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Development of E-Magnetic Learning Media Based on Smart Apps Creator (SAC) on Topic of Magnetism

Nurafni Dg. Palari, Mursalin, Nova Elysia Ntobuo*, Tirtawaty Abdjul, Dewi Diana Paramata, I Made Hermanto
Science Education Study Program, Universitas Negeri Gorontalo, Gorontalo, Indonesia
*Corresponding Author: novantobuo@ung.ac.id

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Abstract: This research aims to produce e-magnetic learning media products based on the Smart Apps Creator (SAC) application on magnetic material that meets quality criteria regarding validity, practicality, and effectiveness. This type of research is Research and Development (R&D) using the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) development model. The research subjects were 21 students in class IX-C of SMP Negeri 11 Gorontalo, Gorontalo Regency, Gorontalo Province. The research results show that (1) the validation results of e-magnetic learning media based on SAC by two validators obtained an average validation score of 96.88%, meeting the criteria of being valid and usable; (2) The practical aspect shows that observations of learning implementation obtained an average percentage of 88% with very good criteria and student responses obtained an average percentage of 9% with very good criteria. The results obtained indicate that the e-magnetic learning media based on SAC that was developed is practical; and (3) The effectiveness aspect is determined through student activity, which reached 84.42% with very good criteria and learning outcomes for the cognitive domain in magnetism topic reached an N-gain value of 0.70, including in the high category and the classical percentage results of participant learning outcomes. Students reached 80.12%. The results of this research can be concluded that e-magnetic learning media based on SAC on magnetism topic at SMP Negeri 11 Gorontalo has met the criteria of being valid, practical, and effective.

Keywords: E-magnetic, Learning media, Magnetism, Smart Apps Creator

INTRODUCTION

Education is an effort to prepare the younger generation to welcome and face developments in the global era. So, education must be implemented as well as possible to produce quality education and increase the quality of human resources. Technological developments have had a huge impact on the field of education. Learning cannot be separated from media, methods, and learning outcomes. Media can be used as a means of providing educational material delivered by teachers to students. Learning methods regulate the organization of teaching materials and delivery strategies. Furthermore, learning outcomes are measured effectively and efficiently to determine students' abilities and understanding of students' interests in subjects (Nurrita, 2018).

The problem often faced by the world of education is the weakness of the learning process. In the process of teaching and learning activities, students learn more theoretically. Classroom learning is more directed at children's understanding of the subject matter. However, the theory students learn has very little application in everyday life. This causes students to lack a deeper understanding of the lesson's material. In teaching and learning activities, the presence of teachers is expected to develop students' potential and creativity. So that students can know not only of theory but also practice it for future developments (Nurrita, 2018).

According to Sari & Wicaksono (2022), in Law No. 20 of 2003 on the National Education System in Article 1, paragraph 1 interprets education as a conscious and planned effort to create learning conditions that actively advance students' abilities in terms of character, knowledge, and competencies that are useful for themselves and the general public. Students have the potential to have the ability to hone their talents to the maximum level or not develop at all, supported by two mutually influencing factors,

namely natural talent (given) and conducive learning environment conditions, thus influencing the completeness and activeness of student learning. To increase learning completeness for students, there are influencing factors, namely the learning environment and the success of the student's learning process in terms of character formation, reasoning ability, concluding, and other competencies.

In detail, article 20 of Law No. 14 of 2005 concerning Teachers and Lecturers explains the teacher's obligations, namely preparing and conceptualizing learning, carrying out a quality learning process, evaluating learning outcomes, and consistently elaborating competency and knowledge qualifications by advanced in science, technology, and art. So, in fulfilling their obligations according to the law and as an important element in national education, teachers should now break the chain of tedious learning processes to achieve completeness in student learning (Sa'diyah, 2023). The many varied methods of using learning media can be one way to break the chain of monotonous knowledge transfer models (Permana, & Nourmavita, 2017; Junaidi, 2019).

Teachers play an important role in improving education quality related to their main duties and functions as educators. Teachers need to design lesson plans and choose varied learning models, interesting media, and good evaluation tools to carry out active, creative, effective, and enjoyable learning. A teacher first carries out the learning process in class by preparing a learning model appropriate to the available learning tools (Gusasi, 2022).

Education is not only seen as an effort to provide information or knowledge and the formation of characteristics and skills, but in a broad sense, it can be seen as including efforts to realize individual desires, needs, and abilities so that a satisfactory personal and social lifestyle is achieved, education is not only a means for preparation for the life that will come later, but for the life of children now who are in the stage of development towards their maturity level (Anggraini & Pratiwi, 2019). In the teaching process, there are five important components in the teaching process, namely objectives, materials, methods, media, and learning evaluation. In the teaching process activities, these five components greatly influence each other. For example, choosing a method of delivering learning material will influence what learning media we will use to deliver the material to students according to the needs and characteristics of the students concerned. The use of learning media is also very helpful in the effectiveness of the learning process during teaching and learning. However, some still ignore the use of learning media in teaching activities. Reasons include difficulty in getting the media to be used, insufficient time to create learning media, lack of funds, etc. The use of learning media also has its characteristics, one of which is that it is relatively cheap. Making learning media must also think about how much budget we have to make the learning media so that the media meets our expectations (Lihawa, 2018; Audie, 2019).

According to (Yuberti et al., 2021), learning media is a communication tool or means for conveying information to help and simplify the learning process and interaction between teachers and students. Media is also a tool that can help teachers attract students' attention and foster high enthusiasm for learning in students. In the learning process, learning media is needed to motivate students to continue learning and ask questions about what they do not know to provide maximum results as expected (Hutabri, 2022; Halid, 2022; Nurfadhillah, et al., 2021). One media that can be applied and implemented in the learning process, especially science learning, is the Smart Apps Creator (SAC) application.

Science is a science that studies objects in nature, both those that can be observed with the senses and those that cannot be observed with the senses. According to Baiq (2021), science learning in schools not only emphasizes knowledge of facts, concepts, and understanding of science but also emphasizes developing skills in using scientific methods and being scientific to solve problems in everyday life. Of the several subjects that students must take from elementary to junior high school, one is science (natural science). However, in reality, students' dominance in understanding science concepts is still claimed to be difficult, so the learning outcomes for most students in science subjects are still unsatisfactory or relatively low.

SAC is a desktop application for creating Android-based applications without programming code (Azizah, 2020; Ferlianti et al., 2022). SAC is a very easy multimedia tool because it can be created without programming code so that teachers with no programming background can create it well and attractively,

with a display that is easy to understand and does not take up a lot of RAM. The concept offered is near and distance learning (Nurhidayah et al., 2022). Near distance learning, namely this media, can be used directly during the learning process by teachers in the classroom. In contrast, distance learning, namely this media, can be carried out and studied when students are outside the school environment and can be used offline, so it does not require expensive quotas (Abi & Sujatmiko, 2022; Amalia, 2022).

In line with research conducted by Abdjul, & Uloli (2023), with the research title "Development of Learning Media Using SAC Based on Local Wisdom in Work and Energy Materials," the results of the research conclusions show that learning media uses SAC based on local wisdom on business and energy material has proven to be valid, practical and effective for learning. Referring to SAC research also conducted by Suleman et al. (2024) with the research topic Improving Student Learning Outcomes Through the Application of a SAC-Based Jire Collaborative Learning Model on Temperature and Heat Material at Senior High School. The conclusions for these research findings show that applying the Jire collaborative learning paradigm based on the SAC can improve student academic achievement in temperature and heat material (Prasetio & Musril, 2022; Lolonto, 2022).

By paying attention to the above, researchers are interested in developing a SAC learning media to facilitate students' understanding of science concepts and material. For this reason, this research is entitled about development of e-magnetic learning media based on SAC in Science Learning on Magnetism Material at SMP Negeri 11 Gorontalo.

METHODS

This research was carried out at SMP Negeri 11 Gorontalo, Jl. Kutai, Tamalate, East Kota District, Gorontalo City. This research was carried out over six months in the odd semester of 2023/2024. The research was conducted during science learning hours and by the teaching and learning activities scheduled at school. This research uses the Research and Development (R&D) method. Research and Development (R&D) or research and development is the type of research used in this research, using the ADDIE development model (Rayanto, 2020). The subjects in this research were students in class IX-C in science subjects at SMP Negeri 11 Gorontalo, with 21 respondents using limited trials.

Data analysis on learning media using SAC for this magnetic material includes validity, practicality, and effectiveness analyses. The validity test of learning tools is determined by expert opinion through the results of a review of the learning tool instruments that have been developed. The validator expert wrote his assessment of the learning media on a validation sheet carried out by two validators. This research analyzes the validity of learning media data using the average value in equation (1) (Arikunto, 2002).

$$X = \frac{\Sigma x_v}{n_v} \quad (1)$$

Information for X is average value, $\sum x$ is total number of answer values from validators, and n_v is number of validators. The validation criteria for the average value analysis can be seen in Table 1 (Sukardi, 2013).

Table 1. Validation Criteria for Learning Tools

Percentage (%)	Validation Criteria
76 – 100	Valid
56 – 75	Enough
40 – 55	Less
0 – 39	Not valid

Product criteria assessment can be used if it meets valid or very valid criteria based on expert assessment. The practicality test of e-magnetic learning media based on SAC on the magnetism material developed in this research was obtained based on an analysis of student responses and an analysis of the implementation of learning. The assessment of student responses uses a scale of 1 to 4, the Likert scale. Analysis of learning implementation consists of two options, "Implemented" or "Not Implemented," based on the syntax of the Discovery Learning model. Two observers assessed the implementation of the learning process steps using the learning implementation observation sheet.

Analysis of the practicality of student response data uses the following equation (2), analyse the practicality of learning implementation data using equation (3):

$$\%\ Student\ Response = \frac{\sum x_s}{n_s}\ x\ 100\% \qquad (2)$$

$$\%\ Implementation = \frac{S}{P}\ x\ 100\% \qquad (3)$$

Information for $\sum x_s$ is the number of student responses for each aspect, and n_s is the number of students. For S is the number of steps carried out, and P is the number of steps planned. Furthermore, the average percentage analysis criteria can be seen in Table 2 (Sukardi, 2013).

Table 2. Validation Criteria for Learning Tools

Value Range (%)	Interpretation
86 - 100	Very good
76 - 85	Good
66 - 75	Enough
56 - 65	Less
0 – 55	Very less

A product can be practical if the average score for the percentage of learning implementation at each meeting achieves the criteria "Very Good" or "Good." Testing the effectiveness of learning media using the developed SAC will result in activities and student learning outcomes obtained from student observations. Following the learning process over several meetings, the results of observing student activities can be analysed using equation (4), average percentage of student activity can be calculated using Equation (5).

$$\%\ Student\ Activity = \frac{A}{N}\ x\ 100\% \qquad (4)$$

$$\%\ Average = \frac{\sum \%\ Meeting}{N_{Meeting}}\ x\ 100\% \qquad (5)$$

Information for A is the total score obtained, and N is the maximum score. Analysis of the effectiveness of students' cognitive learning outcomes data using equation (6) - (7).

$$Individual\ provisions = \frac{N_s}{N_t}\ x\ 100\% \qquad (6)$$

$$Classical\ completeness = \frac{\sum S}{N_s}\ x\ 100\% \qquad (7)$$

Information for N_s is number of scores, N_t is total score. For $\sum S$ is the number of students who obtained a score ≤ 75, and N_s is the total number of students. Furthermore, the average percentage analysis criteria can be seen in Table 3 (Sukardi, 2013).

Table 3. Criteria for assessing student activities and student learning outcomes

Value Range (%)	Interpretation
85 – 100	Very good
70 – 85	Good
66 – 70	Enough
0 – 65	Less

If the percentage of student activity is included in the good or very good category, the product criteria assessment is said to meet the quality of learning media in terms of effectiveness.

FINDINGS AND DISCUSSION

Validation of learning tools

The first stage in this research was the validation stage. The experts/validators in developing this media are lecturers within the Department of Natural Sciences Education Faculty of Mathematics and Natural Sciences, Universitas Negeri Gorontalo. The results of the validators' validation of media and other learning tools shows in Table 4.

Table 4. Learning Device Validation Results

Learning tools	Average percentage		Average percent of all validators	Criteria
	Validator 1	Validator 2		
Media	90.63	87.50	96.88	Valid
Module	93.18	93.18	94.32	Valid
Teacing materials	92.50	92.50	93.75	Valid
Student worksheet	92.50	90.00	96.25	Valid
Learning Results Test	95.00	90.00	95.00	Valid

Table 4 shows that the average validation value for the eligibility percentage for learning media is 96.88%, modules 94.32%, teaching materials 93.75%, student worksheet 96.25% and learning results test 95.00%. Based on the percentage results, e-magnetic learning media

based on SAC and other learning tools meet the valid category and are suitable for use "with minor revisions."

The e-magnetic learning media developed is ideal for learning because it meets the validity aspect. This aligns with research by Rahmadi (2015), which states that experts validate the learning tools developed to see whether the product produced is appropriate and suitable for use. After the experts have validated, an analysis of the validation results will be carried out, and revisions will be made based on comments and suggestions from the validator.

The practicality of e-magnetic learning media based on SAC

The implementation of learning in this research was carried out in 3 meetings at SMP Negeri 11 Gorontalo with 21 students present and observed by two observers. The following average results of learning implementation data can be seen in Figure 1.

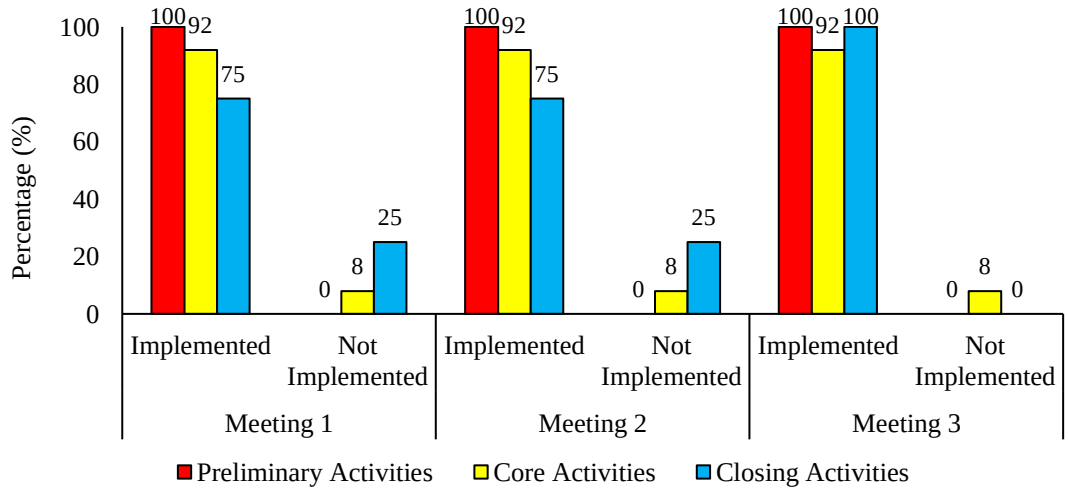

Figure 1. Learning Implementation Diagram

Based on Figure 1, it can be seen that implementation indicators are divided into 1) Preliminary Activities, 2) Core Activities, and 3) Closing Activities. The picture above, it can be seen that at meeting 1, meeting 2, and meeting 3 the implementation percentage of learning was in the "Good" and even "Very Good" categories. During the limited trial, 21 students at SMP Negeri 11 Gorontalo were observed implementing learning. The results obtained were the average percentage of learning implementation, as shown in Figure 1. The average percentage of learning implementation during three meetings was 92%, with the criteria "Very Good."

The conclusion from the results obtained when viewed from the implementation of learning is that the e-magnetic learning media based on SAC that was developed is considered practical for use in the learning process in the classroom with an average percentage score of 92% and obtained the "Very Good" criteria. This is the opinion of Fitria et al. (2017), namely that assessing a learning tool is practical if it meets two criteria, namely that the tool developed can be determined according to the evaluation of experts. The tool developed can be applied in real terms in the field. The results of the data analysis of students' responses to the SAC-based e-magnetic learning media that was developed describes in Figure 2.

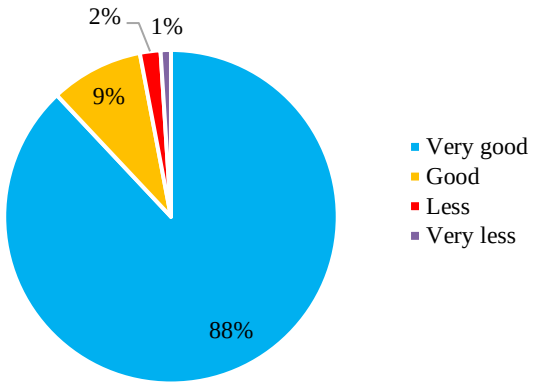

Figure 2. Percentage of Student Responses

Based on Figure 2, there are 1% (Respondents) gave a response in the "Very Poor" category, and 2% (Respondents) gave a response in the "Poor" category. In comparison, 9% (respondents) gave a response in the "Good" category, and 88% (respondents) responded in the "Very Good" category.

Figure 2 shows that the average percentage of student responses for Very Good and Good responses obtained a total response percentage of 88.39%. Thus, most students stated that SAC-based e-magnetic learning media agreed and strongly agreed when used in the learning process. This is in line with the research by Gita et al. (2018), which states that the results of student responses show practicality or benefit if the product that has been developed has been successfully developed by the research team. The same thing is also explained by Sukardi's (2013) view that a device is said to be practical if it is in the good and very good range. The positive response from students proves that using e-magnetic learning media based on SAC, which was developed, is practical to apply in the classroom learning process.

Effectiveness of e-magnetic learning media based on SAC

Several graphs on Effectiveness of e-magnetic learning media based on SAC consist of student activity in Figure 3, N-gain per individual in Figure 4, and N-gain per indicator in Figure 5.

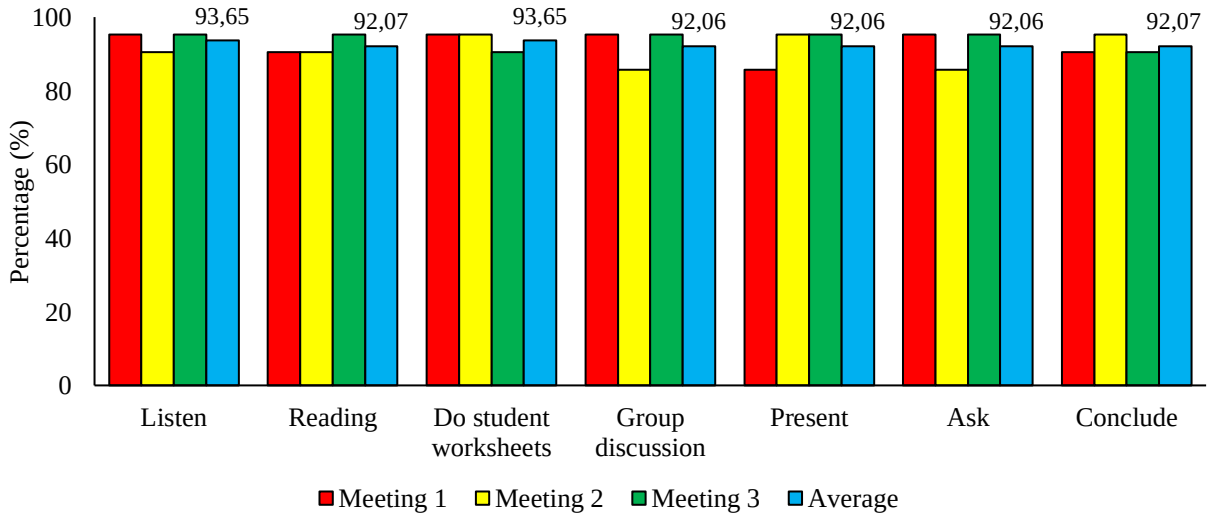

Figure 3. Percentage of Student Activities

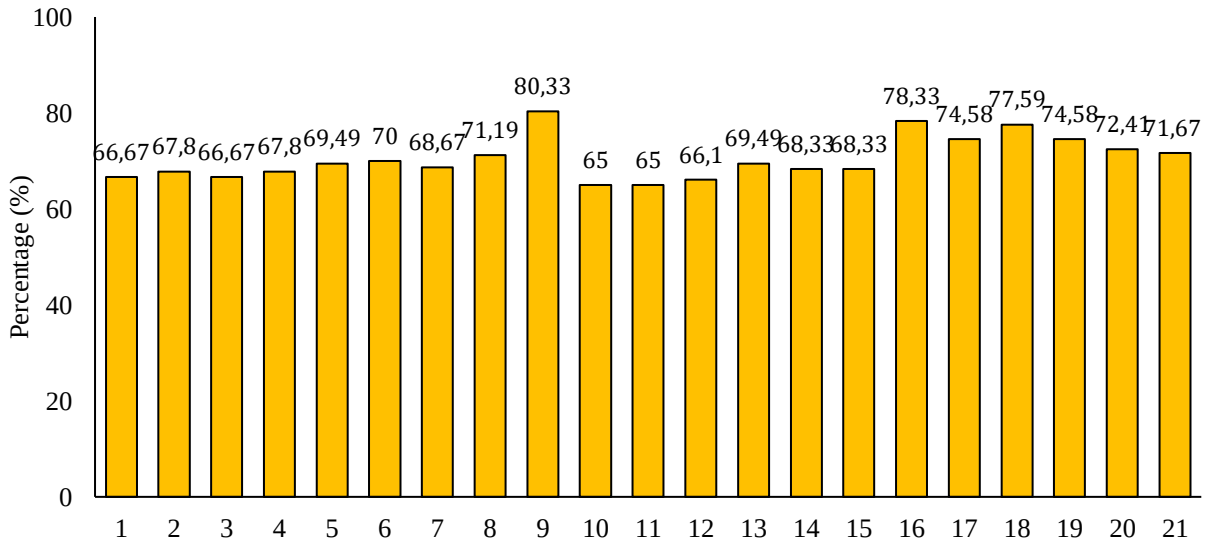

Figure 4. N-gain diagram per individual

Figure 3 shows that the indicators of student activity that received the highest average scores were listening, reading, and working on Student worksheet, with a score of 93.65%. The second highest is the listening indicator, with a value of 93.65%; the third highest is the leading indicator, 92.07%; and the fourth highest is the leading indicator, 92.07%. The average percentage of all indicators obtained was 92.52%, which was included in the "Very Good" criteria. The sales activity analysis results had an average sales value of 92.52%, which is included in the "Very Good" category, where the very good category is within the 86% - 100% value range. The achievement of mobile learning in limited trials is that learning using e-magnetic learning media based on SAC is included in the learning category if seen from the student's activities during the learning process.

According to Adam (2023), effectiveness is measured using indicators, namely, (1) average student on-task activity of at least 90%; (2) the minimum average student activity is 90%; (3) the level of conformity between observed student activities and expected student activities is at least 80%. This aligns with research conducted by Adam et al. (2023), which also states that learning media can increase student activity during the learning process. The cognitive domain learning outcomes test was given to 21 students in class IX-C. As for the N-gain value per individual, it can be seen in Figure 4. Figure 4 shows the increase in learning outcomes for each student after learning using e-magnetic learning media based on SAC on magnetic material. Student learning outcomes can be assessed from cognitive domain learning outcomes tests from C1 to C4, which contain individual and classical completeness. The percentage score results from C1 to C4 can be seen in Figure 5.

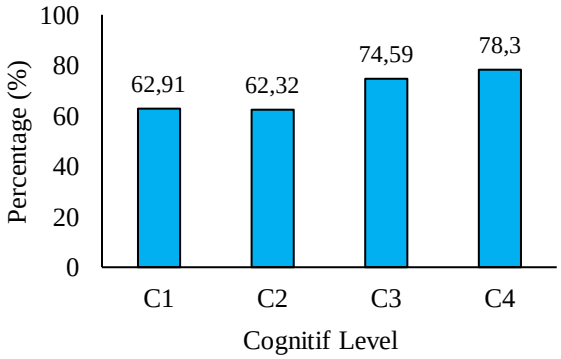

Figure 5. N-gain diagram per indicator

Based on the diagram from Figure 5, indicator C1 (Remembering and Identifying) with several two numbered questions is 62.90%, indicator C2 (Understanding) has several four numbered questions which get a value of 62.35%, indicator C3 (Applying) has several two numbered questions which receive a value. Amounting to 74.55%, indicator C4 (Analysing) has three questions with a value of 78.5%. The following is the classical completeness of student learning outcomes as in Table 5. For information N_s is Number of students, C_s is completed students, and I_s is incomplete students.

Table 5. Classical Completeness of Student Learning Results

N_s	C_s	I_s	Classical completeness (%)
21	18	3	80.12

Based on Table 5, 18 students have reached the criteria for completeness. In comparison, two students have not met the requirements for completeness or have not completed it, so the percentage of classical completeness of students' learning outcomes reaches 80.12%.

The results of the student analysis for class IX-C at SMP Negeri 11 Gorontalo achieved an average pre-test score of 58.00% and a post-test average score of 86.08% with a difference of 42.22% with an N-gain value of 0.65%, which means learning after using learning media e-magnetic based on the interpretation of N-gain according to Arikunto (2002) is included in the high category. This is in line with the research carried out by Anwar et al. (2020), which states that the level of learning can be seen very well from students' progress in each aspect of learning.

CONCLUSION

Research data and discussions show that media based on SAC can improve student learning outcomes in science subjects on magnetism material. In this study, one cycle was used. In this classroom action research, if the learning outcomes in cycle 1 do not meet the Minimum Completeness Criteria, they will continue to the next cycle. Twenty-one students, or 21 students, have completed their learning outcomes in the very good category, 20 students (97.22%), and one student (2.77%) in the good category. The results of student learning that have been completed are also supported by research instruments observing teacher activities for the first meeting held (87%), for the second meeting held (91%), and the meeting when held (96%). Then, for the second research instrument, namely observing student activities that were carried out (89%) and those that were not carried out (11%), it had reached the success indicator, so it was not continued in the next cycle because it had reached the Minimum Completeness Criteria, namely 75. Learning media E-magnetic based on SAC can improve student learning outcomes on magnetism material in class IX C SMPN 11 Gorontalo.

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