Development of Interactive Learning Media Based on Smart Apps Creator to Enhance Elementary School Students' Science Learning Outcomes

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Abstract: This study aims to develop and test the feasibility and effectiveness of interactive media based on Smart Apps Creator to improve student learning outcomes in the subject of Integrated Natural and Social Sciences (IPAS) on energy transformation material. The study involves research and development (R&D) using the ADDIE model. Expert validation for the content and media was 92.8 and 93%, which falls into the very feasible/valid category. The average improvement in student learning outcomes before and after using the Smart Apps Creator-based learning media, measured using the N-gain test, was 0.667, which falls into the moderate category. Teacher and student responses were 100 and 96.4%, respectively, falling into the very practical category. Therefore, the Smart Apps Creator-based learning media is feasible, effective, and practical for teaching to improve student learning outcomes in the subject of IPAS on energy transformation material.

Keywords: Learning media; R&D; Smart apps creator

Introduction

The advancement of time is accompanied by rapid technological development in various fields. In the field of education, technology plays a significant role in enhancing educational quality. One way to improve the quality of education through technology is by using interactive learning tools in the classroom (Maritsa et al., 2021; Pratama & Rahman, 2023). This is in line with Lestari (2018) who suggested examples of technology implementation in education, including learning media, administrative tools, and learning resources. Internet-based learning media, such as web learning, e-learning, or online learning (distance learning), are examples of this implementation; other examples of media using technology include radio, television, video, and interactive presentation devices like electronic whiteboards (Lestari, 2018).

Integrated Natural and Social Sciences (IPAS) is a distinctive feature of the Merdeka Curriculum, which has been implemented in Indonesia since 2022 (Rahmayati & Prastowo, 2023). IPAS is the integration of Natural Sciences (IPA) and Social Sciences (IPS). IPAS is a scientific discipline that studies the interactions between living and non-living objects in the cosmos and the individual and social aspects of human existence, researching the individual and societal aspects of human existence and how they interact with their environment (Kemendikbud, 2022). Subjects in the Merdeka Curriculum aim to develop inquiry skills, self-awareness, and an understanding of the environment, thereby enhancing students' knowledge and concepts in learning. IPAS helps students cultivate their curiosity about phenomena occurring around them (Sugih et al., 2023). Before conducting learning activities, teachers need to prepare instructional materials similar to other subjects. These materials include teaching modules, learning materials, instructional media, student worksheets, and assessment instruments. Due to ongoing developments and changes, teachers are

required to use technology as an effective learning medium (Rahmadhani et al., 2021).

Learning media is a crucial element in the learning process (Ediyani et al., 2020). The presence of learning media helps teachers deliver material effectively, creating an environment of active learning (Legina & Sari, 2022). Utilizing learning media in the learning process can increase motivation, spark new interests, and potentially influence students' psychological engagement with learning (Wulandari et al., 2023). Leaning media is essential for helping students understand lesson concepts, as elementary school students are still in the concrete operational thinking stage (Dita et al., 2021). Research by Samosir et al. (2023) found that character education-based interactive learning media can improve learning outcomes in Indonesian language lessons and is effective for implementation in the classroom. Digital learning media can be used to enhance basic literacy skills in elementary school students (Devi & Rusdinal, 2023). According to Hidayati et al. (2024) instructional media can enhance students' creativity and critical thinking skills.

Based on interviews and observations with fourth-grade teachers at Wonosari 01 State Elementary School, it was found that learning activities had not been running optimally. The use of learning media is still less interesting and varied. Teachers have difficulty developing varied and interesting learning media due to limited time and money. As a result, students tend to get bored during learning. In addition, students have difficulty understanding the material presented by the teacher, especially in the IPAS subject of energy transformation material so learning outcomes are still not as expected. Based on the needs questionnaire distributed to teachers and students, the results obtained by teachers and students need interesting and varied learning media to make students interested and excited when participating in learning activities.

Technology-based learning media that can be used to create interesting, interactive, and innovative learning activities can be created using Smart Apps Creator 3. This software can create interactive media whose results can be synchronized with Android or published on Google Play and can create HTML 5 interactive web pages and Windows EXE files (u-Smart Technology Corporation Limited, 2016). Smart Apps Creator is a desktop application used to create IOS applications without programming code (Sagala & Simanungkalit, 2022). Within Smart Apps Creator there are features to add backgrounds, text, images, videos, music, and interactivity. One of the advantages of using Smart App Creator is its ease of use so that people who do not have programming skills can still design good and interesting mobile applications virtually (Aristia et al., 2023). It is in line with Dewi et al. (2021) this application's user-friendliness facilitates users' creation of learning media. Meanwhile, Jaiz et al. (2022) students can control learning independently and will provide feedback, so that, with this, students will be encouraged to gain knowledge. Syadida & Erita (2022), her research stated that Smart Apps Creator-based learning media is practically used in integrated thematic learning for grade IV elementary schools. While in the study of Septiani & Zakaria (2022) android learning media using SAC can increase student interest in learning. Media SAC-based learning media local wisdom of the Mantingan Jepara Mosque can improve the understanding of the concept of building space in elementary school (Latif et al., 2021).

Learning media as one of the components of learning activities must follow the characteristics and needs of students. Based on the existing problems, this research is needed to develop interesting, interactive, and innovative learning media. Therefore, this study aims to develop and assess the feasibility and effectiveness of interactive media utilizing Smart Apps Creator to enhance students' learning outcomes in the IPAS subject of energy transformation material.

Method

This type of research is known as research and development (R&D). Research and development is a method aimed at producing a product that is then tested for effectiveness. The development model used is referred to as the ADDIE model, which stands for Analyze, Design, Development, Implementation, and Evaluation.
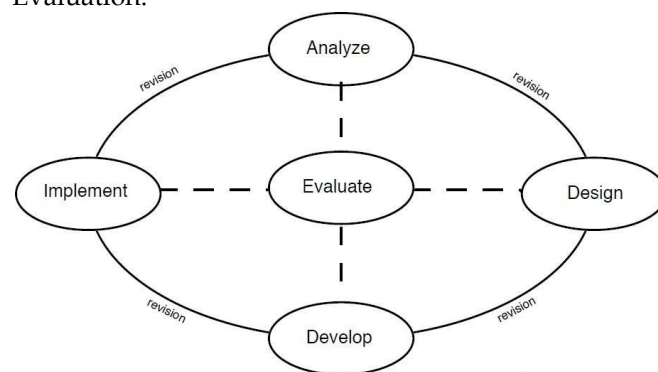
Figure 1. The ADDIE Development Model (Sugiono, 2019)

This research was carried out at Wonosari 01 State Elementary School in Semarang City during the 2023/2024 academic year. The research subjects consisted of material and media expert validators; fourth-grade students totaling 21 students; and fourth-grade teachers of Wonosari 01 State Elementary School in Semarang City. The research procedure starts from the analysis stage. Researchers analyzed to find out the

problems and needs in learning activities. During the second stage, the researcher designs the product to be developed. These products will be created based on the findings of the problem and needs analysis. In the third stage of development, researchers develop Smart Apps Creator-based learning media products that have been designed previously, then validate them to experts to assess feasibility. The fourth stage of implementation, namely implementing products that have been developed and validated by experts to students in learning activities. Implementation is done to test the effectiveness of Smart Apps Creator-based learning media. The fifth stage of evaluation involves assessing the process and outcomes of developing learning media using Smart Apps Creator.

Data collection techniques used to test (pretest and posttest) and non-test (observation, interview, and questionnaire) techniques. The pretest was conducted at the first meeting before the learning process, while the posttest was conducted at the end after learning. The pretest and posttest consisted of 25 multiple-choice questions that had gone through validity tests, reliability tests, difficulty tests, and differentiation tests.

This research involves both qualitative and quantitative data analysis techniques. Qualitative data analysis was conducted by examining the results of observations, interviews, and expert validator suggestions, while quantitative analysis of the expert validation result of the instruments of material experts and media experts and the value of the results of the post-test pretest after learning (Aristaria et al., 2024). Feasibility assessment is carried out by validation by material and media experts using a Likert scale with alternative answers 1-4 according to Sugiono (2016). The Likert scale can be seen in Table 1.

Table 1. Likert scale

Score	Categories
4	Very good
3	Good
2	Fair
1	Poor

Table 2. Categories of material and media feasibility

Percentage (%)	Categories
0-20	Very infeasible/Invalid
21-40	Infeasible/Invalid
41-60	Sufficiently feasible/Valid
61-80	Feasible/Valid
80-100	Very feasible/Valid

The material and media feasibility categories according to Riduwan in Hakiki et al. (2022) can be seen in Table 2. The effectiveness of media will be assessed by

analyzing the pretest and posttest results using SPSS. The N-gain test formula and value categories is based on Hake in Aristaria et al. (2024). The N-gain formula can be seen in Equation 1.

$$< g \geq= \frac{S_{postest} - S_{pretest}}{S_{maximum} - S_{pretest}} \qquad (1)$$

Table 3. N-gain value categories

Value	Categories
$g \geq 0.7$	High
$0.3 \leq g < 0.7$	Medium
$g < 0.3$	Low

The assessment of media practicality was analyzed from teacher and student responses using a Gutman scale with alternative answers "yes" or "no". Categories of media practicality according to Riduwan in Elviana & Julianto (2022) can be seen in Table 4.

Table 4. Categories of media practicality

Percentage (%)	Categories
0-20	Not practical
21-40	Less practical
41-60	Practical enough
61-80	Practical
80-100	Highly practical

Result and Discussion

This research and development procedure follow the ADDIE development model, which includes 5 stages: Analysis, Design, Development, Implementation, and Evaluation.

Analysis

Table 5. Results of teacher and student needs questionnaires

Respondents	Percentage (%)	Categories
Teacher	86	Urgently needed
Students	84.6	Urgently needed
Average	85.3	Urgently needed

At this stage, analysis is carried out to analyze the problems and needs required during learning (Ningsih et al., 2024). Data collection is analyzed through observation, interviews, and questionnaires. Analysis of the problems obtained from observations and interviews with fourth-grade teachers of Wonosari 01 State Elementary School is that students often feel bored because the use of learning media is still less interesting and varied resulting in unsatisfactory student learning outcomes, especially in the subject of IPAS energy transformation material. The development of interesting

and innovative learning media cannot be done by teachers due to limited time and money. In addition to observations and interviews, researchers distributed needs questionnaires to teachers and students. The results of the questionnaire analysis of teacher and student needs for learning media can be seen in Table 5.

The table of questionnaire results of student and teacher needs shows the needs of teachers and students for learning media that are interesting, interactive, and varied by 86 and 84.6%. Based on these percentages, teachers and students need the development of Smart Apps Creator-based learning media in IPAS subjects on energy transformation material.

Design

Researchers designed learning media to be developed according to problem and needs analysis. The media design begins with compiling the material to be presented and creating a media design. The material to be presented is energy transformation, divided into types of energy and examples of energy transformation in the surrounding life. Next, researchers create a display design and add navigation buttons, images, and text using Canva software.

Development

Figure 2. Opening page

Figure 3. Main menu page

Figure 4. Hint button page

Figure 5. Learning Objectives page

Figure 6. Material menu page

Figure 7. Quiz menu page

The media design created at this stage has now been developed into a complete product. The development of the Smart Apps Creator-based learning media is done using Smart Apps Creator 3 software. This application is incredibly user-friendly, and its features are simple

enough to grasp, allowing users' ideas to come through in the creation of educational materials. The results of media development can be found in Figures 2 to 7.

Feasibility of the Media

After product development, researchers conducted validation to assess the feasibility of interactive learning media based on Smart Apps Creator. Validation was carried out by material expert validators to determine the feasibility of energy transformation material according to student needs and media expert validators to determine the feasibility of media. The results of expert validation are shown in Table 6.

Table 6. Material and media expert validation results

Respondent	Percentage (%)	Categories
Material expert validation	92.8	Very feasible/Valid
media expert validation	93	Very feasible/Valid
Average	92.8	Very feasible/Valid

Table 6 shows the results of material and media expert validation. The material validation results of 92.8% are included in the very feasible category while the media validation results of 93%, are in the very feasible category. In line with Ni'mah & Zutiasari (2023) research which shows that the percentages of 92 and 94.6% are very feasible criteria. Following previous research conducted by Mulyoto et al. (2022) smart Apps Creator learning media on biodiversity material is very feasible to be tested on students with material and media validator results of 80 and 86%. Another study conducted by Handayuni & Zainil (2023) also showed that the validation results were highly valid. Based on this, the interactive media based on Smart Apps Creator is feasible and valid to be tested with some revisions to make the media better.

Revision of Media

Figure 8. Material menu page before revision

Figure 9. Material menu page after revision

Figure 10. Material page before revision

Figure 11. Material page after revision

Figure 12. Quiz menu page before revision

Figure 13. Quiz menu page after revision

Researchers revised the learning media based on suggestions from expert validators. Suggestions from material experts, on the material and quiz menu, sub-menus are made to access material and quizzes on types of energy and examples of energy transformation around. The material validator also gave suggestions to add pictures related to the material. The media revision results are shown in Figures 8 to 13.

Implementation

At this stage, the product that has been developed and validated by expert validators is then tested on teachers and students. The implementation was carried out in class IV of Wonosari 01 State Elementary School in Semarang City with 21 students as respondents. Before and after learning, students were given pretest-posttest questions. The pretest and post-test questions consisted of 25 multiple-choice questions. Teachers and students were then given a response questionnaire after learning using Smart Apps Creator-based learning media. The average results of the post-test scores can be seen in Table 7.

Based on the results of the paired sample t-tests, there is a significant difference in learning outcomes from the pretest and posttest. This can be seen from the significance value (2-tailed) of 0.000. The significance level is < 0.005. The last step of the researcher conducted the N-gain test to find the magnitude of the increase in IPAS learning outcomes after the use of Smart App.

Table 7. Student pretest and post-test results

Total Respondents	Test	Average
21	Pretest	53.6
	Posttest	83.0

Table 7 shows the average results of the pretest and posttest of 21 students. The average pretest score obtained was 53.6 while the average posttest score obtained was 83. Based on the table, there is an increase in pretest and posttest scores.

Effectiveness of the Media

Researchers conducted a normality test, paired sample t-test, and N-gain test to evaluate the effectiveness of Smart Apps Creator-based learning media on student learning outcomes. Before analyzing the data, it's important to conduct a test to see if the data is normally distributed. In this study, the Shapiro-Wilk test formula was used for the normality test because the sample size was less than 50. The test results for normality are shown in Table 8.

Table 8. Normality test results

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest	.123	21	.200*	.940	21	.222
Posttest	.198	21	.031	.920	21	.088

Table 8 shows the results of the normality test of pretest and posttest scores in the Shapiro-Wilk column with significance results of 0.222 and 0.088. Based on these scores, the significance results are > 0.005 (5% significance level), so the pretest and posttest data are normally distributed. In the second step, researchers conducted a Paired sample t-test test to see the difference in the average pretest and post-test. Paired sample t-test results of pretest and posttest can be seen in Table 9.

Table 9. Paired sample t-test results

		Paired Differences						t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference					
					Lower	Upper				
Pair 1	Pretest - Posttest	-29.09524	6.84036	1.49269	-32.20893	-25.98155		-19.492	20	.000

Creator-based learning. The result of the N-gain test can be viewed in Table 10. Table 10 shows the results of the N-gain test, it has been established that the average improvement in student learning outcomes before and after utilizing Smart Apps Creator-based educational media is 0.667. including the moderate category. So, the Smart Apps Creator-based learning media is effective for improving student learning outcomes in the IPAS subject matter of energy transformation. In previous research, it was discovered that the utilization of Smart Apps Creator-based educational materials had a positive effect on enhancing student academic performance (Muzakkir et al., 2022; Nurmila et al., 2023; Sutrisni et al., 2022). A study conducted by Jatmiko et al. (2023) obtained the results of the development of learning media based on Android Smart Apps Creator effective for improving learning motivation and understanding of students' science concepts. At the same

time, Widiyatmoko et al. (2021) research shows that android-based learning with smart apps creator effectively improves the critical thinking skills of elementary school students.

Table 10. N-gain test result

	Min	Max	Mean	Std. Deviation
N-Gain	.37	1.00	.6676	.15161
Valid N (listwise)				

Practicality of the Media

Media practicality is seen from the results of teacher and student response questionnaires after learning. The recap of student and teacher responses can be seen in Table 11.

Table 11. Recap of student and teacher responses

Respondent	Percentage (%)	Categories
Teacher	100	Highly practical
Students	96.4	Highly practical
Average	98.2	Highly practical

Table 11 shows the recap of teacher responses of 100% including in the highly practical category while students of 96.4% including in the highly practical category. Similar results to the research conducted by Efendi & Muhammadi (2023), using Smart Apps Creator learning media is practical in elementary school. Another research finding obtained the results of using Smart Apps Creator media in inquiry-based learning, received a positive response from students with a very practical category (Sholihah & Hidayati, 2023). This learning media is very interesting because it combines animation and music, is fun, easy to use, and helps students understand the material (Puspitasari et al., 2022). Research conducted by Suhartati (2021) using the SAC-based flipped classroom learning model increases student engagement and enthusiasm for learning. In addition, it can motivate students to learn because it provides many features (Rizki et al., 2022). As such, this interactive learning media based on Smart Apps Creator is highly practical in learning IPAS energy transformation material.

Evaluation

The evaluation stage aims to assess the process and results of learning media development. Evaluation of the development process is analyzed from the results of material expert validation, media expert validation, and suggestions or comments given. Evaluation of the development results was analyzed from the increase in the average score of the pretest and post-test through the N-gain test and the responses of teachers and students after using Smart Apps Creator-based learning media.

Material and media experts' validation test results are very valid or feasible, so it is suitable for testing with revisions to make the media better. Based on the N-gain test results and teacher and student responses, the learning media is effective for improving learning outcomes and practical to use.

Conclusion

As a result, the conclusion obtained from the research that has been conducted is that the development of interactive learning media based on Smart Apps Creator follows the ADDIE development model. The material and media validation results of 92.8 and 93% fall into the very feasible category. According to the N-gain test, the Smart Apps Creator-based learning media has shown an effective average increase in learning outcomes of 0.66, indicating its effectiveness, especially in the moderate category. The response questionnaire results of teachers and students 100 and 96.2% are included in the highly practical category. Therefore, Smart Apps Creator-based learning media is feasible, effective, and practical to be used for learning to improve student learning outcomes in IPAS subjects on energy transformation material.

Conflicts of Interest
The authors declare no conflict of interest.

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