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SETS-Based Physics Learning Workshop: Strengthening Teachers' Role in Fostering Students' Scientific Literacy

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ABSTRACT

The Physics Learning Workshop based on Science, Environment, Technology, and Society (SETS) was carried out to enhance the ability of physics teachers in the MGMP of Hulu Sungai Selatan Regency to foster students' scientific literacy. The background of this activity is the low achievement of Indonesian students' scientific literacy as reported by PISA, as well as the tendency of physics learning in schools to focus heavily on memorizing formulas and practicing problems, which makes it less relevant to real-life contexts. Partner teachers also experienced difficulties in designing contextual teaching materials, making an assistance program through an applied workshop necessary. The workshop was conducted in five stages: socialization, training, technology implementation, mentoring and evaluation, and program sustainability. The training materials included strengthening the concept of scientific literacy, introducing the SETS approach, and practicing the development of contextual SETS-based physics teaching modules. Teachers not only received material but were also guided in designing teaching tools that engage students in linking physics concepts with real phenomena in their environment, including local issues such as annual floods and wetland utilization. The evaluation results showed an improvement in teachers' skills in designing and implementing SETS-based learning that encourages students to be more active, critical, and reflective in understanding physics concepts. More than 80% of teachers expressed satisfaction with the activity, while the implementation of learning practices reached the "good" category. This workshop successfully strengthened the role of teachers as facilitators who are able to cultivate students' scientific literacy through contextual, innovative, and relevant physics learning in daily life.

Keywords: Physics Learning; Physics Teachers; Scientific Literacy; SETS (Science, Environment, Technology, and Society)

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INTRODUCTION

Science education in the 21st century not only emphasizes mastery of concepts and formulas but also critical thinking, creativity, and problem-solving skills in real-life situations (Muzijah et al., 2020; Wati & Dewantara, 2023). Scientific literacy has become one of the essential competencies that every individual must possess, as it enables them to understand natural phenomena, make evidence-based decisions, and actively participate in a society increasingly filled with scientific and technological issues (Wati, Mahtari, et al., 2023; Wati,

Pratiwi, et al., 2023). This makes scientific literacy one of the key indicators of a nation's education quality.

International surveys such as the Programme for International Student Assessment (PISA) show that Indonesian students' scientific literacy is still at a low level. The 2018 PISA data placed Indonesia at the lower ranks in reading, mathematics, and science competencies. This condition highlights that although students are taught science subjects at school, they are not yet accustomed to connecting the concepts they learn with real-life situations. Thus, strengthening scientific literacy through innovative and contextual learning has become an urgent need (Isnaniah et al., 2024; Sari et al., 2023).

In Indonesia, physics learning is still often focused on delivering abstract concepts with little connection to the real world. Teachers rely heavily on lectures, followed by problem-solving exercises that emphasize procedural skills alone. Such approaches make students tend to be passive, memorizing formulas without training to understand the scientific meaning of the phenomena around them. Consequently, their scientific literacy skills develop only partially, not holistically.

Various studies suggest that one of the causes of low scientific literacy is the limited ability of teachers to integrate learning with real-life contexts (Dewantara et al., 2024; Hartini et al., 2019). Teachers still face difficulties in designing teaching materials that combine scientific concepts with environmental phenomena, technological developments, or social issues. Yet, when learning presents experiences that are close to students' lives, the process of internalizing knowledge becomes more meaningful.

This situation is also found among physics teachers who are members of the MGMP (Teacher Working Group) in Hulu Sungai Selatan Regency. Based on initial observations and discussions with MGMP administrators, it was revealed that physics teaching and learning activities were still dominated by lectures and limited discussions. Teachers admitted that they rarely applied innovative teaching approaches due to limited knowledge, experience, and relevant references. As a result, students in partner schools struggled to relate physics concepts to everyday phenomena.

In addition, MGMP activities that had been carried out previously were more focused on preparing exam materials and discussing national exam questions. While these activities were beneficial for improving evaluation quality, they did not touch on the development of teaching strategies. Therefore, MGMP Hulu Sungai Selatan requires a mentoring program that specifically equips teachers with the skills to design and implement innovative learning models capable of developing students' scientific literacy.

The challenges faced by physics teachers in Hulu Sungai Selatan cannot be allowed to persist, considering the teacher's role as the spearhead of learning. If teachers are not accustomed to contextual learning strategies, students will continue to face a gap between theory and reality. Thus, concrete solutions in the form of relevant training or workshops that suit teachers' needs and school conditions are necessary.

One approach that can be offered to address this need is Science, Environment, Technology, and Society (SETS). The SETS approach emphasizes the interrelation between science, environment, technology, and society. In this way, students can view science not merely as a collection of facts and formulas but as a means of understanding real-life situations. This approach is considered relevant for equipping students with scientific literacy skills as it engages them in critical, analytical, and reflective thinking processes (Rezki et al., 2024; Zainuddin et al., 2020).

Several studies indicate that implementing the SETS approach has been proven to improve students' conceptual understanding, scientific attitudes, and critical thinking skills. For example, physics learning using the SETS approach can help students see the connection between physical laws and issues such as energy, the environment, or technology around

them. These research findings reinforce the theoretical foundation for the importance of training teachers in applying SETS as the main agents of learning transformation in schools.

Based on this background, a physics learning workshop based on the SETS approach was conducted to improve the competencies of physics teachers in MGMP Hulu Sungai Selatan Regency. Through this workshop, teachers are expected to design innovative teaching materials that connect science with environmental, technological, and social issues. Ultimately, this activity not only helps teachers develop their competencies but is also expected to positively impact the improvement of students' scientific literacy in Hulu Sungai Selatan. This article will describe the implementation process of the workshop and the outcomes achieved as a concrete solution to the partners' problems.

METHODS

The implementation method of this community service program was systematically designed to ensure that the formulated objectives could be achieved optimally. The activity, in the form of a Physics Learning Workshop based on SETS to improve scientific literacy in the Physics MGMP of Hulu Sungai Selatan Regency, was carried out through several stages: socialization, training, technology implementation, mentoring, and evaluation, as well as program sustainability.

The first stage was **socialization**, conducted during the preparation phase. The service team organized the committee, developed the schedule or activity rundown, and prepared various technical needs to support the smooth running of the workshop. The activity rundown was designed participatively by incorporating input from the partner, ensuring that the agenda aligned with the needs of physics teachers in MGMP. Participant recruitment was coordinated directly by the MGMP chair, targeting teachers under the forum. The workshop was conducted in a blended format (online and offline) to accommodate broader participation. Information about the activity was disseminated via social media such as WhatsApp and Instagram, managed by students under the supervision of the team leader. This stage was important to ensure that all stakeholders understood the objectives of the program and were motivated to actively participate.

The second stage was **training**, which formed the core of the community service activity. The entire team—comprising the team leader, faculty members, students, and field assistants—was directly involved in conducting the workshop. The partners, in this case, the MGMP teacher members, served as the main participants. The training materials were structured in stages, starting from strengthening the concept of scientific literacy, introducing the SETS (Science, Environment, Technology, and Society) approach, and developing SETS-based physics learning to enhance scientific literacy. Participants were then equipped with skills in developing practical SETS-based physics teaching modules. The training emphasized not only knowledge transfer but also collaboration through mentoring sessions in module preparation. At the end of the training stage, a review and assessment of the teaching modules produced by teachers was conducted to ensure quality before classroom implementation.

The third stage was **technology implementation**. At this stage, the service team facilitated the application of SETS-based learning through example physics teaching modules developed using the SETS approach.

The fourth stage was **mentoring and evaluation**. During mentoring, teacher participants were encouraged to directly implement their SETS-based learning designs in their classrooms. These practices were observed by field assistants and peers to provide feedback on the execution of the lessons. Observations focused on the implementation of instructional steps, alignment with the prepared modules, and the teachers' creativity in integrating scientific literacy. Evaluation was carried out using instruments such as learning

implementation sheets and assessments of the teaching products produced. The evaluation results were calculated to obtain an average score, which was then compared with achievement criteria. The program was declared successful if the average score reached at least the "good" category.

The final stage was **program sustainability**. Thus, the community service activity did not stop at the workshop implementation but also ensured long-term impact in the form of improved quality of contextual, innovative physics learning that fosters scientific literacy among students.

RESULT AND DISCUSSION

The implementation of the physics learning workshop based on SETS to enhance scientific literacy began with the planning and socialization stage. The planning and socialization activities were carried out on July 21, 2025, at SMAN 1 Angkinang together with the Chair of the Physics MGMP of Hulu Sungai Selatan Regency. At this stage, the service team and the partner coordinated regarding the committee structure, scheduling, implementation mechanisms, and the expected outputs. The discussion resulted in an agreement that the activities would be conducted in two formats, namely online and offline, to facilitate participants in accessing materials while also gaining hands-on practical experience in the field. Planning and Socialization activities are documented in Figure 1.

Figure 1 Planning and socialization activities

The next stage was the implementation of the workshop, which began with the delivery of materials online on August 2, 2025. This activity was attended by physics teachers from various senior high schools who are members of the Physics MGMP of Hulu Sungai Selatan Regency. The online materials covered three main topics, namely: Topic 1: Scientific Literacy, Topic 2: SETS, and Topic 3: Physics Learning based on SETS to improve Scientific Literacy.

There are five stages in learning with the SETS approach, namely: (1) the invitation or initiation stage; (2) the formation or introduction stage; (3) the application or usage stage; (4) the confirmation or reinforcement stage; and (5) the evaluation stage (1). The characteristics of the SETS approach in the physics learning process include: (1) teaching physics contextually; (2) requiring thinking skills related to the transfer of physics into technology; (3) bringing situations that utilize physics for community life; (4) considering the benefits and drawbacks of physics applications in relation to relevant technology; (5) explaining the relationship between physics and other SETS elements; and (6) building SETS understanding from various initial individual perspectives (2–4).

The presentation was delivered via the Zoom platform as a medium for sharing teaching materials. The online training atmosphere was active, as evidenced by teachers' participation in question-and-answer sessions as well as small group discussions. The teachers expressed that scientific literacy remains a major challenge in the classroom, and therefore, the SETS

approach was considered relevant to help students connect physics concepts with real-life contexts. Documentation of the implementation of the first workshop session via zoom is shown in Figure 2.

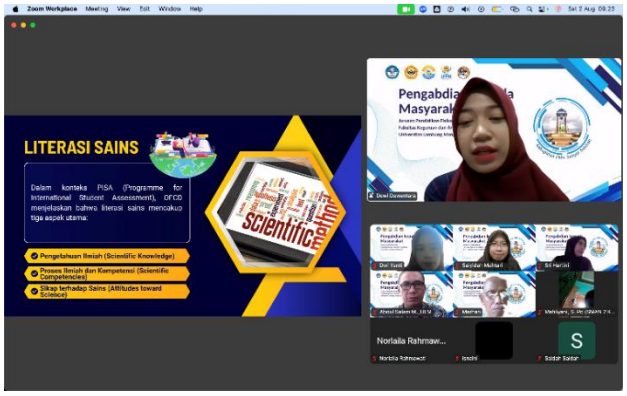

Figure 2 Implementation of the first workshop session via zoom

The next stage was the delivery of material through an offline session on September 4, 2025, held at SMAN 1 Kandangan. This activity focused on Material 4: Introduction and development of SETS-based Physics teaching modules to enhance Scientific Literacy. The teachers were guided by the service team to design SETS-based teaching modules in accordance with the learning topics they taught. During this activity, the teachers not only received the material but also practiced directly in developing applicable teaching tools. Several groups of teachers even succeeded in proposing ideas for module designs that utilized local contexts of South Kalimantan, such as annual flooding phenomena, the use of wetlands, and the local wisdom of surrounding communities. This illustrates a real integration of science, environment, technology, and society, which is the essence of the SETS approach.

Several studies have shown that the application of the SETS approach has proven effective in improving students' conceptual understanding, scientific attitudes, and critical thinking skills (Anam et al., 2024; Hartini et al., 2024). For instance, learning physics using the SETS approach can help students see the interconnections between physical laws and issues related to energy, environment, or technology around them (Fitri et al., 2021; Rezki et al., 2024). These research findings reinforce the theoretical foundation of the importance of providing training on the application of SETS to teachers as the main agents of learning transformation in schools. The implementation of the Second Workshop Session at SMAN 1 Kandangan is shown in Figure 3.

Figure 3 Implementation of the Second Workshop Session at SMAN 1 Kandangan

The evaluation results of the activity showed that the teachers participating in the workshop experienced an improvement in their understanding and skills in designing Physics learning based on the SETS approach. Based on the evaluation sheets, more than 80% of the teachers expressed satisfaction with both the online and offline material delivery and assessed that the materials provided were relevant to their needs. These findings reinforce the view that the SETS approach is effective in enhancing teachers' scientific literacy while also providing a positive impact on students in the classroom.

Thus, the results of the SETS-based Physics Learning Workshop indicate that this community service activity successfully addressed the needs of the Physics MGMP partners in Hulu Sungai Selatan Regency. In addition to enriching teachers' understanding, the activity also produced a tangible output in the form of teaching modules that can be continuously utilized in learning. This is in line with the main objective of the activity, namely, to strengthen teachers' capacity in implementing innovative approaches that are contextual and relevant to the local environment.

CONCLUSION

The implementation of the SETS-based Physics Learning Workshop for the Physics MGMP in Hulu Sungai Selatan Regency has proven to be effective in strengthening teachers' competencies in designing contextual and innovative learning. The workshop, conducted through both online and offline sessions, successfully enhanced teachers' understanding of scientific literacy and their ability to integrate science, environment, technology, and society into classroom practice. More than 80% of participants reported satisfaction and acknowledged the relevance of the training materials to their professional needs, while tangible products such as SETS-based teaching modules were produced as sustainable learning resources.

The implications of this program extend beyond teacher development. By equipping teachers with the skills to implement SETS-based approaches, students are more likely to experience physics learning that is meaningful, contextual, and connected to real-world issues, including local phenomena such as floods and wetland management. This approach not only promotes scientific literacy but also encourages critical and reflective thinking among students, thereby supporting national efforts to improve Indonesia's performance in global assessments such as PISA. The continuation of similar capacity-building initiatives is therefore essential to sustain and expand the impact achieved through this program.

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