this study were students of class X 3, while the object of research was a mathematics learning media based on mobile learning, created using Smart Apps Creator. This platform enables users to design interactive and creative learning applications without requiring programming skills. The goal was to develop engaging and easily accessible media that could enhance students' curiosity and strengthen their mathematical problem-solving skills. The operational definitions used in this study include Research and Development as a process of designing or improving educational products according to Sugiyono, learning media as tools that support communication and understanding, and mobile learning as a flexible learning method that can be accessed anytime and anywhere.

The data were collected through observation, interviews, tests, and questionnaires. Observation was carried out to understand the classroom atmosphere and the learning process. Interviews with teachers and students were used to identify the main challenges in learning mathematics. Pretests and posttests were conducted to measure the improvement of students' problem-solving abilities, while questionnaires were distributed to collect feedback about the developed media. The instruments used were designed using a Likert scale, which included validation sheets from material and media experts, practicality questionnaires for teachers and students, and instruments to evaluate learning effectiveness.

The research procedure followed the five stages of the ADDIE model. The analysis stage identified the curriculum, characteristics of learners, and learning needs. The design stage involved preparing storyboards, flowcharts, and research instruments. The development stage focused on creating and refining the learning media using Smart Apps Creator, followed by expert validation. The implementation stage tested the media in the classroom to observe how well it worked in a real learning setting, and the evaluation stage assessed the practicality and effectiveness of the media based on test results and user feedback.

Data analysis was carried out using both qualitative and quantitative approaches. Qualitative data came from the opinions and suggestions of experts, teachers, and students, while quantitative data were obtained from validation scores, questionnaire results, and test data. The level of validity, practicality, and effectiveness was analyzed using percentage formulas as suggested by Handayani and Zainil in 2023, while the improvement in learning outcomes was measured using the N Gain formula introduced by Meltzer in 2002.

The success indicators of this research referred to three main aspects: validity, practicality, and effectiveness. According to Aker and colleagues in 2013, the media is considered valid if the validation score from experts exceeds sixty percent, practical if it is easy to use and receives positive responses from teachers and students, and effective if it improves student learning outcomes and receives at least eighty percent positive feedback. Based on these indicators, the mathematics learning media developed through Smart Apps Creator is expected to be valid, practical, and effective in providing students with an enjoyable, interactive, and meaningful learning experience that makes mathematics feel more engaging and approachable.

III. RESULTS AND DISCUSSION

This study applies a Research and Development approach that focuses on creating mobile learning-based mathematics media through the Smart Apps Creator (SAC) platform. The development process adopts the ADDIE model, which includes the stages of Analysis, Design, Development, Implementation, and Evaluation. This model serves as a structured guide to produce learning media that are not only valid and practical but also effective in improving students' mathematical problem-solving skills.

During the analysis stage, the researcher explored various challenges in the teaching and learning process as well as the need for innovative learning media. Interviews with mathematics teachers at Dharma Pancasila Senior High School revealed that the school implements the Merdeka Curriculum, and the main topic for the first semester of the 2024–2025 academic year is arithmetic sequences. Based on these findings, the researcher aimed to design mobile learning media that could help students understand the material more deeply while fostering their critical thinking and problem-solving abilities.

The student analysis showed that most tenth-grade learners, aged between fourteen and sixteen, possess diverse learning abilities and often find it difficult to solve contextual mathematics problems. Many students also expressed boredom with conventional learning methods and a greater preference for interactive digital tools accessible through their smartphones. Therefore, the developed media is expected to encourage independent learning, allow students to review materials anytime, and strengthen their understanding of arithmetic sequence concepts.

Observations and interviews further revealed that the learning process in the classroom still tends to be teacher-centered, with limited use of engaging media. This condition often leads to low student participation and reduced enthusiasm for learning mathematics. Hence, the development of digital-based instructional tools is seen as a necessary innovation to support teachers in presenting lessons more interactively and to help students grasp abstract mathematical concepts in a fun, visual, and easily accessible manner.

Design

The design stage aims to produce an initial draft for the development of digital learning media. The media created is digital learning media using Smart Apps Creator (SAC) to deliver learning information attractively through images and animations. This stage consists of two main parts: product design and instrument development. In creating learning media, the design plan plays a crucial role in supporting the development process, which is represented through a flowchart and a storyboard. The flowchart serves as a graphical representation of each step in the media development process to facilitate production, while the storyboard illustrates the layout and sequence of media screens using SAC. The digital learning media design for the arithmetic sequence material consists of several main screens, including the opening page, title page, home page, instruction (interactive buttons), and evaluation page. The process begins by opening the SAC application, setting the layout to horizontal for Android phones, and inserting background images, text, and animations as needed. Next, interactions are added so that each image functions as a button linking to specific sections. On the evaluation page, a timer feature is included to set the duration of each question, and instructions are added to automatically switch to the next question when time expires. Once all sections are completed, the application is published in two formats: *.apk* for Android and *.exe* for PC or laptop.

In addition, at this stage, research instruments are developed to collect data from validators and respondents. These data are used to assess the validity, practicality, and effectiveness of the developed learning media. The instruments include a learning media validation sheet to evaluate appearance and usability, a material validation sheet to assess content, language, and presentation, a teacher practicality sheet to evaluate ease of use and usefulness, a problem-solving test consisting of pretests and posttests to measure students' improvement, and a student response questionnaire to identify their feedback regarding the learning

media in terms of engagement and interest. All instruments use a five-point Likert scale, except the student response questionnaire, which uses simple “Yes” or “No” answers.

Development

The development stage is the process of realizing the previously created design using the Smart Apps Creator application. The developed learning media were validated by experts and improved based on their suggestions before being published as a mobile learning application. The results of the mathematics learning media development using Smart Apps Creator are as follows. The main page displays the title of the learning media and the researcher’s name, along with a Start button to launch the application.



Figure 1. Main Page

The main menu contains buttons to access various contents such as the introduction, material, evaluation, and developer profile.



Figure 2. Main Menu

The introduction menu provides an opening message and an overview of the arithmetic sequence topic, along with a Home button to return to the main menu.

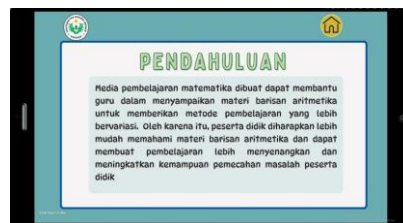


Figure 3. Introduction Menu.

The material menu presents interactive learning resources for two sessions: the first focuses on the concept and application of arithmetic sequences, while the second discusses middle and inserted terms with real-life examples.



Figure 4. Material Menu

The evaluation menu includes practice questions and explanations that can be accessed using a password provided by the researcher.



Figure 5. Evaluation Menu

The developer profile menu displays the identity of the developer or researcher who created the mathematics learning media based on mobile learning using Smart Apps Creator.



Figure 6. Developer Profile Menu

The validation process is an essential stage conducted after the development of learning media to ensure its quality and feasibility. This stage aims to identify weaknesses and provide recommendations for improving the mobile learning-based instructional media developed using *Smart Apps Creator (SAC)*. Validation was carried out by experts, namely media and material validators, using questionnaires designed to assess the validity of the developed media.

Validation of the Lesson Plan (RPP) was conducted by two lecturers from the Mathematics Department of Universitas Negeri Medan and one mathematics teacher from SMA Dharma Pancasila Medan. The results indicated a high level of validity, with an average score of 81%. Validators suggested several improvements, including adjusting time allocation, refining learning objectives to fit the ABCD structure, and adding the *Problem-Based Learning (PBL)* syntax. The following table summarizes the RPP validation results:

Table 1. RPP Validation Results

Aspect	Average (%)	Category
Lesson Plan Format	82.22	Highly Valid
Language	85.00	Highly Valid
Content	78.10	Valid
Average Validity	81.00	Highly Valid

Next, material validation was carried out by two mathematics lecturers from Universitas Negeri Medan and one mathematics teacher from SMA Dharma Pancasila Medan. The results showed that the learning media achieved an average score of 4.35 or 87%, categorized as *Highly Valid*. Validators assessed that the content, language, and instructional presentation were appropriate and feasible for use, with only minor revisions suggested, such as including *Problem-Based Learning (PBL)* elements to make examples more varied.

Table 2. Material Expert Validation Results

Aspect	Average (%)	Category
Content Quality	89.00	Highly Valid
Language	88.00	Highly Valid
Learning Presentation	83.00	Highly Valid
Average Validity	87.00	Highly Valid

Validation by media experts involved two mathematics lecturers, one computer science lecturer from Universitas Negeri Medan, and one mathematics teacher from SMA Dharma Pancasila Medan. Based on the validation results, the media obtained an average score of 4.26 or 85.17%, categorized as *Highly Valid*. Several suggestions were provided, such as improving the color combination and background for better visual comfort, and refining font selection and button layout for better proportion and readability. After implementing these revisions, the media was considered suitable for classroom use. Validation of the mathematical problem-solving test instrument, which consisted of pre-test and post-test items, revealed an average validity score of 82.90%, classified as *Highly Valid*. Validators concluded that the test items were aligned with the content, learning objectives, and problem-solving indicators. Minor revisions were made, such as removing redundant instructions like "check your answers" to enhance clarity.

Table 3. Media Expert Validation Finally

Aspect	Average (%)	Category
Media Appearance	87.89	Highly Valid
Ease of Use	80.45	Valid
Average Validity	85.17	Highly Valid

Table 4. Problem-Solving Test Validation Results

Aspect	Average (%)	Category
Relevance of Content & Objectives	86.67	Highly Valid
Language & Instructions	83.33	Highly Valid
Mathematical Notation & Symbols	73.33	Valid
Average Validity	82.90	Highly Valid

Overall, the validation results from media experts, material experts, and test validators indicate that the Smart Apps Creator (SAC) based learning media meets high validity standards in terms of content, language, appearance, and usability. Therefore, the developed learning media is deemed feasible for use in mathematics instruction after implementing minor revisions as suggested by the experts.

Implementation

The implementation phase involved testing the mobile learning-based arithmetic instructional media developed with Smart Apps Creator (SAC) at Dharma Pancasila Senior High School. The trial was conducted in a Grade X class consisting of 30 students. Based on the evaluations provided by both teachers and students, the developed learning media was found to be highly practical and suitable for classroom use. The teacher response questionnaire indicated a practicality score of 97.89 percent, which falls into the Highly Practical category, as presented in the table below.

Table 5. Teacher Response Result

Number of Teacher	Total Score	Practically Score	Category
1	93	97.89%	Highly Practical

Meanwhile, the student response questionnaire showed a practicality score of 84.81%, which is also categorized as Highly Practical, as shown in the table below.

Table 6. Learner Response Result

Number of Teacher	Total Score	Practically Score	Category
30	2290	84.81%	Highly Practical

Based on these results, it can be concluded that the developed learning media is highly practical and effectively supports students' understanding of arithmetic sequence material.

Analysis of the Effectiveness of Mathematics Learning Media Based on Mobile Learning Using Smart Apps Creator

The effectiveness of the developed learning media was measured through students' pretest and posttest results. The pretest was conducted before using the Smart Apps Creator (SAC)-based media, while the posttest was given after using it.

Table 7. Percentage of Students' Mastery Learning

Description	Students	Percentage
Passed	2	6.67%
Not Passed	28	93.33%
Total	30	100%

After using the media, students' mastery increased to **90%** (27 students passed). This met the minimum standard requiring at least 80% of students to achieve a score ≥ 75 .

Table 8. Achievement of Problem-Solving Ability Indicators

No	Indicator	Pretest	Description	Posttest	Description
1	Understanding the problem	56.39%	Not mastered	90.00%	Mastered
2	Planning a strategy	51.94%	Not mastered	86.67%	Mastered
3	Implementing the plan	40.83%	Not mastered	80.28%	Mastered
4	Reviewing the result	35.56%	Not mastered	74.17%	Mastered

All indicators showed a significant increase, proving the media's effectiveness in enhancing students' problem-solving skills.

Table 9. Overall Achievement of Problem-Solving Indicators

Test	Passed	Percentage	Not Passed
Pretest	2	6.67%	28
Posttest	27	90%	3

The overall average increased from **46.18% to 82.78%**, showing a significant improvement in students' understanding.

Table 10. Improvement in Students' Mathematical Problem-Solving Ability

Description	Pretest	Posttest	Improvement
Highest Score	79	97	18
Lowest Score	20	54	34
Average	46.18	82.78	36.6

Table 11. Levels of Students' Problem-Solving Ability

Score Range	Category	Pretest	Posttest
90–100	Very High	0%	20%
80–89	High	0%	53.33%
65–79	Moderate	6.6%	20%
55–64	Low	16.6%	6.67%
0–54	Very Low	76.8%	0%

The shift in categories indicates a significant improvement in students' learning outcomes.

Table 12. N-Gain Analysis Results

Test	Average (%)	N-Gain	Category
Pretest	46.18	0.68	Moderate
Posttest	82.78	-	-

Table 13. N-Gain Results for Problem-Solving Indicators

Indicator	N-Gain	Category
Understanding the problem	0.77	High
Planning a strategy	0.72	High
Implementing the plan	0.67	Moderate
Reviewing the result	0.60	Moderate

The N-Gain results show moderate to high improvement across all indicators, especially in understanding problems and planning strategies.

Table 14. Learning Media Effectiveness Questionnaire Results

Number of Students	Total Score	Effectiveness Percentage	Category
30	269	89.67%	Very Effective

The questionnaire results confirm that the mobile learning-based mathematics media developed through Smart Apps Creator is very effective in enhancing students' learning outcomes, motivation, and interest in using the media.

Evaluation

The evaluation stage is the final phase of the ADDIE model, aimed at assessing and improving the developed learning media. Errors identified during development are analyzed for necessary revisions. Evaluation involves validation sheets, feedback from stakeholders, and responses from teachers and students to assess practicality. The goal is to refine and enhance the media to be more effective and user-centered.

The Validity of Mathematics Learning Media Based on Mobile learning through Smart Apps Creator

Based on the validation results conducted by media and material experts, the mobile learning-based mathematics instructional media developed using Smart Apps Creator has met the required validity standards. This is supported by data analysis, which indicates that expert assessments both from media and material experts confirm the feasibility of the learning media in enhancing students' mathematical problem-solving skills.

The validation by material experts assessed aspects such as content quality of content, language, and learning presentation, while the validation by media experts focused on media display and usability media. The validation results from material experts yielded a percentage score of 87%, which, based on the assessment criteria $80 \leq x \leq 100$ signifies a very high level of validity in terms of content quality. Similarly, the validation conducted by media experts produced a percentage score of 85.17%, which also falls within the $80 \leq x \leq 100$ range, indicating that the media design and presentation are highly valid. Therefore, based on expert evaluations, the developed learning media is considered highly valid in both content and design. Additionally, several supporting instruments, such as learning modules and evaluation tools, have undergone an expert validation process. Based on the analysis, the learning module achieved a validity level of 81%, categorizing it as highly valid. Meanwhile, the evaluation instruments, including pretests and posttests, were also deemed valid based on expert assessments, confirming their suitability for use in the trial phase.

The validated mobile learning-based instructional media must undergo refinement based on feedback and recommendations from validators. According to the suggestions provided, the mobile learning media developed using Smart Apps Creator meets feasibility criteria but requires some revisions to further enhance its quality. Therefore, it can be concluded that the

Smart Apps Creator-based mobile learning media is valid, feasible, and effective for improving students' mathematical problem-solving abilities and is suitable for implementation in the school environment.

The Practicality of Mathematics Learning Media Based on Mobile learning through Smart Apps Creator

The development of mobile learning-based mathematics instructional media using Smart Apps Creator (SAC) requires careful evaluation of its practicality in real classroom settings. Assessing practicality is crucial to determine how efficiently and effectively the media can be applied by both teachers and students. This evaluation was carried out through questionnaire responses gathered during the classroom implementation of the developed media. The main goal of this assessment was to collect feedback on the usability, accessibility, and overall effectiveness of the instructional media in supporting the mathematics learning process.

Based on data analysis from field trials, the average practicality score obtained from teachers reached 97.89 percent, which is categorized as Very Practical. This result confirms that the mobile learning-based instructional media developed through Smart Apps Creator is highly suitable for classroom use. It shows that the media aligns well with current educational needs and expectations, offering an effective and user-friendly tool to support mathematics learning.

Similarly, the student practicality questionnaire produced an average score of 84.81 percent, which also falls into the Very Practical category within the range of 81 to 100 percent. These findings indicate that students found the learning media easy to use, engaging, and efficient, making it a valuable digital resource for improving understanding and participation in mathematics learning. The overall results demonstrate that the developed media not only enhances classroom interaction but also encourages independent learning in a flexible and enjoyable way.

The Effectiveness of Mathematics Learning Media Based on Mobile learning through Smart Apps Creator

The mathematics learning media based on mobile learning through Smart Apps Creator is considered effective based on several indicators, including classical learning completeness, learning media effectiveness questionnaires, analysis of students' improvements in mathematical problem-solving abilities, and N-gain analysis of test results. This mobile learning media has been proven to enhance students' success in achieving the expected learning objectives.

Based on the data analysis, it was found that during the pretest, only two students obtained scores ≥ 75 , while twenty-eight students scored below 75. After the implementation of the learning media, the posttest results showed that twenty-seven students scored ≥ 75 , and only three students scored below 75. The analysis of students' problem-solving test results indicated that learning outcomes met the criteria for classical completeness. In the pretest, two students (6.67%) met the minimum standard, while twenty-eight students (93.33%) did not. However, in the posttest, twenty-seven students (90%) achieved the minimum required score, and three students (10%) did not. Thus, Class X-3 met the classical learning completeness standard, as at least 80% of students achieved a score of 75 or higher.

Based on the problem-solving skill indicators, improvements were seen across all aspects. For Indicator 1, 56.39% of students achieved mastery in the pretest, increasing to 90% in the posttest. For Indicator 2, 51.94% in the pretest increased to 86.67% in the posttest. For Indicator 3, 40.83% of students achieved mastery in the pretest, which rose to 80.28% in the posttest. For Indicator 4, 35.56% of students achieved mastery in the pretest, increasing to 74.17% in the posttest. These results indicate that students' achievement significantly improved after using the developed learning media. The comparison of pretest and posttest results also shows a notable improvement: during the pretest, only two students (6.67%) met the Minimum Mastery Criteria (KKM) with an average score of 46.18, while in the posttest, twenty-seven students (90%) achieved mastery with an average score of 82.78. This demonstrates an improvement of 36.60 points in students' mathematical problem-solving abilities.

Based on N-gain analysis, the average pretest score was 46.18%, and the posttest score was 82.78%, resulting in an N-gain value of 0.68, categorized as moderate. When analyzed by indicator, the first indicator (understanding the problem) achieved an N-gain of 0.77 (high category), the second indicator (devising a plan) achieved 0.72 (high category), the third indicator (carrying out the plan) achieved 0.67 (moderate category), and the fourth indicator (looking back) achieved 0.60 (moderate category). These findings indicate an overall moderate improvement in students' problem-solving abilities after using the Smart Apps Creator-based mobile learning media.

The results of the classical learning completeness, problem-solving achievement, N-gain analysis, and learning media effectiveness collectively support the conclusion that the mathematics learning media developed for arithmetic sequence material meets the effectiveness criteria. Therefore, this learning media is considered both appropriate and effective for use in the learning process.

Based on students' responses to the learning media effectiveness questionnaire, it was found that aspects such as positive feedback, novelty, and interest in using the media obtained an average score of 89.67%, which falls into the "very effective" category. This result shows that the developed learning media positively affects students' attitudes and increases their interest in engaging with the learning process.

IV. CONCLUSION

This study on the development of mathematics learning media based on mobile learning through Smart Apps Creator (SAC) aimed to improve students' problem-solving skills in arithmetic sequences at Dharma Pancasila High School. Based on the

research results and analysis, the developed learning media was found to be valid, practical, and effective. The validation process showed that the media obtained an 87% approval rating from material experts and 85.17% from media experts, placing it in the highly valid category. The practicality results showed a score of 97.89% from teachers and 84.81% from students, indicating that the media is highly practical and suitable for classroom use. In terms of effectiveness, 90% of students achieved classical learning completeness on the posttest, while the effectiveness questionnaire received an average score of 89.67%, categorized as highly effective. The N-Gain value of 0.68 indicated a medium level of improvement in problem-solving abilities, with each indicator showing increased performance after the use of the learning media.

However, this research had several limitations. The study involved only one class of 30 students, which restricts the generalization of results to larger populations. The scope of development was limited to learning media and problem-solving tests on arithmetic sequences, with constraints in time, cost, and student engagement levels. Additionally, the use of the trial version of Smart Apps Creator limited access to certain features that could have enhanced the learning experience.

Based on these limitations, future research is suggested to expand the number of subjects and topics to produce more generalizable findings. Researchers are also encouraged to use the full version of Smart Apps Creator to utilize its complete features, enabling the development of richer and more interactive media. Further development could explore other mathematical concepts or subjects to broaden the application of mobile learning media in improving students' problem-solving skills and learning outcomes.

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