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GILaS (Science Literacy Activities) through Simple Experiments for Students at St. Paulus Karuni Middle School

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ABSTRACT

Scientific literacy is essential for students to develop their scientific abilities. Indonesian students' performance in this area is still very low, as shown by the 2018 PISA results. To address this issue, schools need to provide support to students. Through this community service program, a solution is offered by conducting GILaS through simple experiments for St. Paulus Karuni Middle School students. The main objective of this community service program is to strengthen students' scientific literacy through simple experiments. Through the experimental method, students are actively involved so they can understand the steps and results of the experiment, thereby strengthening their scientific literacy. The participants were 42 students, 16 male and 26 female. The evaluation instrument used was a student response sheet on the implementation of the activity. The instrument contained four main indicators: 1) interest and motivation to learn, 2) understanding of the material, 3) implementation and mentoring, and 4) general benefit. The results of the activity showed that students responded positively to the GILaS activity, with response rates of 65.28 percent strongly agree, 31.15 percent agree, 1.79 percent disagree, and 0.79 percent strongly disagree. GILaS activities are essential, especially for schools with limited laboratories and those that have never conducted practical work at school. This activity is an important part of a collaborative effort to strengthen students' scientific literacy.

Keywords: GILaS, junior high school students, science literacy, simple experiments

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INTRODUCTION

In the 21st century, marked by digital disruption, environmental crises, and a flood of misinformation, science literacy has become one of the most crucial skills that must be strengthened in education (Jufrida et al., 2019; Stefanski et al., 2019). Scientific literacy is no longer simply the ability to memorize mathematical formulas or rigid conceptual terminology. Instead, this competency represents a person's deep capacity to understand, interpret, and actively engage with the scientific concepts and processes occurring around them (Howell & Brossard, 2021; Aquino, 2025). Mastery of this literacy is a key asset for individuals, particularly for fifteen-year-old adolescents as an indicator of the success of basic education, in navigating the increasingly complex dynamics of the times (Guerrero & Sjostrom, 2025; Jufrida et al., 2019; Jumrodah et al., 2019).

Beyond mastery of academic material, science should be viewed as a method of investigation, a structured way of thinking, and a dynamic bridge connecting technology, society, and the environment (Diquito, 2024; Diez, 2021; Rusilowati et al., 2016). Through a comprehensive understanding of content, procedural processes, and epistemic aspects of how science works, students are trained to critically evaluate scientific evidence (Costa et al., 2021; Qiao et al., 2024). This cognitive skill is essential for application in everyday life. With this ability, modern society can make wise personal decisions, solve practical problems based on natural phenomena, and participate intelligently in public decision making related to current technological issues (Nazara et al., 2026; Osborne et al., 2025; Pratama et al., 2025).

To meet these demands, modern science learning is now directed toward developing creativity and practical competencies that address the needs of contemporary society. In this context, the capacity of educational institutions, including higher education institutions, plays a vital role as academic agents in shaping, facilitating, and improving the quality of student learning (Kerans, 2022; Kerans & Sanjaya, 2024). Through strategic interventions in the academic environment, educational institutions bear full responsibility for producing competent, adaptive learners with high competitiveness relevant to current industrial and social needs.

Effective science education must strengthen students' capabilities in science and technology so that they can thrive within the global community. Developing this scientific competence is crucial in equipping learners with effective life skills (Howell & Brossard, 2021; Kerans & Sanjaya, 2024; Pratama et al., 2025). Through well directed mastery of technology and science, students are shaped not only into consumers of information but into individuals capable of overcoming various life obstacles, making rational strategic choices, and acquiring the essential skills needed to face future global challenges (Diez, 2021; Aquino, 2025; Nazara et al., 2026).

To measure the success of strengthening this competency, various global frameworks have been applied. Referring to the 2015 Program for International Student Assessment (PISA) standards, scientific literacy is comprehensively formed by four interrelated aspects: context, scientific competence, knowledge, and attitude (Costa et al., 2021; Roy et al., 2025). The depth of this literacy can also be reviewed through Bybee's dimensions, which progress from the nominal, functional, and conceptual stages to the multidimensional stage. Notably, as the times develop rapidly, the dimensions of scientific literacy continue to transform by integrating three new domains highly relevant to the digital era: civic scientific literacy, digital media scientific literacy, and cognitive literacy (Guo, 2021; Permatasari & Fitriza, 2025).

At the junior high school level, all conceptual aspects and dimensions can be realized concretely through the implementation of simple experiments in the classroom. For example, for seventh grade students at SMPK St. Paulus Karuni, science learning that is often abstract due to limited laboratory equipment can result in learning that focuses on memorizing abstract theory. This condition can be a factor in students' low scientific literacy (Firda Yusmar, 2023). A process is therefore needed that leads students to prove or discover abstract concepts through a scientific process. The process of demonstrating surrounding phenomena through direct scientific methods or experimentation is expected to strengthen students' literacy. When students conduct simple experiments such as observing the bent pencil phenomenon, floating eggs, or building a simple respiratory system model, they activate their scientific competence and knowledge.

The process of observing, practicing, and assembling equipment in simple experiments, recording observation results, and drawing conclusions directly trains students' cognitive skills and scientific attitudes. This activity transforms theoretical knowledge into functional understanding. Ultimately, through contextual experiments close to daily life, students not only learn about science but also learn to think and act like young scientists ready to face the challenges of modern society.

Experiments provide direct and meaningful experience in understanding science in everyday life. Students are actively engaged in experiments, and through this active engagement their knowledge, skills, and attitudes can be strengthened. Experiments give students space to observe, record, and communicate what they do (Baiq, 2021; La & Onde, 2025).

Based on observations by the head of the community service team during several sessions accompanying university students in the School Practice Seminar and School Field Introduction program at SMPK St. Paulus Karuni, it was found that the learning process was still teacher centered and that practical work was not carried out due to limited tools and materials at the school. Based on these findings, GILaS with simple experiments is needed to strengthen students' scientific literacy through simple experimentation.

METHODS

This community service program was implemented using a direct, simple experimental method. The activity was conducted at SMPK St. Paulus Karuni with 42 students from classes VIIa and VIIb involved. The seventh grade students at SMPK St. Paulus Karuni consisted of 16 male and 26 female students. In this activity, all students from classes VIIa and VIIb were combined and then divided into seven small groups, each consisting of six students.

The community service program was carried out in four main stages: 1) the preparation stage, 2) the simple experiment trial stage, 3) the implementation stage at the school, and 4) the evaluation stage to assess student responses to the program. Student responses were collected through a student response questionnaire containing four criteria, as shown in Table 1.

Table 1. Student response questionnaire instrument

Indicator	Sub Indicator
Interest and Motivation	The experimental activities are fun and enjoyable. I have become more interested in learning science after participating in this activity. The experiments practiced made me curious to try them again at home.
Understanding of Material	The explanation of the material before the experiment began was very easy for me to understand. Through direct experimentation, I find it easier to understand scientific phenomena around us. This activity helped me connect science theory in class with everyday life.
Implementation and Mentoring	The mentors explained the experimental steps patiently and clearly. The tools and materials used in these simple experiments

Indicator	Sub Indicator
	are easy to find nearby. The time given to conduct the experiment was sufficient and not rushed.
General Benefit	Science literacy activities like this should be held again at my school in the future.

The scale used in this questionnaire was a four point Likert scale without a neutral or undecided option, consisting of SA: Strongly Agree, A: Agree, D: Disagree, and SD: Strongly Disagree. Questionnaire data were analyzed descriptively by examining student responses to the activity for each indicator. The four point Likert scale was chosen for the program evaluation questionnaire to prevent students from tending to choose a safe, neutral answer. Students were thereby directed to clearly determine whether their response to the science literacy activity was positive (SA or A) or negative (D or SD).

RESULT AND DISCUSSION

Preparation Stage

In this initial stage, the service team carried out internal and external coordination to ensure the smooth running of the program. The first step began with initial observation and obtaining permission from the partner school, SMP St. Paulus Karuni, to align the schedule and identify student needs. The team then prepared science literacy educational materials and the equipment and materials for the simple experiments. The experimental approach was designed contextually by selecting safe, economical tools and materials that were easy for students to find in their surrounding environment.

Experiment Trial Stage

Before being implemented directly with students, the service team conducted an internal trial of the simple experiments that had been designed. This trial aimed to test the practicum instruments, estimate the time required for each procedure, and anticipate potential technical obstacles in the field. Through this stage, the team ensured that all experimental steps were genuinely safe, easy to understand, and could be independently replicated by junior high school students without significant difficulty. This trial was carried out on 20 May 2026 at the Mathematics and Natural Sciences laboratory of Universitas Katolik Weetebula.

Implementation Stage

This stage is the core of the community service program, in which the GILaS (Science Literacy Activity) was applied directly with students at SMP St. Paulus Karuni. The activity began with an interactive introduction and explanation of basic scientific concepts by the service team to build students' initial understanding. Students were then divided into small groups and directly guided by student mentors to conduct simple science experiments. Students were given ample space to observe phenomena, try the procedures independently, and discuss the connection between the science theory taught in class and the phenomena they encountered directly in the experiments.

The activity was carried out on 21 May 2026 from 08.00 to 12.00 in classrooms VIIa and VIIb at SMPK St. Paulus Karuni. The experiments conducted included the following.

a. Simulation of the respiratory system using baking soda, vinegar, a drink bottle, and a balloon.
b. Carbohydrate testing using rice and flour with the aid of iodine solution.
c. Acid base reactions.

d. The concept of light refraction through the bent pencil experiment and an artificial rainbow.
e. The concept of static electricity using paper and a ruler.
f. Liquid density demonstrated through floating eggs.
g. The concept of ocean waves in a bottle.

After each experiment, students were asked to explain what had occurred. The facilitator in each group then reviewed the concept illustrated by the experiment conducted in that group. The implementation process is shown in Figure 1.

Figure 1. Process of Conducting the Simple Experiments

Evaluation Stage

The final stage was carried out to measure the success of the program and assess student responses to the GILaS activity. Evaluation was conducted by distributing the questionnaire instrument, using a four-point Likert scale, immediately after the experimental activity was completed. Analysis of the student response data from SMP St. Paulus Karuni showed very positive results. The questionnaire results are shown in Table 2.

Table 2. Percentage of Student Response Results

Indicator	SA	A	D	SD
Interest and Learning Motivation	**68.25**	**28.57**	**0.00**	**0.79**
The simple science experiment activities were very exciting and enjoyable.	88.10	11.90	0.00	0.00
I became more interested in studying science after participating in this activity.	64.29	35.71	0.00	0.00
The experiments practiced made me curious to try them again at home.	57.14	38.10	0.00	4.76
Understanding of Material (Scientific Literacy)	**53.17**	**38.89**	**3.97**	**0.00**
The explanation of the material before the	38.10	57.14	4.76	0.00

Indicator	SA	A	D	SD
experiment began was very easy for me to understand.				
Through direct experimentation, I find it easier to understand scientific phenomena around us.	61.90	35.71	2.38	0.00
This activity helped me connect science theory in class with everyday life.	64.29	30.95	4.76	0.00
Implementation and Mentoring	**77.78**	**26.19**	**0.79**	**0.00**
The mentors explained the experimental steps patiently and clearly.	88.10	11.90	0.00	0.00
The tools and materials used in these simple experiments are easy to find nearby.	61.90	35.71	2.38	0.00
The time given to conduct the experiment was sufficient and not rushed.	66.67	33.33	0.00	0.00
General Benefit	**61.90**	**30.95**	**2.38**	**2.38**
Science literacy activities like this should be held again at my school in the future.	50.00	45.24	2.38	2.38

The results for each indicator can be described as follows.

a. Interest and Learning Motivation
Based on the students' positive responses, this activity succeeded in sparking students' enthusiasm for learning. Most students rated the science experiments as very exciting and enjoyable, and the experiments even sparked their curiosity to try them again independently at home. This is reflected in the high cumulative percentage of Strongly Agree responses at 68.25 percent and Agree responses at 28.57 percent.

b. Understanding of Material and Scientific Literacy
Through the direct experimentation approach, students found it easier to understand scientific phenomena in their surrounding environment and were able to connect the science theory learned in class with everyday life. The explanation of the material given by the student mentors before the practical session was also considered easy to understand by most students.

c. Implementation and Mentoring
The mentoring process received very strong ratings, with students reporting that the facilitators explained the experimental steps patiently and clearly. In addition, the time allocated was considered adequate and not rushed, supported by the use of tools and materials that were easy to find in the students' surrounding environment.

d. General Benefit
The sustainability of the program is supported by students' strong desire for similar science literacy activities to be held again at their school in the future.

The success of the GILaS (Science Literacy Activity) program at SMP St. Paulus Karuni in boosting students' interest and learning motivation aligns with modern science learning principles. The evaluation data show that direct, hands-on experimental activities effectively sparked a high level of curiosity, with students reporting that they wanted to try the experiments again independently at home. This positive psychological outcome supports recent research findings indicating that realistic visualization of scientific phenomena through simple experiments effectively reduces cognitive load and reduces the perception that science is a rigid, uninteresting subject (Castro Alonso et al., 2019; Kerans & Sanjaya, 2024). When students are actively involved in exploring tools and materials close to their daily lives, intrinsic motivation and scientific attitudes grow steadily, forming stronger long term memory retention compared with conventional lecture-based methods (Inang, 2023; Maya, 2021).

The high positive student response on the material understanding indicator confirms that a contextual practicum approach is a key stimulus for strengthening scientific literacy. These results show that students found it easier to connect abstract science theory in textbooks with the reality of natural phenomena in their surrounding environment (Maharani, 2025; Rahmawati & Wahyuni, 2026). This reinforces the importance of transforming science education toward one grounded in empirical experience, in order to help close the gap in global science literacy achievement. The use of easily available local materials for experiments not only addresses the limitations of school laboratory facilities but also teaches students about sustainability and critical problem solving. The sustainability of interactive science literacy programs such as this therefore plays a crucial role in preparing junior high school students to develop the higher order thinking skills needed to adapt to the challenges of the 21st century.

The limitations of this community service activity include the following: 1) the experimental activity was carried out for only one day, 2) students' scientific literacy was not measured at the beginning of the activity, so there was no baseline for comparison at the end to assess improvement in scientific literacy, and 3) a follow up plan with the students has not yet been developed.

CONCLUSION

The GILaS (Science Literacy Activity) community service program for seventh grade students at SMPK St. Paulus Karuni strengthened students' scientific literacy. This is evidenced by student responses indicating that the appeal and motivation generated by this activity made them interested in learning science and trying it again at home. In addition, explanations given in a simple manner, using phenomena students frequently encounter around them, made students interested and able to easily explain what they had done, which they then connected to scientific concepts. The implications of this activity provide an initial picture of science activities that engage students, indicating that a specific approach is needed going forward to continue developing students' literacy through experimental activities in school extracurricular programs. For this purpose, teacher mentoring is also needed in the use of simple tools and materials from the surrounding environment as material for simple experiments in the science learning process.

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest.

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