

Development of Android-Based Educational Media Using AppyPie on Pascal's Law to Enhance Problem-Solving Skills Among 11th-Grade Students

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Abstrak

Penelitian ini dilatarbelakangi oleh terbatasnya ketersediaan materi pembelajaran yang mampu meningkatkan kemampuan pemecahan masalah siswa. Penelitian ini bertujuan untuk mengembangkan alat pembelajaran berbasis Android menggunakan AppyPie pada konsep pemrograman Pascal untuk meningkatkan kemampuan pemecahan masalah siswa kelas 11. Metode penelitian yang digunakan adalah pendekatan penelitian dan pengembangan dengan model ADDIE (Analisis, Desain, Pengembangan, Implementasi, Evaluasi). Instrumen penelitian yang digunakan meliputi kuesioner validasi ahli dan kuesioner respons siswa. Analisis data menggunakan data kuantitatif dan kualitatif. Skor validasi kelayakan produk rata-rata adalah 85,51%, menunjukkan bahwa produk yang dikembangkan sangat cocok untuk digunakan. Peningkatan kemampuan pemecahan masalah siswa termasuk dalam kategori sedang dengan nilai N-Gain sebesar 0,60. Hasil ini menunjukkan bahwa penggunaan media pembelajaran berbasis Android dengan bantuan AppyPie mampu meningkatkan kemampuan pemecahan masalah siswa. Hasil tanggapan siswa memperoleh nilai rata-rata 93%, dengan tanggapan siswa terhadap pengembangan media pembelajaran dikategorikan sebagai "sangat baik," yang berarti media yang dikembangkan memiliki daya tarik dan memunculkan respons positif dari siswa. Penelitian ini mendukung pembelajaran yang berpusat pada siswa dan meningkatkan keterampilan pemecahan masalah.

Keywords: AppyPie, Pascal's Law, Media Pembelajaran.

Abstract

This study was motivated by the limited availability of learning materials designed to improve students' problem-solving skills. The study aims to develop an Android-based learning tool using AppyPie on Pascal programming concepts to enhance the problem-solving skills of 11th-grade students. The research method employed a research and development approach using the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). The research instruments used include an expert validation questionnaire and a student response questionnaire. Data analysis utilized both quantitative and qualitative data. The average product feasibility validation score was 85.51%, indicating that the developed product is highly suitable for use. The improvement in students' problem-solving skills falls into the moderate category with an N-Gain value of 0.60. These results indicate

that the use of Android-based learning media with the assistance of AppyPie is capable of improving students' problem-solving skills. Student response results received an average rating of 93%, with student responses to the development of the learning media categorized as "very good," meaning that the developed media possesses appeal and elicits a positive response from students. This research supports student-centered learning and enhances problem-solving skills.

Keywords: *AppyPie, Pascal's Law, Learning Media.*

INTRODUCTION

The rapid development of communication technology has had a significant impact across various fields, including education (Ananda et al., 2024). Advances in information technology have led to improvements in the effectiveness of the teaching and learning process (Utama et al., 2025). Technological developments in education can be seen in innovations in learning media through the use of Android-based mobile devices (Yanti et al., 2024). The use of Android-based learning media provides more flexible learning opportunities because students can access it anytime and anywhere (Nada et al., 2022). Teachers play a crucial role in ensuring the smooth operation of classroom teaching and learning activities, therefore, they are required to be more creative and innovative in

preparing lesson plans (Yanti et al., 2023).

Pascal's Law is one of the Grade 11 physics topics that requires strong problem-solving skills. However, based on daily test results, students' average scores range from 62 to 65. This indicates that most students have not yet mastered the material on Pascal's Law optimally and still require learning strategies that can help improve their conceptual understanding and problem-solving skills.

Physics problem-solving skills are crucial in today's education because they help students develop critical, logical, and systematic thinking skills when understanding the phenomenon of buoyancy in objects within a fluid based on Pascal's law. The Merdeka Curriculum emphasizes contextual problem-solving relevant to real life to prepare students for future challenges,

and Problem-Based Learning (PBL) effectively enhances these skills through active student engagement and collaboration in solving real-world problems, which has been proven to significantly improve problem-solving abilities (Windari & Yanti, 2021).

Based on the research results of Meilani and Meiliasari (2025), the low problem-solving ability of students in kinematics is caused by teaching methods that focus on memorizing formulas, as well as a lack of connection between concepts and real-world applications and experiments.

One solution that can help teachers develop students' problem-solving skills is the use of instructional media that aligns with technological advancements (Indah et al., 2025). Research by Salwa and Tsania (2023) demonstrates that instructional media based on videos, images, and practice problems not only significantly improves students' understanding of physics concepts but also enhances their problem-solving abilities. Similar findings were also reported in a study (Basuki et al., 2021) that developed Android-based media using

Liveworksheet with visual content such as images, videos, and exercises accessible online. The results of this study indicate that the use of such digital media can enhance problem-solving skills and make the learning process more relevant and practical.

One tool that can be applied to develop students' problem-solving skills is the AppyPie platform (Setiadi & Andriani, 2024). Android-based learning materials developed through the AppyPie platform offer a highly practical solution for physics education (Rivai et al., 2021). By presenting content in the form of text, images, and videos, this platform helps students grasp concepts more easily. Its main advantage lies in the ease with which teachers can develop applications without the need for programming (coding) skills, enabling the creation of engaging and well-structured learning materials. Additionally, the offline access feature allows students to learn anytime and anywhere as needed (Putri et al., 2022).

Based on the problem background outlined above, this study is designed to: assess the feasibility of the

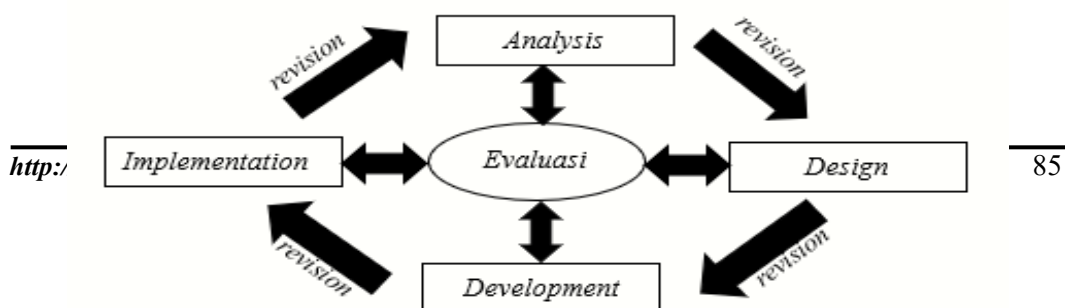
Android-based AppyPie learning media for Pascal's Law material, analyze improvements in the problem-solving skills of 11th-grade students, and determine students' responses to the use of the AppyPie learning media.

METHODS

This study is a research and development (R&D) study. Sugiyono (2020) explains that this method is a research approach used to develop new products and subsequently evaluate their effectiveness. In its development, this study applies the ADDIE model. The development process proceeds sequentially yet interactively; the evaluation results from each phase can be used to guide the subsequent phase. These phases are presented in Figure 1.

The participants in this study were 11th-grade students at SMAN 10 in Bengkulu City, involving 30 students from one class as research subjects.

The sampling method used was purposive sampling. During the limited testing phase, 10 students were selected to assess the readability and comprehensibility of the developed AppyPie. The evaluation at this stage employed the same assessment criteria as the class test to ensure consistency in measuring the media's practicality and its impact on students skills. Subsequently, in the more comprehensive testing phase, 30 students (Class C) were selected to test the effectiveness of AppyPie in improving students' problem-solving skills. This class was selected based on several criteria: the students in the class exhibited relatively homogeneous characteristics regarding cognitive abilities and prior learning; the class was supported by the subject teacher; and it was considered sufficiently representative of the entire student body.



(Mufidah dan Lestari, 2022)

Figure 1. Steps of the ADDIE Research Process

Data collection was conducted using observation sheets, interviews, questionnaires, and tests. Observations were used to directly observe the implementation of learning activities that utilized AppyPie as a learning medium. In-depth interviews were conducted with students who had used AppyPie in the learning process. The purpose of these interviews was to explore their experiences, perceptions, and views regarding the benefits, advantages, and challenges of using this medium. Questionnaires were administered to respondents, consisting of a student response questionnaire and a validation questionnaire for media experts and subject matter experts. Tests were administered to students to measure problem-solving skills, so that it could be analyzed whether there was an improvement in problem-solving

skills after participating in learning using this medium or not. Two types of tests were administered to the students: (1) a pretest conducted before using AppyPie and (2) a posttest administered after using AppyPie.

study employed both qualitative and quantitative methods. Qualitative data were obtained from the suggestions and comments of validators and teachers, as well as from observations made during the learning process, which served as the basis for improving the developed AppyPie. Meanwhile, quantitative data was obtained from expert validation sheet scores, student response questionnaires, and student pretest and posttest scores, which were analyzed to determine the extent to which AppyPie is effective in improving students' problem-solving skills. The

assessment scores from the expert validation questionnaire are shown in Table 1. The questionnaire data scores can be analyzed using the formula in Equation 1 below:

$$\text{Validation} = \frac{\text{Total score}}{\text{Total ideal score}} \times 100 \quad (1)$$

The expert validation questionnaire used a 1-to-5 Likert scale and was

analyzed according to the criteria listed in Table 1. The student response questionnaire also used a 1-to-5 scale with the criteria presented in Table 2. Furthermore, the assessment criteria for problem-solving improvement were based on the N-Gain values shown in Table 3.

Table 1. Validity Criteria

| Percentage (%) | Category |
|----------------|---------------------|
| 0% - 20% | Highly Unacceptable |
| 21% - 40% | Unacceptable |
| 41% - 60% | Somewhat Acceptable |
| 61% - 80% | Acceptable |
| 81% - 100% | Highly Acceptable |

(Oktaviani et al., 2025)

Table 2. Assessment Criteria for Student Response

| Percentage (%) | Category |
|----------------|----------------|
| 0% - 20% | Very Disagree |
| 21% - 40% | Disagree |
| 41% - 60% | Somewhat Agree |
| 61% - 80% | Agree |
| 81% - 100% | Very Agree |

(Renggani et al., 2023)

Table 3. N-Gain Level Criteria

| Average | Criteria |
|--------------------|----------------|
| $g > 0,7$ | High |
| $0,3 < g \leq 0,7$ | Moderate |
| $0 < g \leq 0,3$ | Low |
| $g < 0$ | No Improvement |

(Guntara, 2020)

RESULTS AND DISCUSSION

Analisis Stage

The development of AppyPie began with field observations and in-depth interviews with physics teachers

and several students. The goal was to identify various challenges faced, particularly in accessing and comprehensively understanding Pascal's law. The observations revealed that classroom instruction still relies heavily on printed teaching materials, with the use of non-printed materials limited to PowerPoint presentations and videos. The lack of learning media caused students to be less enthusiastic about learning physics, even considering it a difficult subject. Therefore, the development of new teaching materials is urgently needed to make physics learning in the classroom more engaging and innovative. Learning media is a tool that can support the teaching and learning process by helping students understand the subject matter (Rambe & Erika, 2025). This is because learning media can serve as a communication channel that facilitates teachers in conveying lesson content to their students.

Learning media introduces new concepts in digital education through the integration of responsive, dynamic multimedia. Technology-based learning media, such as computers and

smartphones, not only present information through visuals and audio but also provide motivation and immediate feedback to students during the learning process (Asrifah et al., 2025). They not only address the limitations of traditional, less interactive methods but are also effective in fostering student engagement and deepening understanding of the material, while aligning with the needs of education in the digital age (Bahri et al., 2025).

Desain Stage

Once the observational data has been collected, the next step is to develop a structured, comprehensive, and systematic design. This design process involves creating an AppyPie content framework that includes key elements, such as defining learning objectives aligned with core competencies and developing materials on Pascal's Law. Next, application-based practice questions and reflection exercises are created, along with evaluation tools to comprehensively measure student progress. AppyPie is a web-based platform designed to make it easy for

users, including educators, to create Android applications without needing to understand programming languages (Kusuma et al., 2022). This platform enables flexible learning interactions between educators and students, unrestricted by time and place. The ease of distributing materials and collecting assignments is a distinct advantage (Sompa et al., 2025). Additionally, the integration of video and document content supports the development of problem-solving skills, complemented by storage capabilities that facilitate versatile

access across various devices. This platform offers comprehensive features such as learning content, quiz-based assessments, and virtual discussion forums. The platform's ability to visualize complex concepts successfully creates a more interactive learning experience (Nurillahi & Noviliza, 2022). The interface of the ApyyPie Android-based learning platform, utilizing the Problem-Based Learning (PBL) model, is shown in Figure 2.



Figure 2. ApyyPie Android-Based Learning Platform.

Development Stage

The completed design of the Android-based ApyyPie learning media, which utilizes the PBL learning model, will then be pilot-tested and evaluated by validators before being

implemented in schools. The development of learning media using ApyyPie was undertaken to enhance students' problem-solving skills and to provide them with an engaging experience during the learning

process. Before being tested on students, the developed learning media underwent validation by three validators. The aspects tested included

content suitability, language suitability, presentation suitability, and media suitability, as shown in Table 4.

Table 4. Learning Media Validity Results

| Assessment Aspect | Response | |
|--------------------------|----------|----------------------|
| | Score | Qualitative Category |
| Content Suitability | 85,56% | Highly Acceptable |
| Language Suitability | 84% | Highly Acceptable |
| Presentation Suitability | 85% | Highly Acceptable |
| Media Suitability | 87,50% | Highly Acceptable |

Table 4 presents the validity results of the developed learning media as assessed by three validators. The results of the expert validation indicate that the developed AppyPie media meets the suitability indicators for learning media. The validators also stated that the content is consistent with physics concepts and appropriate for achieving the learning objectives. The language used is communicative, clear, and easy for students to understand. Furthermore, the presentation of the media is assessed as systematically structured and engaging, and includes activity steps that support implementation.

Based on the evaluation results and recommendations from experts, the developed AppyPie is suitable for

use in physics instruction, particularly regarding Pascal's Law. This indicates that AppyPie-assisted learning materials for the Grade 11 high school physics curriculum on Pascal's Law are appropriate for use. Furthermore, the AppyPie-assisted learning media is considered a viable alternative for enhancing students' cognitive abilities and understanding, as well as improving their problem-solving skills in physics. After validation by the validators, the test-based learning media via the AppyPie platform on Pascal's Law was pilot-tested with students who were about to study Pascal's Law to gauge their responses regarding the use of the developed learning media.

Implementation Stage

After receiving a score from expert validation confirming that the product was suitable for use in research, a product trial was conducted in the 11th-grade class at SMAN 10 in Bengkulu City to determine students’ responses to the AppyPie learning media for the designed Pascal’s Law material.

Product improvement was analyzed using the N-gain equation. Based on the results of the pretest and posttest conducted before and after the application of the product in the learning process, an N-Gain value of 0.60 was obtained, falling into the moderate category. The N-Gain results from the pretest and posttest can be seen in Table 5.

Table 5. N-Gain Results from the Pretest and Posttest

| Average score | | N-Gain | Category |
|---------------|----------|--------|----------|
| Pretest | Posttest | | |
| 41,00 | 87,33 | 0,60 | Moderate |

Based on the data presented in Table 5, there was an increase in students’ problem-solving skills, as indicated by the gain scores. This suggests that the development of test-based learning media using the AppyPie platform for Pascal programming material can enhance students’ problem-solving skills. These results align with research conducted by (Basuki et al., 2021), which focused on the development of Android-based learning media using the AppyPie platform. The primary objective of this study was to improve problem-solving skills. The research findings indicate

that the developed learning media is suitable for use and capable of enhancing students’ problem-solving skills. Research conducted by (Setiadi & Andriani, 2024) focused on the development of AppyPie-based multimedia. The results of this study showed that the AppyPie-based multimedia developed proved to be feasible and effective in improving students’ problem-solving skills and cognitive learning outcomes.

Student responses to the AppyPie-based learning media on Pascal’s Law achieved an average percentage of 92% with the “strongly agree” criterion. The

results of the analysis of student responses to the developed learning media are presented in Table 6.

Table 6. Student Response Results to AppyPie-based learning media on Pascal's Law

| Assessment Aspect | Response | |
|-------------------|----------|----------------------|
| | Score | Qualitative Category |
| Content | 91.33% | Very Agree |
| Media | 90.16% | Very Agree |
| Benefits | 92.5% | Very Agree |
| Language | 93% | Very Agree |

Based on Table 6, it can be seen that each evaluation aspect received a high average score; for example, the content aspect received an average score of 91.33%, the media aspect received an average score of 90.16%, the benefits aspect received an average score of 92.5%, and the language aspect received an average score of 93%. Thus, it can be concluded that the development of AppyPie-based learning media for Pascal's Law received strong approval from students, as it features an engaging interface and enhances both cognitive understanding and students' problem-solving skills. The improvement in students' problem-solving skills stems from the implementation of the PBL approach within the AppyPie platform,

which allows students to study the material beforehand before classroom learning activities begin. Through AppyPie, students receive foundational support in the form of material explanations, instructional videos, and trigger questions that build a basic understanding of the lesson concepts. Consequently, when classroom instruction takes place, students do not need to start from scratch but can immediately engage in discussion and problem-solving. This situation encourages students to be more active in analyzing issues and applying their knowledge, which ultimately enhances their problem-solving skills.

CONCLUSIONS

The AppyPie-based learning media on Pascal's Law has been validated by experts in terms of content, presentation, language, and media aspects. The AppyPie-based learning media on Pascal's Law enhances students' problem-solving skills. Students responded with strong agreement regarding the AppyPie platform for Pascal's Law material.

It is recommended that future researchers not only focus on measuring problem-solving skills but also begin to evaluate the impact of the media on student motivation. Expanding on this variable will provide a more comprehensive picture of the efficiency of Android-based learning media in permanently instilling physics concepts.

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