

Development of a Smart Apps Creator-Based Educational Application to Improve Students' Science Process Skills in the Subject of Dynamic Electricity for 12th-Grade High School Students

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Abstract: The utilization of learning applications is a solution to the limitations of laboratory facilities and student misconceptions on dynamic electricity material. This study aims to assess the characteristics, feasibility, and effectiveness of Smart Apps Creator-based applications in improving the science process skills of XII grade high school students. The method used is Research and Development (R&D) with ADDIE model and quasi-experiment nonequivalent control group design. The instruments used included expert validation, student response questionnaire, and pretest-posttest test. The results show that the app supports project-based learning and science process skills through simulation features, questions, and Ohm's law experiments. Expert validation shows the app is very feasible (material 0.875 and media 0.886), with student practicality of 84.6%. The effectiveness test showed the N-gain of the experimental class of 0.57 and the control class of 0.30, with a significant increase in the indicators of observation, prediction, and application of concepts. This application is declared feasible and effective to use in physics learning.

Keywords: Learning Apps, Science Process Skills, Dynamic Electricity, Smart Apps Creator, Physics

Introduction

Advances in Information and Communication Technology (ICT) have driven major transformations in the world of education, one of which is through the implementation of technology-based learning media. These media not only facilitate the transfer of knowledge but also enhance the effectiveness of learning through flexible access and more engaging information delivery (Anggraeni et al., 2023). Mobile learning has become one of the rapidly growing forms of educational innovation, particularly since the onset of the COVID-19 pandemic. This has spurred the adoption of digital-device-based learning (Ningsih et al., 2023).

In physics education, the concept of dynamic electricity is one of the most challenging topics due to its abstract nature and the need for an in-depth understanding of the relationships between current, voltage, resistance, Ohm's Law, Kirchhoff's Laws, and the various types of electrical circuits. A limited grasp of these concepts often leads students to develop misconceptions and struggle with solving problems related to electrical phenomena. Research by Asmaidah (2023) shows that student learning outcomes in this subject remain low. Meanwhile, physics laboratories in schools are not being utilized as intended. The lack of hands-on laboratory experience prevents students' science process skills (SPS) from developing optimally. In fact, SPS are important indicators in science learning (Novita et al., 2024). SPS indicators include observation, prediction, interpretation, and the application of concepts (Rustaman, 2007). Strengthening SPS is also aligned with the Learning Outcomes (LO) and Learning Objectives (LO) in the Merdeka Curriculum, which emphasize scientific reasoning and critical thinking skills. Therefore, teaching approaches and media that encourage students' scientific activities are needed.

One approach considered effective in improving SPS is project-based learning (PjBL). This approach encourages students to work collaboratively, complete projects, and actively develop scientific skills (Puenomo & Ilyas, 2019). Learning media that are relevant and capable of facilitating active student engagement also contribute to the success of this approach.

Smart Apps Creator (SAC) is an Android-based educational app development platform that allows for the integration of various multimedia elements (audio, video, text, and animation) without requiring programming skills (Wiliyanti et al., 2023). This tool has been proven effective in improving students' understanding of physics concepts, their independence in learning, and their motivation (Sholiha et al., 2023). Using SAC as a tool for developing educational apps allows teachers to design content that is contextual, visual, and interactive, tailored to the characteristics of their students.

This application was developed as an innovative approach to teaching dynamic electricity. It not only includes conceptual material but also features interactive elements such as thought-provoking questions, simulated experiments on Ohm's law, case studies, and simple exploratory projects. Through its SAC-based design, the application can be used offline, supports self-directed learning, and is tailored to the characteristics of students in the digital age.

Based on preliminary study results and interviews with physics teachers at SMA Negeri 1 Tahunan Jepara, it was found that students have low levels of science literacy and difficulty understanding dynamic electricity material. In addition, suboptimal laboratory conditions add to the obstacles in conducting laboratory experiments. Therefore, an interactive, project-based alternative learning medium is needed to support students' science process skills.

Methods

This study is a research and development (R&D) project that employs the ADDIE model, which consists of five stages: analysis, design, development, implementation, and evaluation. Each stage was carried out systematically to produce an interactive learning application that is suitable, practical, and effective for use in teaching dynamic electricity to 12th-grade high school students. The details of the application development stages are as follows:

1. The analysis stage was conducted through a curriculum study, teacher interviews, and an analysis of students' needs regarding learning media.
2. The design stage included the creation of storyboards and use case diagrams.
3. The development stage focused on creating the application using Smart Apps Creator, which includes content, practice questions, simulations, and an experimental project on Ohm's Law, as well as feasibility validation by subject matter and media experts.
4. The implementation phase was carried out through a small-scale pilot test with physics students at Semarang State University, a pretest, a large-scale pilot test with the 12th-grade class at SMA Negeri 1 Tahunan Jepara as the experimental class, and a posttest.
5. The evaluation phase included testing the practicality and effectiveness of the application using instruments that had been developed.

The effectiveness test design used a quasi-experimental method with a nonequivalent control group design involving two classes: the experimental class (using Dynaflash Apps) and the control class (using conventional instruction). The research subjects were 12th-grade students in classes XII-4 and XII-5 during the 2024/2025 academic year. The instruments used in this study included:

1. A validation sheet to assess the suitability of the material and media by experts.
2. A student response questionnaire to assess the practicality of the application.
3. A science process skills test consisting of pretest and posttest questions covering the indicators of observation, prediction, interpretation, communication, and application of concepts.

Validation data were analyzed using V-Aiken's formula; practicality was analyzed using quantitative descriptive methods; and effectiveness was analyzed using the N-gain test equation as follows:

$$\langle g \rangle = \frac{\langle S_{post} \rangle - \langle S_{pre} \rangle}{100\% - \langle S_{pre} \rangle} \quad (1)$$

Description:

$\langle S_{pre} \rangle$: Average score on the pre-test (%)

$\langle S_{post} \rangle$: Average score on the post-test (%)

Once the results of the N-gain analysis were known, the values were categorized according to the gain factor criteria shown in Table 1.

Table 1. Gain Factor Criteria

$\langle g \rangle$	Criteria
$g > 0.7$	High
$0.3 \leq g \leq 0.7$	Moderate
$g < 0.3$	Low

Results and Discussion

The Dynaflash Apps application was developed using the ADDIE model. During the analysis phase, observations were conducted using student questionnaires and interviews with physics teachers at SMA Negeri 1 Tahunan Jepara. The results of the student questionnaire showed that 72% of students had difficulty understanding the material on dynamic electricity. Physics teachers at the school also noted the presence of misconceptions regarding the relationship between current, voltage, and resistance in the dynamic electricity material. The results of this analysis served as the initial framework for the design and development of the application.

The design phase involved developing storyboards and use case diagrams with dynamic electrical content. The application development phase utilized Smart Apps Creator to produce educational media featuring animations, quizzes, practice problems, and links to PhET simulations. The application was implemented in an experimental class with 33 students, while the control class used conventional teaching methods. The evaluation phase consisted of both formative and summative assessments to evaluate the media's suitability, practicality, and effectiveness.

Features of the Dynaflash App

The Dynaflash App has visual and functional features designed to support interactive and contextual physics learning. The app was developed using Smart Apps Creator and can be run offline on Android devices. The following is a description of its features:

1. User Interface
The app features a simple home screen with main navigation buttons leading to course materials, videos, quizzes, and project assignments. The use of intuitive icons and contrasting colors makes it easy for users to access the menu.
2. Modular Content Structure
Course materials are organized into several modules, each consisting of an introduction to concepts, theoretical explanations, contextual case studies, and practice problems. Each module begins with a prompt question that aligns with the physics learning outcomes in the Merdeka Curriculum.
3. Interactive Media
The app is equipped with instructional videos, visual illustrations, simple simulations based on PhET links, and audio narration to explain the material thoroughly. The Ohm's Law simulation allows students to manipulate variables and observe their effects in real time.
4. Exercises and Assessment
Each module provides a simple case study aligned with the SPS. There are multiple-choice quizzes that provide immediate feedback in the form of automatic scoring and answer explanations in the additional practice exercises. Assessment scores are displayed immediately at the end of each

session to facilitate self-directed learning.

5. Exploratory Projects

PjBL-based project assignments are available that encourage students to conduct simple experiments, such as designing electrical circuits using simple tools. Instructions and worksheets are provided within the app for download or printing.

6. Accessibility and Navigation

Navigation between pages is organized sequentially and is easily accessible. There are “Back,” “Next,” and “Main Menu” buttons on every page. The app also provides usage instructions on the home page.

Dynaflash Application Suitability

The application’s suitability was tested through validation by two experts: a physics professor from Semarang State University and a physics teacher at SMA Negeri 1 Tahunan Jepara. The validation was conducted to assess the alignment of the content and media presentation with the learning standards of the Merdeka Curriculum. The assessment covered two main aspects: content suitability and media suitability.

Content Validity

The assessment of content validity was conducted by considering alignment with the Learning Outcomes, the depth and breadth of the content, and the accuracy of the concepts. The validation results show a V-Aiken’s value of 0.875, classified as “highly valid.” Additionally, the percentage of evaluations by university instructors and high school teachers was 82.86% and 97.14%, respectively, both classified as “highly suitable.” The results of the analysis for each aspect are shown in Table 2.

Table 2. Analysis of the Feasibility Validation of the Material for Each Aspect

Aspect	V-Aiken’s	Criteria
Content	0.875	Highly Valid
Presentation	0.875	Highly Valid
Language	0.875	Highly Valid

The material presented aligns with the learning objectives and is supplemented with information and thought-provoking questions that support conceptual understanding. This is consistent with the research by Simamora & Winardi (2024), which found that the integration of relevant information in digital media can enhance students’ understanding and critical thinking skills. The visuals, narratives, and contextual elements of the material are also organized systematically and communicatively, appropriate for the high school level (Nursidah et al., 2021).

Media Validity

The media were evaluated based on visual quality, language, interface design, software engineering, and media utility. The validation results showed a V-Aiken value of 0.886, classified as “highly valid.” The assessment percentage by physics professors was 84.76% and by physics teachers was 97.14%, both classified as “highly suitable.” The results of the analysis for each aspect of media suitability are presented in Table 3.

Table 3. Validity Analysis of Media Suitability by Aspect

Aspect	V-Aiken’s	Criteria
Display quality	0.90	Highly Valid
Language	0.84	Highly Valid
User interface design	0.84	Highly Valid
Software Engineering	0.90	Highly Valid
Media Usefulness	0.93	Highly Valid

The media has good visual quality with an aesthetically pleasing interface and clear navigation. The composition of visual elements (text, images, videos) is arranged proportionally to support a comfortable learning experience (Septiara et al., 2025). The language used is communicative and appropriate for

students' level of understanding, while the interface design structure facilitates ease of use and reinforces students' focus (Yusa et al., 2023). The software engineering aspect demonstrates system stability and ease of operation. Meanwhile, the media's usability aspect received the highest score (0.93), indicating that the application supports independent learning and can be used repeatedly throughout the learning process (Rahayu et al., 2025).

Based on the overall validation results, the Dynaflash Apps application has been deemed suitable for use as a learning tool to improve students' science process skills in the area of dynamic electricity.

Practicality of the Dynaflash Application

The practicality of the application was analyzed based on students' feedback after using it in the learning process. The instrument used was a practicality assessment questionnaire covering six main aspects: content, usefulness, language use, visual presentation, ease of access and use, and navigation. This assessment aimed to determine the extent to which the app was considered easy to use, useful, and supportive of the students' learning process. Table 4 shows the results of the app's practicality analysis.

Table 4. Practicality Analysis of the Application

Aspect	Percentage	Criteria
Content	84.7%	Very Practical
Usefulness	85%	Very Practical
Language	83.6%	Very Practical
Visual Presentation	85.2%	Very Practical
Ease of Access and Use	83.8%	Very Practical
Navigation	84.2%	Very Practical
Average	84.6%	Very Practical

The analysis results show that the application received an average score of 84.6%, falling into the "very practical" category. High scores across all aspects reflect that the application is generally well-received by users. The content aspect was evaluated as presenting well-structured, easy-to-understand material that aligns with the curriculum. Students appreciated the clarity of content delivery, the comprehensiveness of illustrations, and the practice questions that aid in understanding concepts. The usefulness aspect received the second-highest score, at 85%. This indicates that the app is capable of enhancing students' understanding of dynamic electricity concepts, encouraging independent learning, and boosting their motivation to learn. The language used in the app was evaluated as clear, effective, and communicative, appropriate for the literacy level of high school students. This supports understanding of the material without leading to multiple interpretations.

Students noted that the app's visual design is appealing and informative. The combination of colors, fonts, images, and animations is well-balanced, which helps in understanding the content. The app's accessibility and usability were rated as easy to use on mobile devices and did not cause any significant technical issues. However, some students mentioned that the app's file size is quite large, which could be a challenge on devices with limited storage capacity. Finally, regarding navigation, the interface features intuitive navigation buttons that make it easy to move between pages. This supports a smooth self-directed learning process.

Overall, the average score of 84.6% indicates that Dynaflash Apps meets high practicality criteria and is suitable for use as a mobile learning tool to support physics education.

Effectiveness of the Dynaflash App

The effectiveness of the Dynaflash learning app was analyzed by comparing pretest and posttest scores between the experimental class, which used the app, and the control class, which received conventional instruction. The purpose of the analysis was to measure the extent to which the app was able to improve students' science process skills. N-gain calculations were used to assess improvements in learning outcomes. The results showed that the experimental class achieved an N-gain of 0.57 (moderate to high category), while the control class achieved an N-gain of 0.30 (moderate to low category). This indicates that the use of the app had a more significant impact on improving conceptual understanding compared to conventional instruction. Table 5 and Table 6 show the pretest, posttest, and N-gain scores for the experimental and control classes.

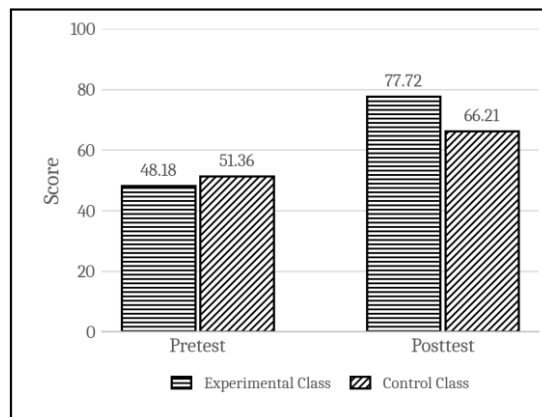
Table 5. Analysis of Pretest and Posttest Scores for the Experimental Class

Component	Score		N-gain	Criteria
	Pretest	Posttest		
Number of Students	33	33		
Highest Score	75	95	0.57	Moderate
Lowest Score	25	55		
Average	48.18	77.77		

Table 6. Analysis of Pretest and Posttest Scores for the Control Class

Component	Score		N-gain	Criteria
	Pretest	Posttest		
Number of Students	33	33		
Highest Score	75	85	0.3	Moderate
Lowest Score	30	45		
Average	51.36	66.21		

Improved learning outcomes in the experimental class were achieved through the integration of project-based learning and the use of digital media, which allowed students to access materials independently both at school and at home. Interactive features, automated quizzes, and simple experiments on Ohm's law further supported students' active engagement. This aligns with Boari et al. (2023), who found that the integration of mobile learning and PjBL can significantly improve learning outcomes. Meanwhile, the control class's limited access to self-directed learning resources and external factors, such as delays in instruction and inconsistent teacher supervision, contributed to the minimal improvement in learning outcomes. The results of the comparative analysis of pretest and posttest scores are presented in Figure 2, and the comparison of N-gains is presented in Figure 3.

**Figure 2.** Pretest and Posttest Scores of the Experimental and Control Classes

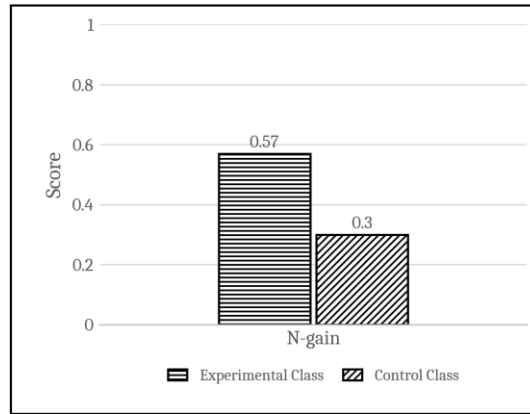


Figure 3. N-gain Scores of the Experimental and Control Classes

A comparison of the N-gain values for each indicator from the pretest and posttest results of the experimental and control classes is presented in Figure 4.

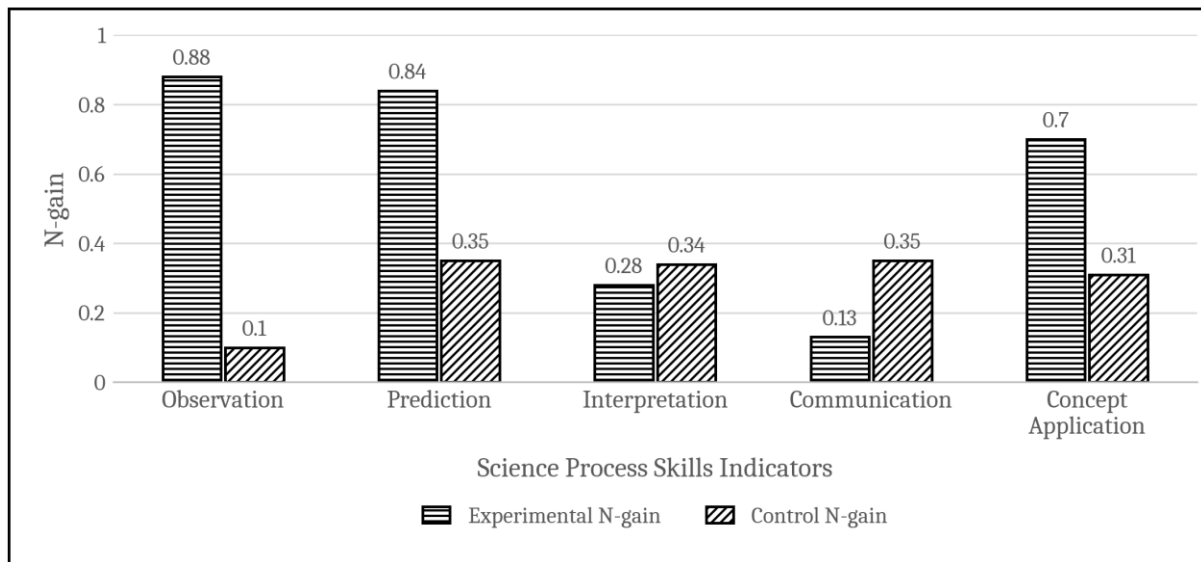


Figure 3. N-gain by Indicator for the Experimental and Control Classes

The results show that the experimental class achieved high N-gains in the indicators of observation (0.88), prediction (0.84), and concept application (0.70). This indicates that app-based digital media effectively fosters skills in observing, making data-driven predictions, and applying physics concepts in real-world contexts. This aligns with the research by Sholiha et al. (2023) and Purnomo & Ilyas (2019), which confirms that active engagement in projects and access to interactive media can improve students' science learning outcomes.

However, for the interpretation and communication indicators, the N-gain values of 0.29 and 0.133 fell into the low category. These low results were due to limited implementation time and the application's features not yet being optimized to support two-way interaction or group discussions. Additionally, regarding the communication indicator, student activities focused more on conducting lab experiments than on writing reports and engaging in systematic discussions. On the other hand, the control class showed better results in the communication aspect because the conventional discussion approach was more structured.

Overall, the Dynafash app demonstrated effectiveness in improving students' science process skills, particularly in the areas of observation, prediction, and concept application. This medium can serve as a solution for self-directed and collaborative learning, although further development is needed to optimize interpretation and communication in digital learning.

Conclusion

Based on the results of the development and testing of the Dynafash Apps application—built using Smart Apps Creator with a PjBL approach to the topic of dynamic electricity—the following conclusions were drawn:

1. The application's characteristics indicate that the developed learning medium supports project-based learning and reinforces science process skills. Interactive features such as the Ohm's law simulation, practice problems, and exploratory projects can be accessed both in the classroom and independently, in accordance with the flexibility principle of the Merdeka Curriculum.
2. Validation results show that the application has a very high level of feasibility, with a content validation score of 0.875 and a media validation score of 0.886, both falling into the "highly valid" category. Additionally, the results of the student practicality survey reached 84.6%, falling into the "very practical" category. This indicates that the application is suitable for use as a physics learning medium.
3. The application's effectiveness is reflected in the improvement in science process skills among students in the experimental class, who achieved an N-gain score of 0.57 (moderate to high category), compared to 0.30 in the control class. The most significant improvements occurred in the indicators of observation (0.88), prediction (0.84), and concept application (0.70). Although the improvements in the indicators of interpretation (0.28) and communication (0.13) were relatively lower than those of the control class, overall, the app proved effective in supporting meaningful science learning.

Based on the research findings, it is recommended that this Smart Apps Creator-based learning application be further developed so that it can be used on other operating systems, such as iOS. In addition, the approach and application design that have proven effective for dynamic electricity content can be adapted for the development of learning materials on other physics topics. Broader trials over a longer period of time and in schools with different characteristics also need to be conducted to test the app's consistency and effectiveness in various learning contexts.

References

- Anggraeni, M. D., Mucharromah, R., Taqiyya, B. Z., Fadilah, R. E., Mahardika, I. K., & Yusmar, F. (2023). Perkembangan Teknologi dan Komunikasi dalam Pendidikan. *FKIP e-PROCEEDING*, 1-5.
- Asmaidah, S. (2023). Perbandingan Hasil Belajar Fisika Materi Pokok Listrik Dinamis dengan Menggunakan Metode Problem Solving dan Metode Demonstrasi di Kelas X SMA Negeri Padangsidempuan. *JURNAL PhysEdu (PHYSICS EDUCATION)*, 5(1), 42-48.
- Boari, Y., Megavitry, R., Pattiasina, P. J., Ramdani, H. T., & Munandar, H. (2023). The Analysis of Effectiveness of Mobile Learning Media Usage in Train Students' Critical Thinking Skills. *Mudir: Jurnal Manajemen Pendidikan*, 5(1), 172-177.
- Ningsih, I. R., Saraswati, D. L., & Miftah, Z. (2023). Pengaruh Physics Mobile Learning pada Materi Gelombang Bunyi dan Cahaya untuk Mengetahui Kemampuan Berpikir Analisis Siswa. In *SINASIS (Seminar Nasional Sains)*, 4(1).
- Novita, N., Ginting, F. W., Zahara, S. R., Zahara, S. R., Muliani, M., & Ulfa, R. (2024). Pengembangan Modul Getaran Harmonis Berbasis PjBL untuk Meningkatkan Keterampilan Proses Sains Siswa. *OPTIKA: Jurnal Pendidikan Fisika*, 8(1), 176–186. <https://doi.org/10.37478/optika.v8i1.4166>
- Nursidah, Febrian, & Fera, M. (2021). Validitas Aplikasi Mobile Learning Nuansa Budaya Melayu Kepulauan Riau dengan Integrasi Game Edukasi. *Student Online Journal (SOJ) UMRAH-Keguruan dan Ilmu Pendidikan*, 2(2), 1484-1492.
- Purnomo, H., & Ilyas, Y. (2019). *Tutorial Pembelajaran Berbasis Proyek*. Yogyakarta: K-Media.

- Rahayu, A. H. R. N., Hardianto, D., & Rijal, B. S. (2025). Pengembangan Modul Elektronik Interaktif untuk Meningkatkan Minat dan Kemandirian Belajar Informatika di SMK Negeri 1 Pajangan. *Ideguru: Jurnal Karya Ilmiah Guru*, 10(2), 1343–1349. <https://doi.org/10.51169/ideguru.v10i2.1840>
- Rustaman, N. (2007). *Keterampilan Proses Sains*. Bandung: UPI.
- Septiara, D., Murdani, H., & Kurniady, I. (2025). Analisis Desain User Interface (UI) pada Aplikasi iPusnasberdasarkan Teori Dmitry Fadeyev. *Librari: Jurnal Ilmiah Ilmu Perpustakaan*, 1(1).
- Sholiha, I., Faradhillah, F., & Muliani, M. (2023). Pengembangan Media Mobile Learning Berbasis Android Terhadap Pemahaman Konsep Siswa pada Materi Kinematika Gerak Lurus Kelas X SMA Negeri 1 Batang Kuis. *Relativitas: Jurnal Riset Inovasi Pembelajaran Fisika*, 5(2), 92-102.
- Simamora, M., & Winardi, Y. (2024). Pengembangan Media Pembelajaran Smart TV dalam Pengembangan Matematika di Sekolah Menengah Pertama Bekasi. *JOHME: Journal of Holistic Mathematics Education*, 8(1), 75. <https://doi.org/10.19166/johme.v8i1.8228>
- Wiliyanti, V., Latifah, S., Syarlisjisman, M. R., & Kurnia, A. E. (2023). Pengembangan Media Pembelajaran Fisika Berbasis Mobile Learning Berbantuan Smart Apps Creator pada Materi Fluida Dinamis. In *Seminar Nasional Pembelajaran Matematika, Sains dan Teknologi*, 3(1), 129-137.
- Yusa, I. M. M., Priyono, D., Anggara, I. G. A. S., Setiawan, I. N. A. F., Yasa, I. W. A. P., Yasa, N. P. D., & Sutarwiyasa, I. K. (2023). *Buku Ajar Desain Komunikasi Visual (DKV)*. PT. Sonpedia Publishing Indonesia.