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Smart Apps Creator (SAC) Learning Media to Improve Science Literacy of Elementary School Student

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ABSTRACT

Scientific literacy is one of the 21st-century skills that students must learn, yet their competence falls short of expectations. Smart Apps Creator (SAC) is an application that provides many features to help teachers construct interactive learning media to increase scientific literacy.

Purpose –This research aims to define the profile of students' scientific literacy and assess the needs of SAC media to increase scientific literacy.

Methodology – This study employs a mixed method. This study's subjects were sixth-grade primary school pupils and teachers. Data were gathered by test, interview, observation, and documentation methods. The data analysis approach included descriptive statistics and interactive analysis. This research was conducted with the initial step of finding the problem's topic at the research location. Next, the researcher formulated the problem formulation research objectives and created research instruments. After that, the researcher took care of the research permit. After the research permit was approved, the researcher collected the research data. After the research data was obtained, the researcher analyzed and checked the validity or credibility of the data. Then, the researcher drew research conclusions based on the research objectives that had been set at the beginning.

Findings –The study's findings reveal the scientific literacy profile of grade VI primary school pupils in the moderate category, and both students and instructors agree that the development of SAC media is necessary to increase scientific literacy.

Significance – This study's findings help improve students' scientific literacy skills via SAC media.

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INTRODUCTION

21st-century skills include the cognitive, social, attitudinal, and emotional competencies required for effective functioning in contemporary society (Teo et al., 2021). Critical thinking, creative thinking, communication, collaborative problem solving, creativity, metacognition, communication, digital and

technology literacy, civic duty, and global awareness are all required to succeed in the twenty-first century (Suryandari et al., 2021). Scientific literacy skills are also required in the twenty-first century (Hindun et al., 2024). Scientific literacy refers to the skills and understanding of scientific ideas and processes that allow people to make decisions based on their knowledge and to participate actively in all parts of life, particularly in science (Lestari et al., 2020). Scientific literacy is important for recognizing scientific concerns that underpin decision-making and articulating a cohesive point of view using scientific and technological evidence (Queiruga-Dios et al., 2020).

However, Indonesian students' scientific literacy remains low (Palennari et al., 2022). According to the findings of the Programme for International Student Assessment (PISA) research conducted between 2000 and 2018, Indonesia's science score has fallen. Indonesia is rated 70th out of 78 nations, still trailing nearby Thailand, Malaysia, and Vietnam (OECD, 2019). Furthermore, the most recent PISA (Program for International Student Assessment) data suggest that Indonesian students' reading abilities remain below average compared to the average international score and are frequently in the lowest PISA measuring stage (Lendeon & Poluakan, 2022). The Organization for Economic Cooperation and Development (OECD) put Indonesia 62nd out of 81 participating nations in PISA 2022, scoring 388 (OECD, 2022). Previous studies showed that pupils' scientific literacy remains inadequate (Fuadi et al., 2020; Latif et al., 2022). The results of observations and initial interviews conducted by researchers at an elementary school in Wonogiri Regency also revealed that students' science literacy skills were still low and below the Minimum Completion Criteria. According to the science literacy indicator, pupils have not yet grasped scientific knowledge's procedural and epistemic components. Students only master scientific content knowledge (Nuraisyah et al., 2021).

Furthermore, students need teacher assistance to develop scientific literacy competencies/processes and attitudes (Adawiyah et al., 2023). Students demonstrate this by recognizing scientific issues, collecting evidence, concluding, and communicating scientific discoveries. Scientific views must nevertheless be conditioned to a feeling of responsibility for resources and the environment.

Low scientific literacy can be produced using traditional and limited learning paradigms and media (Febriani et al., 2023). Using conventional learning media and books as the primary source leads to a lack of efficacy in presenting content, causing pupils to become passive and bored with the material being taught (Heliawati et al., 2022). As a result, with the advancement of learning media in this digital age, learning must be focused on digital technology (Pramesti, A.C & Mashabi, 2023). This is consistent with changes in student conduct as they have gotten accustomed to utilizing devices.

This research urgently needs to be conducted to increase students' scientific literacy. This is mainly to improve students' scientific literacy in research locations where there is a problem of low scientific literacy. Mastering scientific literacy is important in preparing for the different global contests now entering Indonesia (Safrizal, 2021). Scientific literacy is required to enhance community welfare and progress toward a better living than previously (Palennari et al., 2022). Students with strong scientific literacy can apply scientific concepts, processes, attitudes, and values to make informed decisions and interact with others and their environment in the context of global and national development (Sholikah & Pertiwi, 2021). Scientific literacy is also important for problem-solving, acquiring new information, expressing scientific explanations, making conclusions based on scientific facts, and developing reflective thinking processes (Anjli et al., 2023). Furthermore, this study is necessary since primary schools in the research area have not consistently implemented interactive learning tools. This study also assists instructors in making natural and social sciences easier to grasp for pupils via interactive digital learning tools (Purniasih & Agustiana, 2024).

Based on the abovementioned issues, the researcher proposes a solution that involves leveraging SAC media to help students enhance their scientific literacy abilities. Smart App Creator (SAC) is an Android-based program that allows you to develop and distribute multimedia apps for Android smartphones, laptops, and PCs (L. P. Sari & Erita, 2024). SAC media provides several benefits, including digital program output in real-time, a JSON database, HTML 5 animation, and the ability to construct learning media, practice questions, etc (Widiansyhrani, 2022). This media is also an interactive application that requires no computer code, allowing it to be utilized quickly and effortlessly (Asri & Nugraheni, 2024). Previous studies

have also shown that learning through SAC media can help students enhance their scientific literacy (Heliawati et al., 2022; Pebriani et al., 2022). This solution might be an alternative to the challenges in this study site, such as inadequate scientific literacy and a non-interactive learning medium. SAC media may be a learning medium, making learning more active and student-centered (Maasawet et al., 2023). SAC media is one of the most creative and interactive learning media to use technology (Hidayah & Mulyani, 2024).

Previous research in this area has included the creation of SAC-based learning media to promote Natural and Social Sciences (IPAS) education in primary schools (Hidayah & Mulyani, 2024). The study demonstrated that learning media, such as SAC-based apps, can improve scientific learning outcomes. Second, investigate the creation of SAC-based Android media to improve scientific learning results (Sutrisni et al., 2022). The study found that SAC media improves grade IV students' scientific learning outcomes. Third, creating SAC media promotes critical thinking (Asri & Nugraheni, 2024). The study's findings demonstrated that SAC media helps improve critical thinking abilities in mathematics education (Maulana et al., 2022). Fourth, research regarding applying the STAD model assisted by SAC media to increase student motivation and learning outcomes (Pujiastuti, 2021). The study's findings demonstrated an improvement in students' learning outcomes due to using the STAD learning model in conjunction with SAC-based mobile learning media, which affected students' high learning motivation. Fifth, research on developing SAC media to improve student creativity in mathematics learning (Berlyan & Madiun, 2024). According to the findings of this study, using SAC media in mathematics education may boost student creativity, as seen by improved creative thinking and problem-solving skills.

However, this study differs from past investigations. Previous studies have not measured the use of SAC media in improving scientific literacy. This study will discuss the need for SAC media to improve students' scientific literacy, especially in elementary schools. Another factor to consider while using SAC media in digital technology-based learning is students' enthusiasm for electronic media (Indrasvari et al., 2021). Students are more enthusiastic about studying with electronic media, such as gadgets than with text media, such as textbooks (Haleem et al., 2022; Liu, 2023). This is because students prefer and are interested in digital learning materials that incorporate music, animation, video, and graphics. Furthermore, this research issue is relevant to 21st-century skills and the Industrial Revolution 4.0, including scientific literacy. SAC media used in education are also technologically based digital media (Ferlianti et al., 2022; T. Y. Sari et al., 2022).

This study was carried out to define the profile of students' scientific literacy and assess the requirements of SAC media for improving scientific literacy (Julianti et al., 2022). The findings of this study can help create learning media in primary schools and help pupils improve their scientific literacy.

METHODOLOGY

Research Design

This study employed mixed-method research. Mixed-method research is an approach that gathers, analyzes, and integrates quantitative and qualitative methodologies across several studies to comprehend study issues (Creswell, 2018). The selection of this method is based on the data collection carried out in phases, beginning with quantitative research initially and then continuing qualitatively. This is undertaken to fulfill the study's goals, which need quantitative data and narratives about the issue under investigation, and to conduct a requirements analysis for the required learning media.

Population and Sample

This study was conducted in SDN 3 Padarangin and SDN 1 Randusari in Wonogiri Regency. The population of this study was all grade IV elementary school students and teachers in Slogohimo District, Wonogiri Regency. The sample of this study was students of SDN 3 Padarangin and SDN 1 Randusari in Wonogiri Regency, with a sample size of 30 grade VI students and two grade VI teachers. This study was done from November to December 2024. This sample was selected using a purposive sampling strategy. The purposive sampling approach involves selecting study participants depending on their features or attributes

(Etikan et al., 2016). The school was chosen as the research location because the school was experiencing problems with scientific literacy and had not implemented interactive media continuously.

Data Collection

Data is acquired through tests, interviews, observations, and documentation. Tests assess pupils' scientific literacy skills. Data-gathering methods such as observation, interviews, and documentation address the need for SAC learning media to promote scientific literacy abilities. The SAC media needs interview tool was administered to students and instructors in grade VI primary school.

The validity of the student's scientific literacy test items depends on the content validity of expert opinion or judgment (Sugiyono, 2019). This is done by asking for expert opinions in the form of lecturers to assess the validity of the test items before being tested. After the test items are declared valid, the test is tested, and its reliability is analyzed. The reliability of the test used Alpha Cronbach. The reliability results show a Cronbach Alpha value of 0.712> 0.7 so that it is declared reliable (Asrul et al., 2014). This study's qualitative data validity technique is the triangulation of techniques and sources. According to (Sugiyono, 2019), triangulation of techniques is a strategy for testing the trustworthiness of data by comparing it to the same source using multiple techniques. The collected data is then compared, and conclusions are formed to gain more reliable data on its validity. Source triangulation is a strategy for determining the trustworthiness of data by comparing data from many sources (Sugiyono, 2019). Students and instructors served as the sources for this information.

Data Analysis

This research employs both quantitative and qualitative data analysis methods. Quantitative data analysis employs descriptive statistics. Descriptive statistical analysis examines data by portraying or illustrating the acquired information as it exists without aiming to draw inferences or generalizations applicable to the broader population (Vebrianto et al., 2020). Qualitative data analysis techniques involve collecting data, reducing it, presenting it, and making conclusions (Miles et al., 2019). The scientific literacy indicators used in this study were adopted from (OECD, 2018), consisting of indicators of scientific knowledge, scientific literacy competency/process, scientific application context, and scientific attitude. The number of scientific literacy questions is 20 questions, with each indicator consisting of 4 questions. Questions on the scientific knowledge indicator are numbered 1,5,9,13,17, the scientific literacy competency/process indicator is numbered 2,6,10,14,18, the scientific application context indicator is numbered 3,7,11,15,19, and the scientific attitude indicator is numbered 4,8,12,16,20. The following is the division of categories of scientific literacy levels in students:

Table 1. Science Literacy Value Categories

No.	Value	Categories
1.	$X > 80$	Very High
2.	$60 < X \leq 80$	High
3.	$40 < X \leq 60$	Medium
4.	$20 < X \leq 40$	Low
5.	$X \leq 20$	Very Low

Source: (Mellyzar et al., 2023)

The first stage in conducting this study was identifying the problem at the research site. The researcher then developed the problem formulation, study objectives, and research tools. The researcher then completed the research permission. Following the approval of the research permission, the researcher gathered the study data. Following acquiring the study data, the investigator examined and verified the data's accuracy or reliability. Subsequently, the investigator developed study findings that aligned with the initial research goals.

Then, the SAC learning media needs indicators were adapted from (Zuwida et al., 2021); the details are as follows:

Table 2. SAC Learning Media Needs Instrument Indicators

No.	Indicator
1.	Media that is usually used in the learning process
2.	The learning resources used can support the learning process.
3.	Are the media currently used interesting and easy to understand?
4.	Teachers use interactive media in the learning process.
5.	There is a need for the development of learning media.
6.	Using learning media can explain the material.
7.	The media used can visualize the material being presented.
8.	The use of interactive media helps students understand learning materials.
9.	The learning process requires the use of learning media.

FINDINGS

Student Science Literacy Profile

The students' scientific literacy profile data was obtained through a test. The test used was in the form of multiple choices. The researcher gave the test to the students directly. This test was given to obtain data on the level of the student's scientific literacy profile and the indicators of science that they had mastered. Based on the exam results, the average score for pupils' scientific literacy skills was 58.67. The lowest number of pupils was 40, and the highest was 80. The percentages of scientific literacy are as follows:

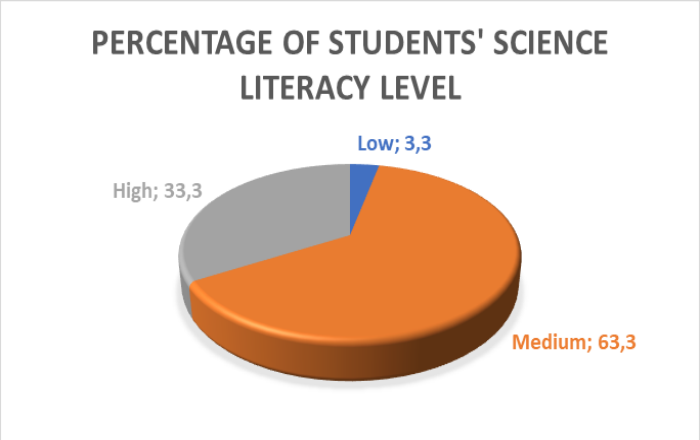

Figure 1. Percentage of Students' Science Literacy

According to Figure 1, most fourth-grade students in SDN 3 Padarangin and SDN 1 Randusari in Wonogiri Regency fall into the medium group, accounting for 63.3% or 19 pupils—students in the low group account for 3.3%, or one student. The percentage of pupils with a high degree of science literacy was just 33.3% or ten students. Students mastered the following types of science literacy indicators:

Table 3. Percentage of Student Mastery of Science Literacy Indicators

No.	Indicator	Category
1.	Scientific Knowledge	83,33 %
2.	Scientific Literacy Competency or Process	36,67 %
3.	Scientific Application Context	48 %
4.	Scientific Attitude	54,67 %

According to Table 3, scientific knowledge indicates the most scientific literacy that students master, accounting for 83.33% of the total. Scientific literacy competency/process indicates the most scientific

literacy that students struggle with. Furthermore, pupils master the indication of scientific attitude at 54.67%. Only 48% of students grasp the indication of the scientific application context.

The Need for SAC Media to Improve Science Literacy

The need for SAC media to develop students' scientific literacy is obtained through data collection of observations, interviews, and documentation. Observations and documentation are carried out during the learning process in class. Interviews are conducted with students and teachers after learning in class. Based on the results of data collection, the following are the results of observations made by researchers regarding the need for SAC media to improve students' scientific literacy:

Table 4. Results of SAC Media Needs Observations

No.	Observed Activities	Yes	No
1.	Media that is usually used in the learning process	√	
2.	The learning resources used can support the learning process.		√
3.	Are the media currently used interesting and easy to understand?		√
4.	Teachers use interactive media in the learning process.		√
5.	There is a need for the development of learning media.	√	
6.	Using learning media can explain the material.		√
7.	The media used can visualize the material being presented.		√
8.	The use of interactive media helps students understand learning materials.		√
9.	The learning process requires the use of learning media.	√	

Based on the observation results in Table 3, the learning process in the research subjects uses digital media. However, its use is still limited to PowerPoint (PPT). In addition, during learning, teachers still often prioritize printed media, namely textbooks and student worksheets (LKS). The results of this observation are supported by the results of interviews with class teachers who revealed that:

"*I only use PPT media a few times. Because it takes more time to prepare the equipment and is quite troublesome.*" *-YP*

"*Not often, but I have used an LCD projector. Because the number of LCD projectors in my school is limited, only one and is often used by other teachers.*" *-TES*

The following are the results of documentation during the implementation of classroom learning using PPT media and textbooks for the learning process:

Figure 2. Learning Process in Class

Furthermore, the learning resources used to support the learning process come from PPTs and textbooks. Both schools revealed that they still prioritize textbooks in the form of textbooks and LKS only. Schools have not used interactive and varied learning media. One teacher revealed that:

"Never used digital and interactive learning media because it requires thorough preparation."-TES

"At that time, I was teaching framework material. I used digital media in PPT to explain the material accompanied by pictures."-YP.

After that, the results of the third indicator observation for learning media were less interesting because it was only in writing on the projector board, so it could not stimulate students to think critically. The learning carried out was still centered on the teacher (teacher-centered learning). This result is supported by interviews with research subjects who revealed that:

"*Yes, I use PPT media in teaching science materials. I have not used other interactive digital media*" *-TES.*

Then, based on the observation results on the fourth indicator, teachers have not used interactive learning media. Students show less initiative and activeness during the learning process. Many students need to be accompanied by teachers to be active in learning.

Based on the observation results of the fifth indicator, the media used by teachers needs to be developed so that the learning media becomes interactive. This is because learning needs to be developed to be more interesting and interactive. Teachers also expressed the same opinion based on the results of their interviews, namely:

"*It is important to develop digital media because science material is broad, contextual and difficult to understand if only using image media.*" *-YP*

"*It is important because much of the science material is abstract, so using digital media can help students understand the material more easily.*" *-TES.*

Furthermore, based on the results of the sixth indicator observation, teachers have not used media that can explain the material well. PPTs and textbooks used to teach the material have not been equipped with videos or more interesting explanations. The teacher also said that if digital learning media are developed, it will help participants understand the subject matter. This is because it will make it easier for teachers to find various sources of digital learning materials according to their needs.

"*Digital media can help students understand learning materials because, with digital media, science learning is unlimited. Teachers can easily search for digital sources according to their needs*" *-YP.*

Based on the observation results, the PPT media delivered by the teacher is still simple, only in the form of writing and images, so it has not visualized the material thoroughly and clearly. Therefore, the teacher expressed in his interview that he hoped to develop digital media that could provide any material and trigger students' curiosity. One of them is smartphone-based learning media.

"*Yes, it is easier to use because now there is a lot of digital media around us. Mobile phones are one of them. Almost all students have them.*"*-YP.*

"*Digital media with animated images can increase students' interest in learning and reading materials, for example, materials about the Solar System because they are following the world of children who like attractive images and colors.*"*-TES.*

Based on the observation results, the PPT media used has not been able to engage students interactively in learning activities. The image media used has not been able to help students understand the learning material. Therefore, the teacher expressed the need for digital media for teachers to be able to explore broad and contextual material so that it can encourage students to think critically and scientific literacy so that students better understand the science subject matter. The following teacher interviews support the results of this observation:

"*Digital media can make it easier for students to understand the material, for example, the solar system, because with the help of digital media, the material looks more concrete.*"*-YP.*

"*Digital media can make it easier for students to understand the material on the solar system because the material presented can look real and contextual.*"*-TES.*

Then, based on the observation of the ninth indicator, the learning process requires interactive media that can visualize teaching materials in the form of scientific literacy. The teacher also revealed that the science material is abstract, so using interactive digital media with various animations to improve student understanding, especially scientific literacy, is more appropriate. Here is one of the results of an interview with the teacher:

"Digital media for the social sciences material on the solar system needs to be developed because the material is broad and abstract, so it would be better if the material were developed using digital media so that students can understand it more easily." -YP.

In addition to the results of observations and interviews with teachers, researchers also conducted interviews with research subjects of grade VI students. The study's results revealed the same thing as the results of teacher interviews. Respondents revealed that when studying in class, most media used were textbooks and PPT. Students also said interactive digital learning media was not used during science learning. They also said they needed the digital media to be important for learning. This is because it can help students understand and think critically in science subjects. Respondents also said that they needed interactive digital learning media for the Solar System material that contains animated images to increase interest in reading in science.

Based on the findings of the preceding study, both instructors and students who are the subjects of this study require the creation of interactive digital media to promote students' scientific literacy. The Solar System was the source material for interactive digital media production. As a result, the researcher provides a method to create interactive digital media using the SAC (Smart Apps Creator) application.

DISCUSSION

According to the research findings, the degree of scientific literacy among the study's participants is usually moderate. The findings of this study are consistent with earlier research indicating that pupils' scientific literacy is medium stage (Mellyzar et al., 2023). The difference is that this research was conducted in grade VI of elementary school, whereas the previous one was conducted in grade VII of junior high school pupils. The study found that pupils' scientific literacy remains poor owing to a lack of reading interest, and the learning method is still dull. Furthermore, past research has found that primary school kids' scientific literacy remains poor (Barus et al., 2024; Zulfiana et al., 2023).

The unique findings in this study are the scientific literacy indicators that are most mastered and those that are least mastered. Scientific knowledge is the most widely mastered indication among pupils. Scientific competency or process is the sign that students struggle with the most. This follows previous research, which revealed that the lowest achievement in scientific literacy was in the intellectual process skills indicator (Takda et al., 2023). The scientific knowledge indicator measures comprehension of essential scientific concepts required to explain natural occurrences and changes caused by human activities. If students master this indication, they can answer questions regarding scientific content, procedure, and epistemic understanding.

Meanwhile, the indicator of scientific competence, also known as process literacy, refers to the mental process of answering a question or addressing a problem, such as recognizing and analyzing data and forming conclusions. According to the analysis's results, pupils struggle with problem-solving using the facts and evidence acquired. Students still have difficulty analyzing and evaluating evidence that supports solving problems.

Another research finding is that students' scientific literacy is now low due to the lack of digital and interactive learning resources (Yulia et al., 2024). The current learning media has not been able to help students think critically. In addition, the media used has not been able to convey the material well and visualize it. According to an examination of student and teacher demands, they require digital and interactive learning material to acquire scientific literacy. Teachers and students need interactive digital media with various animations to improve student understanding, especially science literacy. This is because there is abstract science material that requires learning media that can visualize the material well. An example of a material that requires interactive media is the solar system. To address this issue, researchers propose the creation of digital and interactive learning materials based on SAC to increase scientific literacy.

The findings of this study are consistent with earlier research that has shown that SAC learning media may greatly increase students' scientific literacy during the COVID-19 epidemic (Heliawati et al., 2022). According to the survey, SAC media is interactive multimedia that is user-friendly and accessible anywhere and anytime. SAC media can help students enhance their scientific literacy by allowing them to absorb the

topic while seeing animated films and graphics. SAC material is accompanied by practice questions and problem-solving exercises that students can complete optimally.

Other research has found that SAC media can increase students' scientific learning results (Sutrisni et al., 2022). According to the study, including intriguing information in the SAC 3 application can improve learning efficiency by preventing students from becoming bored with the topic given by the teacher. Students engaged in the content presented by the teacher will grasp it better, and their science literacy will improve.

Previous studies have also shown that developing SAC learning media based on smart app creators can increase primary school students' learning results in energy transformation material (Rukoyah & Bektiningsih, 2024). The SAC application has a growing influence on medium-level scientific learning results. Creating learning material using Android Smart Apps Creator is useful in enhancing students' learning motivation and comprehension of scientific topics.

The results of this study can answer the problem formulation and research objectives set at the beginning. The findings of this study can help to improve students' scientific literacy. Furthermore, it can provide a solution for instructors to employ interactive learning media based on Android, namely Smart Apps Creator media. The availability of these media can improve student motivation (Eni et al., 2024) and learning results in elementary school (Amali et al., 2023). Furthermore, the required SAC products can be used as input materials regarding learning media, which can later add learning resources in schools, especially in science and science learning. This will improve the quality of school education.

However, this study was carried out at the preliminary study or needs analysis stage. As a result, more studies are needed to determine the efficiency of Android-based Smart Apps Creator instructional material in enhancing students' scientific literacy. Therefore, an in-depth study is needed regarding developing SAC media to increase students' scientific literacy (Sipayung et al., 2020).

CONCLUSION

Based on the research and debate findings, it is possible to infer that students' scientific literacy profiles remain modest. Teachers and students require digital and interactive learning resources to boost elementary school students' scientific literacy. As a result, researchers provide solutions to the challenges that arise by creating interactive learning media using Smart Apps Creator (SAC) to increase students' scientific literacy. This research can improve scientific literacy and the creation of interactive digital-based learning materials. Further study is needed to determine the usefulness of developing SAC media in boosting students' scientific literacy.

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