

Attempts to Train Literacy and Numeracy through STEM-based Learning Media Making Training for Science Teachers in Muaraenim Regency

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Abstract: This training aims to train literacy and numeracy through making STEM-based learning media on renewable energy material. In addition, teachers are expected to be able to provide innovation in media making, which can be implemented in science learning. The method used in this activity is Participatory Action Research (PAR). Several steps are taken to achieve the set goals, namely 1) giving a pretest or initial test, 2) implementing the service, and 3) giving a final test and evaluation and reflection. This activity was attended by 30 participants who were science teachers and members of the Science MGMP. The results showed that the percentage for the pretest score with 30 participants obtained an average of 47.6%, and the posttest score obtained an average of 93.20%, for a Gain score of 87%. This value represents the interpretation of the practical improvement category. Based on the results of the questionnaire on the level of satisfaction with the implementation of the service, it can be indicated that all teachers feel delighted with the training assistance service activities. This training activity has provided practical solutions to facing the challenges of 21st-century learning, especially in areas with limited facilities.

Keywords: Learning media; Literacy and numeracy; Renewable energy; Science learning; STEM Approach; Training

Introduction

Improving literacy and numeracy competencies is one of the main focuses in education to face the challenges of the 21st century. Literacy, which includes the ability to understand, evaluate and use information, and numeracy, which consists of the skills to use math in everyday life, are essential basic skills for learners to master. These two competencies not only play a role in academic achievement but also as provisions for success in future life (Committee on Science Literacy and Public Perception of Science et al., 2016).

The importance of literacy and numeracy skills in educational contexts cannot be overstated, particularly in STEM (Science, Technology, Engineering, and Mathematics) education. In the Muaraenim Regency, efforts to enhance these skills among science teachers are

crucial for improving student outcomes in these disciplines. Literacy and numeracy are foundational skills that enable students to engage with more complex educational content and real-world problem-solving scenarios. Research indicates that effective training programs for teachers can significantly enhance their ability to foster these skills in students (D et al., 2022; Hamdu et al., 2023; Palinussa et al., 2023).

Numeracy literacy, which encompasses the ability to use mathematical concepts and skills in practical situations, is an essential component of a well-rounded education. Studies have shown that teachers equipped with strong numeracy skills can better facilitate student learning and engagement (Hidayah et al., 2022). The Minimum Competency Assessment (MCA) has been introduced as a tool to evaluate students' numeracy skills, providing educators with insights into areas

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needing improvement (Deda et al., 2023). This assessment framework not only measures student competencies but also serves as a guide for teachers to tailor their instructional strategies effectively.

Moreover, the integration of STEM-based learning media is pivotal in enhancing both literacy and numeracy among students. STEM education promotes an interdisciplinary approach that encourages critical thinking and problem-solving skills (Handayani & Khairuna, 2022; Nugroho & Shalikhah, 2023). By utilizing interactive and engaging learning materials, teachers can create a more stimulating educational environment that fosters student interest and participation (Festiyed et al., 2019). This approach aligns with contemporary educational practices that emphasize the importance of engaging students through innovative methods, thus improving their literacy and numeracy skills (D et al., 2022; Deda et al., 2023).

In the context of Muaraenim Regency, training programs focused on STEM-based learning media for science teachers can address existing gaps in literacy and numeracy education. Such initiatives are essential not only for improving teacher competencies but also for ensuring that students develop the necessary skills to thrive in a rapidly changing world. The collaboration between educators, parents, and the community is vital in this endeavor, as it creates a supportive ecosystem that nurtures student learning (Hamdu et al., 2023; Lestari et al., 2021).

Implementing a STEM-based learning approach (Science, Technology, Engineering, and Mathematics) has been proven effective in training students' literacy and numeracy. This approach allows students to understand concepts deeply through solving real problems that integrate various disciplines. In addition, STEM-based learning helps students develop critical, creative, and collaborative thinking skills that are indispensable in the modern era (Bybee, 2013).

However, the implementation of STEM-based learning still needs to be improved, especially regarding teachers' readiness to design and use relevant learning media. Based on a survey in the field, many science teachers in Muaraenim District have yet to receive intensive training in developing STEM-based learning media. Innovative learning media can increase students' learning motivation and facilitate them in mastering literacy and numeracy.

Through training in STEM-based learning media, teachers are expected to improve their professional competence in designing more interactive and contextualized learning (Ismet et al., 2023; Nazhifah et al., 2023). This effort also aligns with Merdeka Belajar's policy, which emphasizes the importance of learning relevant to student needs and the demands of the times. (Kinneer et al., 2023). By improving teacher competence,

the quality of science learning in the Muaraenim Regency is expected to improve so that students can optimally master literacy and numeracy.

As one of the subjects relevant to STEM, science has great potential to be used to train students in literacy and numeracy. Science learning supported by STEM-based learning media can help students understand scientific concepts more deeply and applicatively. Teachers play a central role in creating interactive and contextualized learning experiences, so training for teachers is an urgent need.

Therefore, training STEM-based learning media for science teachers in the Muaraenim Regency is a strategic step toward answering these challenges. Through this training, teachers will gain knowledge about STEM concepts and implementation and practical skills in designing relevant learning media to train students' literacy and numeracy (Nazhifah et al., 2023). In addition, this initiative is in line with the Merdeka Belajar program, which encourages innovation in learning to create a more meaningful learning experience that suits the needs of students in the digital era (Admawati et al., 2018).

Based on the above background, the service team designed training and mentoring activities to make STEM-based learning media on renewable energy material to train Muaraenim Regency science teachers' literacy and numeracy skills. Ultimately, this effort will improve the overall quality of education at the regional and national levels.

Method

Through training in making STEM-based learning media, this service activity is carried out through the Participatory Action Research (PAR) method. This research is situation-based and builds theory from practice involving individuals or groups of people with the same goal of improving their practice by analyzing, evaluating, and reflecting so that it can be helpful in solving real problems (Aguilera et al., 2021).

The training and mentoring program in making STEM-based learning media for junior high school science teachers aims to equip educators with the skills and knowledge needed to improve their teaching practices and train literacy and numeracy skills. Therefore, several steps are taken to achieve the set objectives, namely 1) giving a pretest or initial test, 2) implementing the service, and 3) giving a final test and evaluation and reflection.

The training and mentoring activities for making STEM-based learning media were attended by 30 participants and several training groups were formed. Activities were carried out at SMPN 1 Muara Enim face-

to-face. The activity procedure begins with giving pre-test questions and presenting material related to STEM-based learning media, literacy and numeracy and renewable energy. The material was delivered by lecturers of the physics education study program and collaborated with students from the physics education study program.

Then, the final stage is evaluation and reflection through giving post-tests and distributing response questionnaires to their perspectives on STEM-based learning media innovations to train literacy and numeracy. Furthermore, the service team processed data on participant responses, namely the results of the initial and final tests that had been carried out. The data were analyzed using the N-gain test. The following formula determines how much the trainees' understanding of the material increases before and after it is given. The N-gain test equation is as follows (Hake, 2002):

$$N - Gain = \frac{\bar{x}_{post} - \bar{x}_{pre}}{\bar{x}_{max} - \bar{x}_{pre}} \quad (1)$$

Then N-Gain can be categorized through Table 1.

Table 1. N-Gain criteria

N-Gain Scale	Criteria
$N\text{-gain} \leq 0.3$	Low
$0.7 \geq N\text{-gain} > 0.3$	Medium
$N\text{-gain} > 0.7$	High

Result and Discussion

Community service is one part of the Tridarma of Higher Education. This activity aims to assist specific communities in improving quality in several activities. In general, this program is designed by the Community Service Team to make a real contribution to society, especially in developing the welfare and progress of the community. Training activities for making stem-based learning media to train literacy and numeracy for science teachers in Muara Enim Regency have been carried out in a hybrid manner from 22 August to November 2024. Thirty participants attended the service activity.

Pre-test Activity

The initial test given to trainees was to measure teachers' ability and prior knowledge of STEM-based renewable energy learning media and literacy and numeracy skills. Twenty multiple-choice test items were administered to participants via Google Forms, and the test was completed using electronic devices directly.

Material delivery activities

Physics Education lecturers of Sriwijaya University delivered the material along with a team of students divided into two types of material: the nature of learning media and the STEM approach. The second material was the submission of material on Literacy and Numeracy Indicators. After the delivery of the material, a demonstration of making STEM-based learning media was carried out by a Physics Education lecturer from Sriwijaya University and a team of students. The activity showed in Figure 1.



Figure 1. Material delivery activities by speakers

First, instructions are given to teachers to pay attention to the demonstration of learning media in the form of props on renewable energy materials. Each teacher forms a group for four renewable energy themes: solar energy, wind energy, water energy and biomass. Furthermore, teachers are asked to explore teaching aid products made by the service team so that later, they can be innovated by training participants and applied to train students' numeracy and literacy skills.

Resource persons carried out demonstration activities, collaborating with the student service team of the Physics Education Study Program of Sriwijaya University. The activity went smoothly, and the trainees actively interacted. The props demonstration activities are shown in Figure 2.



Figure 2. Learning media demonstration activities, teaching aids on renewable energy material

Mentoring and Monitoring of STEM-based Learning Media Development

The implementation of mentoring is carried out online through Zoom meetings. Teachers were given four weeks to complete the STEM-based learning media on science subjects on renewable energy. This mentoring was conducted twice online to assist the trainees while running their projects. This activity has a good impact on teachers, helping them to perfect the learning media and literacy and numeracy instruments that have been made (Delima et al., 2023; Padang et al., 2020; Wakidah et al., 2022). The results of STEM-based learning media on renewable energy materials can be seen in Figure 3.

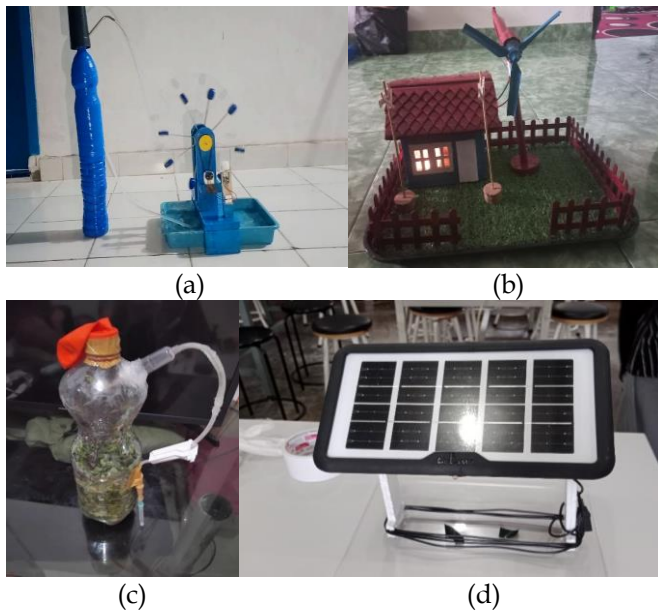


Figure 3. STEM-based learning media on renewable energy (a) water energy, (b) wind energy, (c) biomass, (d) solar energy

Post-Test Activity

The final test was given to trainees at the end of training and mentoring activities to make STEM-based learning media on renewable energy material for science teachers to practice literacy and numeracy. The purpose of giving this final test is to find out whether the trainees have better abilities and insights into STEM-based learning media and literacy and numeracy. The final test given to the trainees consisted of twenty multiple-choice questions. The test was distributed through g-form and conducted directly with their respective mobile devices.

The post-test helps evaluate the extent to which participants understand the material delivered during the training. The results reflect the level of achievement of the learning objectives. The post-test helps identify areas that still need attention or further training so that the next training can be more focused.

The data processed from the Pre-test, post-test, and N-Gain values shows that teachers' understanding of STEM-based learning media, renewable energy, literacy, and numeracy has increased. Pre-test and post-test

values, namely, the pre-test value, are the values obtained before giving them to the training participants in a series of service activities. The post-test value is obtained after being given treatment or after the trainees have participated in the service (Aguilera et al., 2021). Information on the results of administering the initial and final tests is shown in Figure 4.

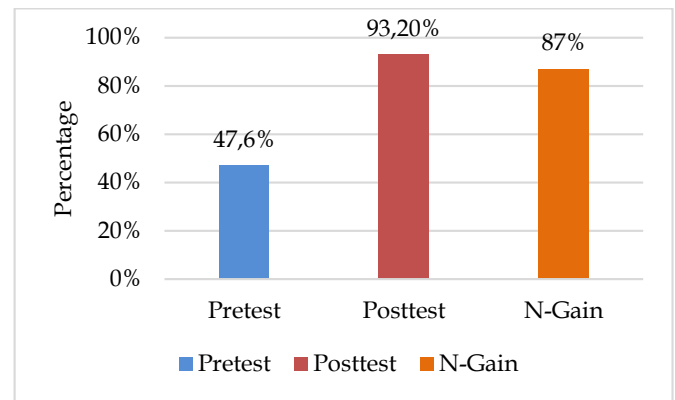


Figure 4. initial and final test results of trainees

Through the graph in Figure 4, the pretest and posttest scores can be seen. The percentage for the pretest score with 30 participants obtained an average of 47.6%, and the posttest score obtained an average of 93.20%, for a Gain score of 87%. This value represents the interpretation of a practical improvement category. The service activities carried out have succeeded in having a positive impact on the ability of science teachers to make STEM-based learning media. The increase in teacher ability is not only seen in terms of knowledge but also in terms of teacher skills in making stem-based learning media on water energy, wind energy, solar energy, and biomass energy. This shows that science teachers already have sufficient knowledge and skills in making STEM-based learning media (Ewar et al., 2023).

The role of learning media in promoting literacy and numeracy is further supported by the findings of Misu et al., who emphasized that effective planning and implementation of learning media in mathematics can strengthen students' numerical learning (Misu et al., 2023). Similarly, Prahani discusses how props can simulate real-world problem-solving scenarios, thereby fostering critical thinking and practical application of knowledge (Prahani, 2023).

Science learning consists of a combination of physics, chemistry, biology which are integrated with other fields of science (Patriot et al., 2023). Many science learning materials require understanding, therefore educators need to explore innovative media that can support learning activities in the form of learning media. (Wiyono et al., 2022).

Evaluation of Training and Mentoring Activities

Based on the results of the questionnaire on the level of satisfaction with the implementation of the service to junior high school science teachers in Muara Enim Regency regarding the making of STEM-based learning media to train literacy and numeracy skills, it can be indicated that all teachers are delighted with the service activities of mentoring training in making STEM-based learning media to train literacy and numeracy for science teachers in Muara Enim Regency. The results of the questionnaire are shown in Figure 5.

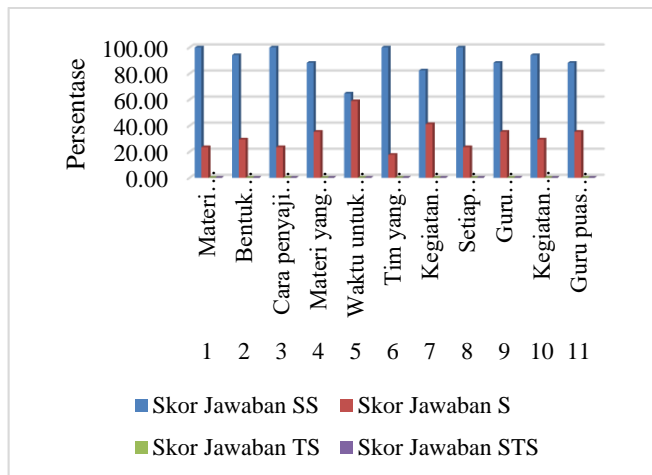


Figure 5. Teacher respond about training activities

In addition, the questionnaire results also show that the participants feel the benefits directly related to the things that have been delivered by the service team and want to continue this activity. The service activities carried out have positively impacted the ability of MGMP Science teachers to train participants in making STEM-based learning media. The improvement of teachers' abilities and skills is seen in terms of knowledge and teacher skills in making STEM-based learning media on renewable energy material. The results of this activity are the basis for the service team to communicate with partners so that STEM-based learning media products can be consistently used in learning and developed along with the development of science.

Conclusion

Junior High School Science MGMP teachers in Muaraenim Regency received training and assistance in making STEM-based learning media on renewable energy material as part of a community service program. Several stages are carried out in training and mentoring activities: 1) giving the initial test, 2) implementing the service, and 3) giving the final test. The results showed that the pre-test and post-test data increased by 87% in

the high category. This indicated that the trainees had better understood STEM-based learning media, renewable energy literacy and numeracy. This training activity has provided practical solutions to facing the challenges of 21st-century learning, especially in areas with limited facilities.

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