



Development of Science Learning Media Using the Smart Apps Creator Application in Solar System Materials for Junior High School

Andini^{1*}, Mursalin², Nova Elysia Ntobuo³, Tirtawaty Abdjul⁴, Ritin Uloli⁵

^{1,2,3,4} Gorontalo State University, Indonesia

* Corresponding Author: andiniagus04@email.com

ARTICLE INFORMATION

Article History:

Received June 2026

Revised July 2026

Accepted August 2026

Keywords:

Smart Apps Creator, science learning media, solar system, ADDIE.

DOI:

10.71280/jotter.v4i3.615

ABSTRAK

Science learning in junior high school is still dominated by lecture methods with limited use of learning media, so that students tend to be passive and have difficulty understanding abstract material, especially in the Solar System material. Therefore, this study aims to develop science learning media using the Smart Apps Creator application on Solar System materials that meet valid, practical, and effective criteria. This research is a research and development using the ADDIE model which consists of Analysis, Design, Development, Implementation, and Evaluation stages. The subjects of the study were 37 students in grade VII of junior high school. The research instruments include validation sheets, observation sheets on learning implementation, student response questionnaires, observation sheets for student activities, and learning outcome tests. The results of the study showed that the learning media developed met the valid criteria with a media validation percentage of 91.25%, modules of 97.32%, teaching materials of 96.59%, LKPD of 94.32%, and learning outcome tests of 98.61%. The practical aspect was shown by the implementation of learning by 95.24% in the very good category and the response of students of 89% in the very good category and 11% in the good category. The effectiveness aspect was shown through the activities of students who were in the very good category and an increase in learning outcomes with an average pretest score of 63.65%, posttest of 86.62%, and an N-gain value of 0.66 in the medium category. Based on these results, science learning media using the Smart Apps Creator application on the Solar System material was declared valid, practical, and effective for use in learning.

INTRODUCTION

Education is an effort to develop the potential of students through a quality learning process. In achieving learning goals, learning media has an important role as a means to help teachers convey material in a clearer, more interesting, and easier to understand manner. Therefore, the use of innovative learning media needs to be carried out so that the learning process becomes more effective, interactive, and meaningful for students.

Learning media is a means of conveying information from teachers to students in the learning process. The concept of learning media is rooted in Shannon and Weaver's communication theory which explains that the process of conveying messages requires media as a link in order for information to be received effectively. In addition, the Cone of Experience theory put forward by Edgar Dale explains that the more concrete the learning experience that students get, the easier the information is to understand and remember. Therefore, the use of the right learning media is an important factor in creating effective and meaningful learning. A learning environment that is systematically designed through the use of media can help students achieve learning goals optimally (Sahabuddin et al., 2023).



The development of science and technology in the era of the industrial revolution 4.0 has had a great influence on the world of education. Teachers are required to be able to adapt to technological developments and integrate them in the learning process. This is in line with Piaget's theory of cognitive learning which states that the learning process occurs through the assimilation and accommodation of new experiences into the cognitive structure that learners already have. In addition, Vygotsky's theory of social constructivism emphasizes that learning will be more meaningful if students actively interact with their learning environment, including through the use of digital technology. Hidayat and Anwar (2022) stated that technology that is well integrated in learning can increase learning motivation and help students understand abstract concepts.

However, the learning process in schools is still dominated by lecture methods without the support of interactive learning media. Based on the results of observations during the School Teaching Program (PMS), teachers tend to deliver material conventionally by focusing on oral explanations and the use of package books. This condition causes students to be less active, less interested in learning, and have difficulty understanding abstract material.

The results of observations at SMP Negeri 1 Bulango Selatan show that science learning is still dominated by the use of lecture methods with the help of package books and blackboards. The use of interactive learning media is still relatively low, so students tend to be passive and less enthusiastic during learning. This problem is increasingly seen in the material of the Solar System, which contains abstract concepts about celestial bodies, planetary positions, and movements of the solar system that are difficult to observe directly. Lestari and Ramadhan (2021) stated that students have difficulty understanding the concept of the solar system if learning only uses lecture methods and static images. Therefore, learning media that is able to visualize the concept of the solar system in a more concrete and interesting way is needed.

The implementation of the Independent Curriculum requires teachers to be more creative and innovative in choosing learning strategies and media that suit the characteristics of students. The Merdeka Curriculum emphasizes student-centered learning, is flexible, and encourages the use of digital technology in the learning process (Putri & Santoso, 2023). The use of appropriate learning media can increase students' attention, interest, and motivation to learn so that learning becomes more effective. Herlambang et al. (2024) stated that learning media can foster interest in learning and increase student motivation because it allows students to be actively involved in the learning process.

One of the applications that can be used to develop interactive learning media is Smart Apps Creator. Smart Apps Creator is a multimedia-based application that allows teachers to create learning media without the need for programming skills. The app is capable of integrating text, images, audio, video, animations, and interactive quizzes in one learning medium. Wulandari and Nugroho (2021) stated that the use of Smart Apps Creator can help teachers present material in a more interactive manner so that students can more easily understand the concepts learned. In addition, the media produced can be accessed via smartphones and computers and exported in various formats to support the implementation of digital learning in the era of the Independent Curriculum (Hidayatullah & Cahyono, 2022).

Several previous studies have shown that the use of Smart Apps Creator has a positive impact on the learning process and outcomes. Rukoyah and Bektiningsih (2024) reported that interactive learning media based on Smart Apps Creator is able to improve student learning outcomes and obtain very practical responses. Prisningtyas and Nugraha (2024) show that Smart Apps Creator-based media has a very high level of validity and is suitable for use in science learning. Sulindra et al. (2023) stated that Smart Apps Creator media is able to increase student involvement in learning. In addition, Nurasma et al. (2025) found that the use of Smart Apps Creator has a positive influence on students' learning interests.

Based on these various studies, it can be seen that Smart Apps Creator has the potential to increase students' motivation, activities, and learning outcomes. However, research on the development of science learning media using the Smart Apps Creator application on the Solar System material at SMP Negeri 1 Bulango Selatan has not yet been found. In addition, this study not only examines aspects of media validity, but also assesses the practicality and effectiveness of media through learning implementation, student response, student activities, and improvement of learning outcomes using N-gain analysis. Therefore, this study aims to develop science learning media using the Smart Apps Creator application on the Solar System material that meets the criteria of valid, practical, and effective for use in learning.

METHODS

This research was carried out at SMP Negeri 1 Bulango Selatan, Bone Bolango Regency, Gorontalo Province in the even semester of the 2025/2026 school year. The research was carried out during the science learning process in accordance with the schedule of teaching and learning activities at school. This research uses a type of research and development (Research and Development) with the ADDIE development model consisting of five stages, namely Analysis, Design, Development, Implementation, and Evaluation. However, in this study, the development stage is limited to the Development stage with limited trials. The subject of the study is 37 students in grade VII of SMP Negeri 1 Bulango Selatan. A limited trial was conducted to determine the quality of science learning media using the Smart Apps Creator application on the Solar System material developed.

Data analysis on science learning media using the Smart Apps Creator application of the Solar System material includes validity, practicality, and effectiveness analysis. Validity analysis was used to determine the feasibility level of media based on validator assessments. Practicality analysis was obtained through the implementation of learning and students' responses to the media used. The effectiveness analysis was obtained from the results of observation of student activities and the improvement of learning outcomes based on pretest and posttest scores analyzed using the N-gain test.

The learning validity test is determined by the opinions of experts through the learning tools that have been developed. The validator expert writes down the analysis of the learning media on the validation sheet carried out by 2 validators. The analysis of the validity of this learning media data uses the average score formula according to Arikunto (2002:216) as follows.

$$X = \frac{\sum x}{n}$$

Description:

X = average value

$\sum x$ = Total number of answer values from validators

N = Number of validators

Table 1. Validity of Learning Tools

Present (%)	Validation Criteria
76,100%	Valid
56,75%	Quite valid
40,55%	Invalid
0,39%	Invalid

Based on the table above, Smart Apps Creator learning media in science learning can be used if it meets valid criteria based on expert assessment. The practicality test in this study was obtained

based on the analysis of student responses and the analysis of implementation in learning. The student response questionnaire uses the Likert scale which is used on a scale of 1 to 4, to find out the students' response to the Smart Apps Creator-based learning media to be developed. Answers on the Likert scale can be scored, with the meaning of points 4 (Strongly Agree), 3 (Agree), 2 (Disagree), and 1 (Strongly Disagree). Calculating student responses is used with the following formula.

$$\text{Response (\%)} = \frac{\text{The number of student responses for each aspect that appears}}{\text{Number of students}} \times 100$$

The assessment of student responses was carried out by matching the average results of the total score given with the criteria in the table below. The percentage of responses can be assessed by the following criteria.

Table 2. Student Response Criteria

Yes	Value Range	Interpretation
1	86%-100%	Excellent
2	76%-85%	Good
3	66%-75%	Enough
4	56%-65%	Less
5	0%-55%	Very Less

A product is said to be practical if the average score of the percentage of student responses at each meeting gets a score with the criteria of "very good" and "good". The data obtained from the analysis of response data is material to see the practicality of the Smart Apps Creator-based learning media that has been developed.

The test of learning implementation through the steps of the learning process was observed using a learning implementation observation sheet. The learning implementation analysis consists of two options, namely "Implemented" or "Not Implemented" based on the syntax of the Problem Based Learning learning model. Calculating the implementation of the learning process is used with the following formula.

$$\text{Implementation (\%)} = \frac{\text{many steps are carried out}}{\text{Many Steps Implemented}} \times 100$$

The assessment of learning implementation is carried out by matching the average results of the total score given with the criteria in table 3 as follows:

Table 3. Learning Implementation Criteria

Yes	Value Range	Interpretation
1	86%-100%	Excellent
2	76%-85%	Good
3	66%-75%	Enough
4	56%-65%	less
5	0%-55%	Very Less

A learning media based on Smart Apps Creator can be said to be practical if the average score of the percentage of learning implementation at each meeting gets a score with the criteria of "very good" or "good". The effectiveness test of this learning media is based on the analysis of student activities and student learning outcomes during the learning process. In following the learning process during several meetings, the results of students' observations can be analyzed using the formula:

$$\% \text{ Student activities} = \frac{\text{Number of shoes obtained (A)}}{\text{Score Maximum (N)}} \times 10$$

Observations are made at each meeting, so the average percentage of student activities can be calculated using the formula:

$$\% \text{ average(PA)} = \frac{\% \text{Meetings 1} + \% \text{Meetings 2} + \% \text{Meetings 3}}{N} \times 100$$

The assessment of student activities is carried out by matching the average results of the total score obtained with the following criteria:

Table 4. Criteria for Peseta Didik Activities

Yes	Value Range	Interpretation
1	86%-100%	Excellent
2	76%-85%	Good
3	66%-75%	Enough
4	56%-65%	Less
5	0%-55%	Very Less

Improvement of learning outcomes using N-gain analysis. In this study, Pretest and Posttest will be used, which will then be searched whether there is an increase in the Pretest and Posttest. Increase in N-gain (ternormalized gain). The N-gain analysis aims to categorize the magnitude of the improvement in student learning outcomes. To obtain the gain of ternormalization, an equation according to Hake is used as a sequence.

$$<g> = \frac{\% \text{Post test scores} - \% \text{Pre Test scores}}{100 - \% \text{Pre Test scores}} \times 100\%$$

Description:

g = Gain (Ability increase)

% Pretest score = Percentage of pre test score

% Posttest score = percentage of posttest score

The magnitude of the <g> factor can be seen in Table

Table 5. Gain Value Criteria

Value	Classification
(<g>) ≤ 0.3	Low
0.3 <(<g>) < 0.7	Medium
(<g>) ≥ 0.7	Height

Smart Apps Creator-based learning media can be said to be effective if the average score of the percentage of the N-gain criterion of students gets a score with the criteria of "High" and "Medium".

RESULTS AND DISCUSSION

Results and This study uses the ADDIE development model. This operational framework consists of five stages of development that are arranged in a linear manner: analysis (analysis of field conditions), design (draft design), development (product development), implementation (class implementation), and evaluation. However, this engineering research is deliberately limited to the Development stage. These restrictions are based on considerations of efficiency and limitations of research time allocation in the field, which consequence the transfer of output testing scenarios into the form of experiments or trials on a micro (limited) scale.

The educational technology artifacts embodied in this study are in the form of interactive digital science learning media produced through the Smart Apps Creator (SAC) platform by containing the substance of the subject matter of the Solar System. Before being disseminated in instructional activities with students, the prototype of the digital media that has been constructed must go through a theoretical testing phase (validation) by two competent theoretical experts acting as validators. The target subjects involved in this micro-scale testing phase are a group of phase D students in grade VII at SMP Negeri 1 Bulango Selatan. The main target of this small-scale testing agenda is specifically oriented to map, describe, and measure the quality of the Smart Apps Creator-based teaching tool reviewed from three main quality parameters, namely the scientific validity coefficient, the functional practicality index, and the effectiveness coefficient in supporting science learning performance.

The final results of this development research succeeded in collecting an empirical data matrix related to the level of validity (validity), applicability (practicality), and usefulness (effectiveness) of the use of Science educational media based on Smart Apps Creator on the topic of the Solar System through modification of ADDIE syntax. The accumulation of research findings and quantitative-qualitative descriptions are described in depth in the following explanatory subchapter.

Validation Results

1. Learning Tool Validation

The first stage of this research is the validation stage. The experts/validators in the development of this media are lecturers in the Department of Natural Sciences Education (IPA), Faculty of Mathematics and Natural Sciences, Gorontalo State University. Based on the results of the validator's assessment, the science learning media using the Smart Apps Creator application on the Solar System material was declared feasible for use in the limited trial stage. The recapitulation of the results of the validation of learning tools is presented in Table 6.

Table 6. Learning Tool Validation

Table 6 shows that the average value of the percentage of feasibility of validation results in Media is 91.25%, Modules is 97.32%, Teaching Materials is 96.59%, LKPD is 94.32%, and THB is

Learning Tools	Average Percentage of Each Validator		Average overall percent of validators	Criteria
	Validator I	Validator II		
Media	92,5	90	91,25	Valid
Modules	96,43	98,21	97,32	Valid
Teaching Materials	95,45	97,73	96,59	Valid
LKPD	92,05	96,59	94,32	Valid
THB	100	97,22	98,61	Valid

98.61%. Based on the results of this percentage, the learning media and learning tools developed meet the valid category and are suitable for use with minor revisions. This shows that the learning tools that have been validated by experts have met the feasibility aspects of content, presentation, language, and graphics so that they can be used in the learning process.

Practicality of Learning Media Using Smart Apps Creator Applications in Solar System Materials

The implementation of learning in this study was carried out 3 times at SMP Negeri 1 South Bulango school with 37 students who were present and seen by two people. The following average results of learning implementation data can be seen in Figure 1 below.

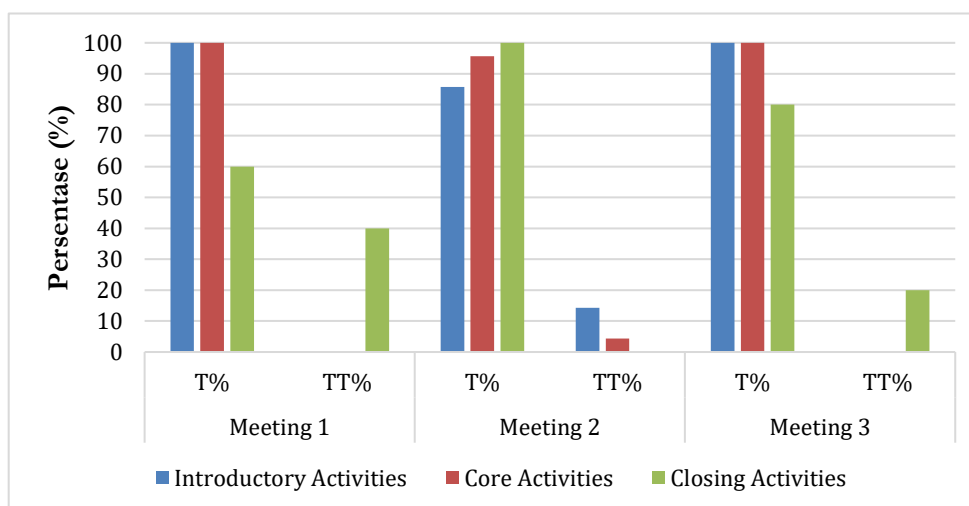
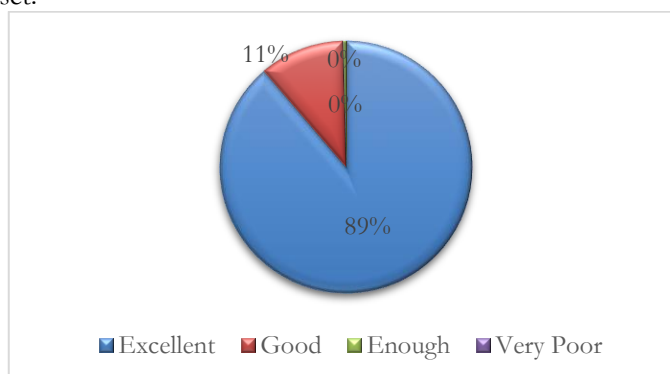


Figure 1. Learning Implementation Diagram

Based on Figure 1, it can be seen that the indicators of learning implementation at meeting 1, meeting 2, and meeting 3 show the percentage that is in the "Good" to "Very Good" category. Most of the learning stages, especially the introductory activities and core activities, were carried out very well at each meeting. Although at several meetings the closing activities have not been carried out optimally, overall the average implementation of learning still shows very good results. This shows that the learning process using the developed learning media can be carried out in accordance with the plan that has been set.



The results of the analysis of student response data to learning media using the Smart Apps Creator application developed are described in Figure 2 below.

Figure 2. Percentage of Student Responses

Based on Figure 2, it can be seen that most students give a very positive response to the learning media used. As many as 89% of respondents responded with the category "Very Good", while 11% of respondents responded with the category "Good". Meanwhile, there were no students who responded to the "Sufficient" or "Very Less" categories, which was shown by a percentage of 0% in both categories.

Thus, it can be concluded that the students' response to the developed learning media is in the "Very Good" category. These results show that learning media can be well received by students, interesting to use, and able to support the learning process effectively.

The Effectiveness of Solar System Learning Media Using the Smart Apps Creator Application

The effectiveness of the learning media of solar system materials using the Smart Apps Creator aka developed can be seen through student activities and student learning outcome tests. The following results of student activity data can be seen in Figure 3.

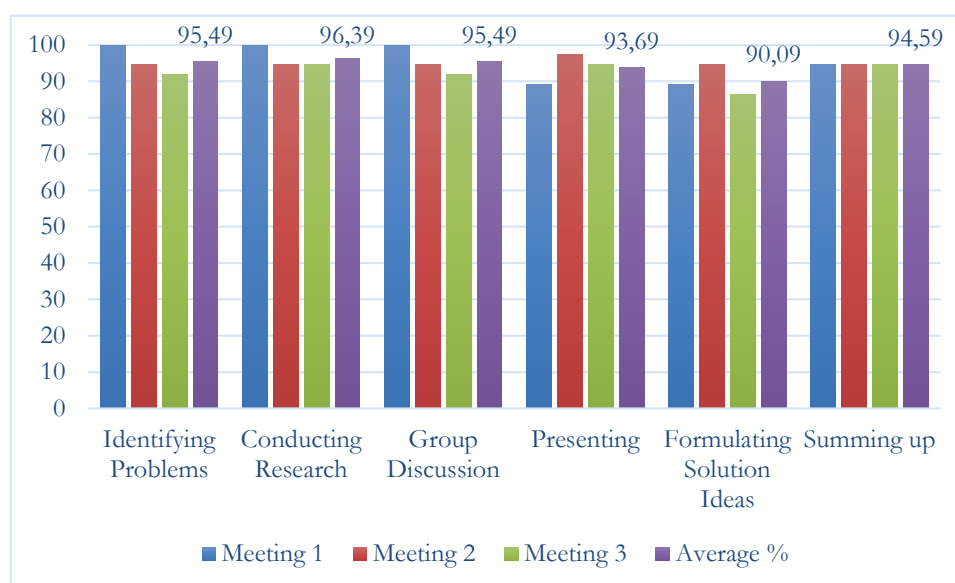


Figure 2. Presentation of Student Activities

Based on Figure 3, it can be observed that the activities of students in each indicator show results that are in the good to very good category. The indicator conducting the investigation obtained the highest average score with a percentage of 96.39%. Furthermore, the indicator indicators identify problems and discuss which each recorded 95.49%, concluded the material by 94.59%, presented the results of 93.69% and formulated a solution idea of 90.09%. The cognitive domain learning outcome test was given to 37 students in grade VII. As for the N-gain value per individual. The following is presented a table of the average pre-test, post-test, difference between the two, and N-gain of cognitive learning outcomes in learning that uses science learning media using the Smart Apps Creator application on solar system materials. Can be scored in the following table 7:

They respond	Pre-test percentage	Post-test percentage	Difference (%)	N-gain	Criteria
37	63, 65%	86, 62%	22, 97	0, 66%	Medium

Based on table 7, it can be seen in the table that in the limited trial, the N-Gain value obtained was 0.66 which is included in the "Medium" category. This shows that the learning outcomes of students towards learning using science learning media using the Smart Apps Creator application which was developed are effective for use and affect learning outcomes in the aspect of students' knowledge.

Discussion

1. The Validity of Learning Media Using the Smart Apps Creator Application on Solar System Materials

Based on Table 6, there are five learning tools validated by experts, namely learning media, modules, teaching materials, LKPD, and Learning Outcome Tests (THB). The validation results showed that the learning media obtained an average score of 91.25%, modules of 97.32%, teaching materials of 96.59%, LKPD of 94.32%, and THB of 98.61%. Based on this percentage, learning media using the Smart Apps Creator application and other learning tools meet the valid and suitable category with minor revisions.

This shows that the learning media developed has met the feasibility aspects of content, presentation, language, and graphics so that they can be used in the learning process. Valid media can help teachers in conveying material more interestingly and make it easier for students to understand the concepts learned. This finding is in line with the research of Dea Handayani et al. (2023) which states that Smart Apps Creator-based learning media obtained validation results of 90% with good criteria so that it is declared valid and suitable for use in the learning process.

2. The Practicality of Learning Media Using the Smart Apps Creator Application on Solar System Materials

Based on Table 6, there are five learning tools validated by experts, namely learning media, modules, teaching materials, LKPD, and Learning Outcome Tests (THB). The validation results showed that the learning media obtained an average score of 91.25%, modules of 97.32%, teaching materials of 96.59%, LKPD

Implementation of Learning

In the limited trial, observation of the implementation of learning was carried out at SMP Negeri 1 Bulango Selatan by involving 37 students during three meetings and observed by two observers. Based on the observation results, the implementation of learning at each meeting was in the good to very good category. Most of the learning stages, especially the introductory activities and core activities, were carried out very well at each meeting. Although at several meetings the closing activities have not been carried out optimally, overall the average implementation of learning still shows very good results.

Based on these results, it can be concluded that the learning media using the Smart Apps Creator application developed is relatively practical to be used in the learning process. This shows that the developed media is easy to use and can help teachers carry out learning activities in accordance with the predetermined plan.

Student Responses

Based on the results of the analysis of student responses, it is known that as many as 89% of students responded with the category of "Very Good" and 11% of students responded with the category of "Good". Meanwhile, there were no students who responded to the "Sufficient" or "Very Less" categories.

These results show that the majority of students give positive responses to the use of learning media using the Smart Apps Creator application on solar system materials. Students feel that the media used is interesting, easy to understand, and helps them during the learning process. The positive response given by students proves that the learning media developed is practical to be applied in classroom learning. This is in line with the opinion of Sukardi (2013) who states that a learning tool is said to be practical if it gets an assessment in the good or very good category and can be accepted by users.

3. The Effectiveness of Learning Media Using the Smart Apps Creator Application on Solar System Materials

Student Activities

The results of the analysis of student activities showed that all activity indicators were in the very good category. The indicator conducting an investigation obtained the highest average score of 96.39%, followed by the indicator of working on the LKPD of 96.39%. Furthermore, the indicators identified problems and discussed which each recorded a figure of 95.49%, concluded the material by 94.59%, presented the results of 93.69% and the indicator formulated a solution idea obtained the lowest average of 90.09%. Based on these results, it can be concluded that students are actively involved during the learning process using Smart Apps Creator-based learning media. The high percentage of student activities shows that the media developed is able to increase student participation in learning. These findings are in line with the research of Adam et al. (2023) who stated that the use of Smart Apps Creator-based learning media can increase student activities during the learning process.

Cognitive Learning Outcomes

Based on the results of the cognitive learning outcome test analysis, the average pre-test score was 63.65%, while the post-test average score was 86.62%, with an increase of 22.97%. The results of the N-gain calculation showed a value of 0.66 which was included in the medium category.

The increase in learning outcomes shows that the use of learning media using the Smart Apps Creator application has a positive influence on students' understanding of solar system materials. The difference in the average score of the pre-test and post-test proves that students experience an improvement in ability after participating in learning using the developed media. Thus, science learning media using the Smart Apps Creator application on solar system materials has met

the effectiveness criteria because it is able to improve students' learning outcomes in the aspect of knowledge.

CONCLUSION

The validity of learning media using the Smart Apps Creator application was obtained through a validation process by two validators who are lecturers of Science Education, Faculty of Mathematics and Natural Sciences, Gorontalo State University. The validation results showed that the learning media obtained an average score of 91.25%, modules 97.32%, teaching materials 96.59%, LKPD 94.32%, and THB 98.61%. Based on this percentage, learning media and other learning tools are included in the category of valid and suitable for use with minor revisions.

The practicality of learning media using the Smart Apps Creator application was obtained from the results of the analysis of learning implementation and student response questionnaires. The results of the implementation of learning carried out during three meetings showed that the learning process was in the good to very good category. In addition, the results of the student response questionnaire showed that 89% of students responded with the "Very Good" category and 11% responded with the "Good" category. Thus, it can be concluded that learning media using the Smart Apps Creator application developed is included in the practical category to be used in the learning process.

The effectiveness of learning media using the Smart Apps Creator application was obtained from the results of the analysis of student activities and cognitive learning outcome tests. The results of the observation of student activities showed that all activity indicators obtained an average percentage in the very good category, with the highest score in the indicator conducting an investigation of 96.39% and the lowest score in the indicator formulating solution ideas of 90.09%. Meanwhile, the cognitive learning outcomes of students showed an increase, with an average pre-test score of 63.65%, an average post-test of 86.62%, and an N-gain value of 0.66 which was included in the medium category. Therefore, it can be concluded that the learning media using the Smart Apps Creator application developed is included in the category of valid, practical and effective for use in learning Solar System material.

BIBLIOGRAPHY

- Arikunto. (2013). *Research Procedures of a Practical Approach* (Revised Edition). Jakarta: PT Rineka Cipta.
- Fadjeri, A., & Nurchayati, A. D. (2022). Validity Testing on ICT-Based Learning Media Development. *Journal of Education Surya Edukasi*, 8(1).
- Fitriani, F., Yusrizal, Y., & Nurmaliah, C. (2024). Analysis of the validity of Problem-Based Learning-based science learning tools in the implementation of the Independent Curriculum. *Indonesian Journal of Science Education*.
- Hake, R. R. (1999). Analyze the change/profit score. AREA-D Division D American Educational Research Association, Measurement and Research Methodology.
- Hadju, A., Prasetya, B., & Lestari, M. (2025). Smart Apps Creator-based learning innovation. *Journal of Science Education Innovation*, 9(1), 55–66.
- Herlambang, R., Setiawan, A., & Nugraha, F. (2024). The effectiveness of interactive digital media on the learning motivation of junior high school students. *Journal of Science Education*, 12(1), 33–42.
- Hidayatullah, M. (2022). The effectiveness of Smart Apps Creator in creating interactive learning media. *Journal of Education and Technology*, 7(3), 89–97.
- Hidayatullah, M., & Cahyono, B. (2022). Implementation of Smart Apps Creator in mobile learning. *Journal of Science Education Innovation*, 8(1), 45–53.
- Lestari, D., & Ramadhan, A. (2021). Students' difficulties in understanding the concept of the solar system. *Journal of Science Education*, 9(2), 112–120.

- Nurasma, N., Rahman, A., & Putri, D. (2025). The effect of using Smart Apps Creator on students' learning interests. *Journal of Science Learning Innovation*, 6(1), 45–54.
- Putri, M., & Santoso, H. (2023). The Independent Curriculum and the challenges of teachers in the digital era. *Journal of National Education*, 18(2), 67–78.
- Sahabuddin, S., Yusuf, M., & Hasan, A. (2023). The use of learning media in creating an effective and meaningful learning environment. *Journal of Education and Learning*, 12(2), 115–124.
- Sari, P., & Handayani, E. (2023). The use of Smart Apps Creator to increase the learning motivation of junior high school students. *Journal of Educational Technology*, 25(1), 71–83.
- Sugiyono. (2015). *Educational Research Methods with Quantitative, Qualitative and R&D Approaches* Bandung: Alfabeta.
- Sukardi. (2013). *Educational Research Methodology: Competencies and Practices*. Jakarta: Bumi Aksara.
- Sulindra, S., Wahyuni, R., & Kurniawan, D. (2023). The effect of the use of Smart Apps Creator on student involvement in science learning. *Indonesian Journal of Science Education*, 12(3), 210–219.
- Wulandari, S., & Nugroho, T. (2021). Smart Apps Creator as an interactive learning medium for the 21st century. *Journal of Educational Technology*, 23(2), 98–108.