

Development of Mobile-Based Science Learning Solar System Application to Improve Student Learning Outcomes

Fieki Hilyah Zamzami¹, Mochamad Desta Pradana², Atika Anggraini³

UIN Syekh Wasil Kediri, Indonesia

fiekihilyah010303@gmail.com; destapradana83@gmail.com

Abstract

This research and development project addresses the issue of low student performance in science, particularly on the topic of the solar system, which is attributed to a lack of engaging and effective learning resources. The primary objective is to evaluate the feasibility and effectiveness of a mobile application-based learning medium in improving student learning outcomes. The study adopts the ADDIE model comprising analysis, design, development, implementation, and evaluation as its methodological framework within the Research and Development (R&D) paradigm. Data were collected through tests and questionnaires, with analysis conducted using parametric t-tests and Likert scales. Validation results indicated high feasibility, with scores of 96.6% for content, 75.8% for media, and 95.94% for user testing involving 30 seventh-grade students. The effectiveness test revealed a statistically significant improvement ($p = 0.000 < 0.005$) between pretest and posttest scores, with an N-Gain score of 0.6742, indicating a moderate effect. These findings demonstrate that mobile-based learning media are both practical and effective in enhancing science instruction on the solar system. The study recommends broader integration of mobile-based tools to enrich interactive learning experiences in science education.

Keywords: Mobile-Based Application Media; Solar System; Science Education; ADDIE Model; Learning Outcomes

INTRODUCTION

Education is the main foundation of the future of the nation and state. If a country has a good and quality education sector, then the quality of the nation will improve over time. Education is not only aimed at knowledge transfer, but also at shaping character, improving skills, and creating a superior next generation (BP et al., 2022). In this context, the learning process is a vital element, especially in the classroom, where direct interaction between teachers and students takes place. However, in reality, there are still many obstacles in the learning process, such as less innovative methods, limited media, and lack of student involvement in learning (Nasution & Salman, 2024).

The results of pre-surveys and interviews with teachers at MTs Miftahul Ulum Gondang show that around 70% of students have difficulty understanding science material, especially on the topic of the solar system. This has an impact on the low average score of students which only reaches 66.83, below the 70 standard. This condition is an indicator of the low effectiveness of continuous learning.

Seeing this reality, the researcher assesses that there is a need for innovative solutions to address the problem. One strategy that can be done is to develop mobile-based learning media, considering that students are currently very familiar with technology, especially mobile devices (Ibad & Sarifah, 2021). Technology-based learning media is considered effective in delivering complex and abstract teaching materials because it is able to present visualization and interactivity (Putra & Negara, 2021).

The use of appropriate mobile-based learning media can make it easier for students to understand abstract concepts, especially in science lessons. Azhar Arsyad (2016) explained that the right learning media can increase the effectiveness of learning by making the material easier to understand. Other research supports this idea, such as that conducted by (Nurhamidah et al., 2022), which shows that Android learning media for solar system material can significantly improve students' mastery of concepts.

A number of other studies also support the development of technology-based learning media. For example, research by (Putri et al., 2021) who developed virtual reality media on solar system material, and (Prafitasari et al., 2024) who created an Android educational game that students love because of their validity and interesting visualization. (Maharani et al., 2024) in their research used Google Sites to improve learning outcomes, while (Adzkiya & Suryaman, 2021) emphasized the effectiveness of digital platforms in

supporting learning at the elementary level. However, there has not been much research that has specifically developed a mobile-based learning application for solar system materials in the madrasah environment, which has its own characteristics and challenges.

This research offers novelty through the development of a mobile-based solar system learning application with interactive features such as animations, videos, quizzes, and two-dimensional (2D) and three-dimensional (3D) visual displays. The app is designed to be used flexibly through mobile devices, making it easier for students to access learning materials anytime and anywhere (Handoyo et al., 2024).

Theoretically, this research refers to cognitive learning theory and constructivism theory (Hasya & Purwowododo, 2024). Cognitive learning theory emphasizes the importance of active processing of information by learners, while constructivism theory suggests that learners should actively build knowledge through interaction with the learning environment. The mobile-based learning media developed in this study is expected to facilitate independent and interactive learning according to the principles of the two theories (Susilowati et al., 2021).

This study centers on the design and evaluation of a mobile-based application for science learning, specifically focused on solar system content, conducted with seventh-grade students at MTs Miftahul Ulum Gondang. The primary objective is to examine the feasibility and effectiveness of the mobile application in enhancing the science learning outcomes of seventh grade students (Mogi et al., 2025). This study employs the Research and Development (R&D) approach, utilizing the ADDIE model, which comprises five sequential phases: Analysis, Design, Development, Implementation, and Evaluation. In the realm of educational media, the ADDIE paradigm is well-known. development for its structured and systematic framework, which supports efficient and effective design processes (Rustandi & Rismayanti, 2021).

With this learning application, it is hoped that students can more easily understand the material of the solar system in a fun and interactive way. This application is also expected to be able to increase learning motivation and provide a more meaningful learning experience. The products developed from this research have the potential to be used more widely as an alternative learning medium in other madrasahs that face similar problems. It is anticipated that this study will significantly advance the science of learning media development and enrich academic literature in the area of teaching science, particularly when

it comes to integrating mobile technologies. The outcomes of this research can be a reference for the development of similar learning media in the future and encourage teachers to be more innovative in developing technology-based learning media according to the needs of students.

METHODS

Using the ADDIE instructional design approach, which consists of the phases of Analysis, Design, Development, Implementation, and Evaluation, this study employs a Research and Development (R&D) methodology as outlined by Branch (2009). The ADDIE model was selected because of its organized, iterative nature and suitability for systematic instructional development within a limited timeframe (Okpatrioka Okpatrioka, 2023). This model also ensures that each stage from needs assessment to product refinement is aligned with the learning objectives and user needs.

This study used a one-group pretest-posttest research design, which is appropriate for assessing changes in learning outcomes before and after the intervention. This design enables the researcher to assess the created learning materials' efficacy using observable changes in student performance.

The research was conducted at MTs Miftahul Ulum Gondang involving 30 seventh-grade students as participants. The sample was selected using purposive sampling, targeting students who are currently studying the solar system material in their science curriculum. The research was carried out over a period of three months, from February to April 2025, covering all stages of media development and assessment.

Tests and questionnaires were used to obtain data. The viability of media was assessed using validation sheets completed by experts, including two lecturers in science education and two science teachers. The instrument validity was examined through content validation by experts, while reliability was tested using Cronbach's Alpha to ensure internal consistency. In addition, student feedback was obtained through small group trials.

The data analysis involved two key approaches: (1) Descriptive analysis of the feasibility scores using Likert scale ratings to determine the level of media validity; and (2) Inferential statistical analysis to determine the media's efficacy. The effectiveness was measured using the Paired Sample T-Test to compare the outcomes of the pretest and

posttest, and learning gain was calculated using Normalized Gain (N-Gain). Software called IBM SPSS Statistics 25 was used to help data analysis..

Through comprehensive methodology, the study aimed to develop and validate an effective mobile-based learning media for the solar system topic in junior high school science education.

RESULTS

Observations and interviews with science teachers at MTs Miftahul Ulum Gondang revealed significant challenges in student comprehension of the solar system topic. Approximately 70% of seventh-grade students scored below the minimum mastery criteria, with average scores under 66.83. The limited availability of instructional media primarily posters and a globe contributed to ineffective classroom engagement. These findings underscored the urgent need for interactive and accessible media to enhance conceptual understanding. The development began by formulating the Instructional Content Framework, aligning learning content with curriculum indicators (Hamidah et al., 2024). A two-dimensional (2D) media design was produced, including pretest-posttest instruments, videos, material summaries, and interactive quizzes. The application was created using PowerPoint and converted into a mobile-based format using iSpring Suite 11, then distributed via barcode for installation.

After the production stage is completed, the next stage is to validate the product by conducting a validity test, which consists of material validation tests, media validation and validation by small classes. The purpose of this validation is to determine whether mobile-based science *learning media* before being tested, so that the developed media can have a good level of feasibility. The data processing technique for the validation questionnaire in this study uses *the Likert Scale*. Berikut is the result of a validity test

Table 1. Validation Results

Statement	R-Count	R- Table	Information
P1	0,893	0,349	Valid
P2	0,870	0,349	Valid
P3	0,745	0,349	Valid
P4	0,688	0,349	Valid
P5	0,864	0,349	Valid
P6	0,780	0,349	Valid
P7	0,676	0,349	Valid
P8	0,780	0,349	Valid
P9	0,539	0,349	Valid
P10	0,790	0,349	Valid
P11	0,602	0,349	Valid
P12	0,652	0,349	Valid

According to the findings of the SPSS-calculated questionnaire validity test, the Pearson correlation value between each question item (P1 to P12) and the total questionnaire score was obtained. All question items showed a significant positive correlation at a significance level of 0.05 or 0.01, which signifies that each item has a strong relationship to the total score and can be considered valid. The correlation value between items with a total score varies from 0.539 to 0.893, with some items such as P1 (0.893), P2 (0.870), and P5 (0.864) showing a very high correlation.

Furthermore, a reliability test was conducted to determine whether the questionnaire could produce consistent results when assessed by more than one person, using Cronbach's alpha. Table 2 below displays the reliability test's findings.

Table 2. Reliability Test Result

Reliability Statistics	
Cronbach's Alpha	N of Items
.933	12

Based on the output of *Cronbach's alpha reliability test*, When the value is more than 0.6, the significance value is known to be 0.933. which means that the questionnaire as a whole is declared reliable or consistent.

Furthermore, the assessment conducted by media experts aims to evaluate the feasibility of mobile-based science *learning media* in terms of media design. Media expert validators provide assessments through validation questionnaires that include aspects of presentation, display design, language, and user convenience. The validation assessment by

media experts on this learning media product was carried out by two validators, namely a science lecturer from IAIN Kediri as validator 1, and a science teacher from MTs Miftahul Ulum Gondang as validator 2. The following table displays the findings of two media experts' evaluations of the mobile-based science learning materials:

Tabel 3. Data Analysis of Design and Media Validation Results

No	Assessment indicators	Validator score	
		V1	V2
1	Use of buttons	3	3
2	Text type and size	4	4
3	Color composition	4	4
4	Photo, image, and graphic quality	4	4
5	Video or audio quality	4	4
6	Animation quality	4	4
7	Ease of language understanding	4	4
8	The cover design appeals to users	4	4
9	Clarity of instructions and rules of use	4	4
10	Ease of operation of the product from preparation to completion	4	4
11	Ease of storage	3	3
12	Mobile-based science learning apps are easier to use	3	4
Total score		45	46
Percentage Eligibility Score		75%	76,6%
Average		75,8%	
Category		Feasible	

Calculation of material expert qualification 1:

$$P = \frac{45}{60} \times 100\% \\ = 75\%$$

Calculation of material expert qualification 2:

$$P = \frac{46}{60} \times 100\% \\ = 76,6\%$$

The findings of the feasibility study of science education materials based on mobile devices by media experts I were 75%, while the assessment by media experts II reached 76.6%. Thus, the average feasibility value of mobile-based science learning media is 75.8%, which meets the "Feasible" criteria.

After the media validation stage, a material expert validation stage is conducted with the goal of evaluating the feasibility of the material that has been developed in mobile-based science *learning media*. The assessment was carried out using a material validation sheet, which included elements of independent learning capacity, presentation feasibility, language feasibility, and topic feasibility. The validation assessment by material experts on this learning

media product was carried out by two validators, namely a science lecturer from IAIN Kediri as validator 1, and a science teacher from MTs Miftahul Ulum Gondang as validator 2. The following table displays the findings of the two validators' validation of mobile-based science learning materials by subject matter experts:

Table 4. Data Analysis of Material Validation Results

No	Assessment indicators	Validator score	
		V1	V2
1	The content's match with the curriculum	5	5
2	Content appropriateness in relation to learning objectives	5	5
3	The content's match with the learning objectives	5	5
4	The depth of the material presented	4	5
5	Materials according to the student's ability level	5	5
6	Adequacy of further explanatory material	4	4
7	Adequacy of the material's presentation and sequence	5	5
8	Appropriateness of the use of the language used	5	5
9	The language is simple to figure out.	5	5
Total score		43	44
Percentage Eligibility Score		95,5%	97,7%
Average		96,6%	
Category		Highly feasible	

Calculation of material expert qualification 1:

$$P = \frac{43}{45} \times 100\% \\ = 75\%$$

Calculation of material expert qualification 2:

$$P = \frac{44}{45} \times 100\% \\ = 76,6\%$$

The findings of the evaluation of science learning resources on mobile devices by subject matter experts I were 95.5%, while the assessment by subject matter experts II reached 97.7%. Thus, the average value of mobile-based science learning media is 96.6%, which meets the criteria or "Very Feasible".

Small class trials are used as user validation before the media is implemented in large classes. This small class test was conducted by five students of grade VII MTs Miftahul Ulum Gondang to assess the feasibility of the created media that has been revision by media and technology masters as well as material masters. The outcomes of the five students' assessment are as follows:

Table 5. Analysis Results from Validation Recapitulation by Users I, II, III, IV and V

No.	Indicator	R1	R2	R3	R4	R5
1.	Mobile-based solar system app is easy to use	5	5	5	5	5
2.	Easy-to-read font size and typeface	4	5	5	5	5
3.	Attractive design	4	5	4	4	4
4.	Use of easy-to-understand language	5	5	5	4	4
5.	The images presented are clear and simple to figure out	5	5	5	5	5
6.	The videos presented are clear and Simple to figure out	5	5	5	5	5
7.	Clarity of material and easy to understand	5	4	5	4	5
8.	Interactive quizzes presented are interesting	4	5	5	5	5
	The material presented is clear and complete	5	4	5	5	4
10.	The activities in the mobile-based solar system app are clear and easy to understand	5	5	5	5	4
11.	Interactive quizzes on mobile-based solar system apps help students gauge material comprehension	5	5	5	5	5
12.	Animation or simulation features in mobile-based solar system apps clarify the concepts taught	5	5	5	5	5
13.	Navigation in mobile-based solar system apps is easy to understand	4	5	5	5	5
14.	The material presented in the mobile-based solar system application increases motivation in learning science	5	5	5	5	5
15.	Ease of use of media for learning	5	5	5	4	5
Total score		71	73	74	71	71
Percentage Eligibility Score		94,6%	97,3%	98,6%	94,6%	94,6%
Average		95,94%				
Category		Highly feasible				

The feasibility assessment's results of mobile-based science learning media by user I were 94.6%, the assessment by user II reached 97.3%, the assessment by user III reached 98.6%, the assessment by user IV reached 94.6%, while the assessment by user V reached 94.6%. Thus, the average feasibility value of mobile-based science learning media is 95.94%, which meets the "Very Valid" criterion.

To measure the effectiveness value of a product, researchers use normality tests that aim to test whether a data is distributed normally or not. The researcher conducted a normality test on the grade VII students' findings from the pretest and posttest utilizing the Shapiro-Wilk formula through the IBM SPSS Statistics 25 for Windows tool.. The According to the calculation results, the grade VII Pretest and posttest results for the pupils were 0.135 and 0.231, respectively were distributed normally at the $p \geq 0.05$ level of significance. The

table below displays the findings of the normality test of the pretest and posttest score data for the seventh-grade students.

Table 6. Normality Test Results

Tests of Normality							
	Kode	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Nilai	Nilai Pre Test	.124	30	.200*	.946	30	.135
	Nilai Post Test	.138	30	.151	.955	30	.231
*. This is a lower bound of the true significance.							
a. Lilliefors Significance Correction							

This are referred to that the pretest and posttest data of seventh-grade pupils are distributed normally according to the normalcy test results that was conducted. Therefore, the data can be proceeded to the next stage, namely hypothesis testing analysis. Hypothesis testing in this study, the researcher used the T-test for paired samples. Finding out whether there is a notable distinction between the average pretest score (before using media) and posttest score (after using media) is the aim of Pretest and posttest results from the Paired Sample T-Test hypothesis test data of grade VII students using mobile-based science learning media on Solar System material. The IBM SPSS Statistics 25 for Windows program was employed to calculate the scores for the pretest and posttest. of seventh-grade pupils in order to administer the T-test for paired samples. The results of the hypothesis test using the Paired Sample T-Test on the pretest and posttest These are the data:

Table 7. Results of the t test

Paired Samples Test									
Pair		Mean	Std. Deviation	Std. Error Mean	9 % Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
					1	Pre_Test - Post_Test			

A significance value of 0.00, indicating a significant difference between the two, was less than 0.05 The output paired samples t test was used to identify the pre test and post-test data.

The normality test of gain or N-Gain in data analysis is used to evaluate Whether student learning results have improved. assess the efficiency of the application of a treatment in research. The normality test of score gain is carried out by calculating the Pretest and posttest score differences. From this calculation of the difference, we can determine whether the use of media can be considered effective or not. The following are the N-Gain test findings for the pretest and posttest data:

Table 8. N-Gain Test Results

Statistics		
NGain_Score		
N	Valid	30
	Missing	30
Mean		0.6742
Minimum		0.22
Maximum		1.00

The average result of the NGain test is 0.6742, as shown in table 4.19. This value falls between 0.3 and 0.7, indicating that The adoption of mobile-based science learning resources has a substantial impact on the medium category..

DISCUSSION

The outcomes of the investigation reveal the potential for the created mobile-based science learning resources in terms of both content and media, as well as their ability to enhance students' learning outcomes regarding solar system-related subjects. In the "very feasible" and "feasible with minor revisions" categories, the percentages for material specialists and media experts were 96.6% and 75.8%, respectively. The pretest and posttest results, which indicated a substantial increase ($p < 0.05$), with an average N-Gain value of 0.6742. that fell into the medium group, supported these findings. Furthermore, with a Cronbach's Alpha score of 0.933, the questionnaire instrument utilized in this study exhibits great reliability. These results demonstrate that the created medium is not only practical to use but also successful in helping students understand abstract concepts like the solar system.

The findings in this study are also strengthened by previous literature and research (Nurhamidah et al., 2022) which asserts that Android-based instructional media can enhance pupils' conceptual understanding. in solar system materials. Research (Darojat et al., 2022) that developed media for virtual reality also found that interactive visualizations can help

students in recognizing the solar system concept in greater detail. In line with that, (Putra & Negara, 2021) states that mobile-based interactive multimedia can enrich students' science learning experience. In addition, (Mogi et al., 2025) show that the utilization of visual materials like pop-up books is very effective in conveying solar system material to elementary school students. (Maharani et al., 2024) also added that Google Sites-based interactive media is able to improve learning outcomes in abstract physics material. These findings are in line with research by (Adzkiya & Suryaman, 2021) which shows that the use of digital media such as Google Sites can improve student activities and learning outcomes. Research by (Hikmah & Yermiandhoko, 2022) and (Hapsari & Yuda, 2022) also affirms that Android and mobile-based media are beneficial for elementary school education.

In terms of implications, The research findings show that integrating mobile-based learning resources into science education can be an innovative and effective method, particularly when it comes to abstract subjects like the solar system. Mobile-based media allows for the flexibility of access and self-paced learning that is in line with the characteristics of 21st-century learning (Hamidah et al., 2024) . As stated by (Iskandar et al., 2024) , Making use of digital media, such as mobile applications and technology-based platforms, can boost student engagement and make studying more pleasurable. Furthermore, studies carried out (Rosmiati et al., 2023) shows that media with ADDIE-based interactive animations can increase students' motivation to learn. Research by (Anafi et al., 2021) using Unity 3D as learning media development software also proves that technology-based media integration increases learning effectiveness.

However, this study has several limitations that need to be examined. First, application development is still limited to one learning topic, namely the solar system. This makes generalizations to other science materials still limited. Second, the media trial was only carried out at one level and one institution, namely class VII MTs Miftahul Ulum Gondang, so the scope of external validity of this study was not optimal. Third, the app was developed for the Android platform only, while it is not yet available in the iOS version or the web version, which limits accessibility for all users. Fourth, the limited mobile device facilities and digital literacy of students are also challenges in the implementation of this media in different educational environments (Tasmiyah et al., 2023).

Despite its limitations, This study continues to have a major influence on the development of technology-based education materials. This study confirms that mobile-

based media with the integration of visualization, interactivity, and flexibility of access can increase the effectiveness of science learning. As stated by (Oktafia & Fitriyati, 2024) , learning media designed with a gamification approach and digital technology can significantly rise pupils' interest and learning outcomes. This is in line with the idea of (Depita, 2024) that today's education must be responsive to technological developments and the needs of students.

Thus, It is expected that the findings of this study will provide the basis for the creation of comparable educational materials in the future, as well as encourage teachers and developers to continue to create technology-based learning innovations that are relevant, adaptive, and contextual.

CONCLUSION

This study comes to the conclusion that the mobile-based science learning application created for the solar system topic is both practical and efficient for usage in Grade VII classrooms, based on the formulation of the research problems and the outcomes of data analysis. The medium's validity and suitability for educational use were confirmed by the media validation procedure, which produced a material expert score of 96.6%, a media expert score of 75.8%, and a user trial score of 95.94%.

The effectiveness of the application was further supported by quantitative analyses. The results of this study of the pretest and posttest indicated that student performance had significantly improved, and the A score of 0.6742 for N-Gain indicated a moderate level of learning gain. These results demonstrate students benefit from mobile-based learning resources comprehension of abstract scientific content, particularly in the context of the solar system.

This study advances the field of scientific education by offering factual support for the successful integration of mobile-based applications in the classroom, aligned with the ADDIE development model. It serves as a reference for future educational media development, particularly in resource-limited school environments.

Future research should consider expanding the scope to other science topics and involving larger, more diverse populations to enhance the generalizability of findings.

Furthermore, comparative studies between mobile-based media and other digital platforms could offer deeper insights into their relative effectiveness in improving learning outcomes.

REFERENCES

- Adzkiya, D. S., & Suryaman, M. (2021). Penggunaan Media Pembelajaran Google Site dalam Pembelajaran Bahasa Inggris Kelas V SD. *Educate : Jurnal Teknologi Pendidikan*, 6(2), 20. <https://doi.org/10.32832/educate.v6i2.4891>
- Anafi, K., Wiryokusumo, I., & Leksono, I. P. (2021). PENGEMBANGAN MEDIA PEMBELAJARAN MODEL ADDIE MENGGUNAKAN SOFTWARE UNITY 3D. <https://journal.ipts.ac.id/index.php/ED/article/view/3206>
- BP, A. R., Munandar, S. A., Fitriani, A., Karlina, Y., & Yumriani. (2022). PENGERTIAN PENDIDIKAN, ILMU PENDIDIKAN DAN UNSUR-UNSUR PENDIDIKAN. *Al Urvatul Wutsqa: Kajian Pendidikan Islam*, 2(1), 1–8. <https://journal.unismuh.ac.id/index.php/alurwatul>
- Darojat, M. A., Ulfa, S., & Wedi, A. (2022). PENGEMBANGAN VIRTUAL REALITY SEBAGAI MEDIA PEMBELAJARAN SISTEM TATA SURYA. *JKTP: Jurnal Kajian Teknologi Pendidikan*, 5(1), 91–99. <https://doi.org/10.17977/um038v5i12022p091>
- Depita, T. (2024). Pemanfaatan Teknologi Dalam Pembelajaran Aktif (Active Learning) Untuk Meningkatkan Interaksi dan Keterlibatan Siswa. *TARQIYATUNA: Jurnal Pendidikan Agama Islam Dan Madrasah Ibtidaiyah*, 3(1), 55–64. <https://doi.org/10.36769/tarqiyatuna.v3i1.516>
- Hamidah, F. I., Suriswo, S., & Kusrina, T. (2024). Pengembangan Bahan Ajar IPAS Model Discovery Learning untuk Meningkatkan Hasil Belajar. *Journal of Education Research*, 5(3), 3199–3206. <https://doi.org/10.37985/jer.v5i3.1423>
- Handoyo, T., Ashriyah, I., & Kamal, R. (2024). Pengembangan Bahan Ajar Berbasis Multimedia. *Harmoni Pendidikan: Jurnal Ilmu Pendidikan*, 2(1), 230–250. <https://doi.org/10.62383/hardik.v2i1.1064>
- Hapsari, E. D., & Yuda, Y. P. (2022). EFEKTIVITAS PENGGUNAAN MEDIA PEMBELAJARAN MENULIS AKSARA JAWA BERBASIS MOBILE TERHADAP PRESTASI SISWA. *EDUSAINTEK: Jurnal Pendidikan, Sains Dan Teknologi*, 9(2), 351–361. <https://doi.org/10.47668/edusaintek.v9i2.475>
- Hasya, S. A., & Purwowododo, A. (2024). Pengembangan Bahan Ajar Berbasis Ensiklopedia Ilmu Pengetahuan Sosial Pada Materi Kegiatan Ekonomi Untuk Meningkatkan Hasil Belajar Siswa SD NU Insan Cendekia Ngadiluwih Kediri. *The Elementary Journal*, 2(1), 11–21. <https://doi.org/10.56404/tej.v2i1.87>
- Hikmah, H., & Yermiandhoko, Y. (2022). PENGEMBANGAN MEDIA PEMBELAJARAN MAKIBAJA BERBASIS ANDROID MATERI AKSARA JAWA UNTUK SISWA KELAS IV SEKOLAH DASAR *Habibatul Hikmah Yoyok Yermiandhoko*. <https://ejournal.unesa.ac.id/index.php/jurnal-penelitian-pgsd/article/view/46159>

- Ibad, T. N., & Sarifah, M. (2021). Penggunaan Media Realia dalam Meningkatkan Pengalaman Belajar Siswa. *Bidayatuna Jurnal Pendidikan Guru Mandrasah Ibtidaiyah*, 4(2), 232. <https://doi.org/10.54471/bidayatuna.v4i2.1303>
- Iskandar, M. Y., Aisyah, S., & Novrianti. (2024). PENGEMBANGAN COMPUTER BASED TESTING MENGGUNAKAN APLIKASI KAHOOT! UNTUK EVALUASI PEMBELAJARAN. *JURNAL KEPEMIMPINAN & PENGURUSAN SEKOLAH*, 9(2), 218–226. <https://doi.org/10.34125/jkps.v9i2.493>
- Maharani, P. A., Risdianto, E., & Setiawan, I. (2024). Pengembangan Media Pembelajaran Interaktif Berbantuan Google Sites untuk Meningkatkan Hasil Belajar Siswa pada Materi Momentum dan Impuls. *Jurnal Penelitian Pembelajaran Fisika*, 15(1), 31–42. <https://doi.org/10.26877/jp2f.v15i1.17458>
- Mogi, T., Kua, M. Y., Rewo, J. M., & Lawe, Y. U. (2025). Pengembangan Media Pembelajaran Pop Up Book pada Mata Pelajaran IPAS dengan Materi Sistem Tata Surya untuk Siswa Kelas V SDI Mengeruda. *JagoMIPA: Jurnal Pendidikan Matematika Dan IPA*, 5(1), 210–222. <https://doi.org/10.53299/jagomipa.v5i1.1118>
- Nasution, L., & Salman. (2024). PENGARUH TEKNOLOGI PADA DUNIA PENDIDIKAN. *Progressive of Cognitive and Ability*, 3(1), 34–42. <https://doi.org/10.56855/jpr.v3i1.868>
- Nurhamidah, S. D., Sujana, A., & Karlina, D. A. (2022). PENGEMBANGAN MEDIA BERBASIS ANDROID PADA MATERI SISTEM TATA SURYA UNTUK MENINGKATKAN PENGUASAAN KONSEP SISWA. *Jurnal Cakrawala Pendas*, 8(4), 1318–1329. <https://doi.org/10.31949/jcp.v8i4.3190>
- Okpatrioka Okpatrioka. (2023). Research And Development (R&D) Penelitian Yang Inovatif Dalam Pendidikan. *Dharma Acariya Nusantara: Jurnal Pendidikan, Bahasa Dan Budaya*, 1(1), 86–100. <https://doi.org/10.47861/jdan.v1i1.154>
- Oktafia, M. A., & Fitrayati, D. (2024). PENGEMBANGAN MEDIA PEMBELAJARAN ULAR TANGGA BERBASIS GAMIFIKASI PADA MATA PELAJARAN EKONOMI. *Jurnal Pendidikan Ekonomi (JURKAMI)*, 9(1), 33–42. <https://doi.org/10.31932/jpe.v9i1.3236>
- Prafitasari, A. N., Kurniawati, L. S., & Dewi, J. A. (2024). Kreasi game Android tata surya: Menarik, valid, dan disukai siswa sekolah menengah pertama. *DWIJA CENDEKIA: Jurnal Riset Pedagogik*, 8(1), 149. <https://doi.org/10.20961/jdc.v8i1.85960>
- Putra, W. P., & Negara, I. G. A. O. (2021). Pengembangan Multimedia Sistem Tata Surya pada Muatan IPA. *Mimbar Ilmu*, 26(1), 108. <https://doi.org/10.23887/mi.v26i1.32183>
- Putri, N. K., Yuberti, Y., & Hasanah, U. (2021). Pengembangan media pembelajaran berbasis web google sites materi hukum Newton pada gerak benda. *Physics and Science Education Journal (PSEJ)*, 133–143. <https://doi.org/10.30631/psej.v1i3.1033>
- Rosmiati, M., Sulistiyah, S., Farabi, N. A., & Susanti, S. (2023). Pengembangan Animasi Interaktif Sebagai Media Pembelajaran Kebudayaan Indonesia Dengan Model ADDIE. *MULTINETICS*, 9(1), 79–88. <https://doi.org/10.32722/multinetics.v9i1.5846>

- Rustandi, A., & Rismayanti. (2021). Penerapan Model ADDIE dalam Pengembangan Media Pembelajaran di SMPN 22 Kota Samarinda. *JURNAL FASILKOM*, 11(2), 57–60. <https://doi.org/10.37859/jf.v11i2.2546>
- Susilowati, A. Y., Sayekti, I. C., & Eryani, R. (2021). Penerapan Media Realia untuk Meningkatkan Motivasi Belajar Siswa Pada Siswa Sekolah Dasar. *Jurnal Basicedu*, 5(4), 2090–2096. <https://doi.org/10.31004/basicedu.v5i4.1160>
- Tasmiyah, T., Rusmawati, R. D., & Suhari, S. (2023). Pengembangan Bahan Ajar Berbasis Web Google Sites Materi Stoikiometri dengan Model ADDIE. *JIIP - Jurnal Ilmiah Ilmu Pendidikan*, 6(12), 9799–9805. <https://doi.org/10.54371/jiip.v6i12.2889>