

Enhancing rural teacher competence in Meranti Islands Regency high school basic physics practical curriculum

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ABSTRACT

Teacher competency standards serve as benchmarks that can be utilised to assess the attributes deemed essential for professional competence in educators. Educators play a crucial and strategic role in the pursuit of national development objectives, particularly within the realm of education. However, the objective of education appears to be a reduction in competency standards at the conclusion of each academic year for specific subjects, particularly in the realm of science and Basic Physics. Consequently, this initiative seeks to inspire educators and students in secondary education to enhance their understanding of the educational process by engaging in the study of science, specifically Basic Physics, utilising appropriate tools and resources. The suggested mode of engagement involves the processes of instruction and education within secondary educational institutions across the Meranti Islands Regency, encompassing SMA, MAN, MTs, and SMP levels. This activity further offers insights into experiments and demonstration tools for educators in the realm of science and Basic Physics, facilitating a comprehension of concepts that range from simple to intricate natural phenomena through accessible demonstration media designed for practical application. In this manner, educators are anticipated to exhibit motivation and enthusiasm throughout the learning process, accompanied by a thorough and nuanced comprehension of the subject matter. To enhance teacher competency standards significantly, ensuring they become more qualified and professional.

Keywords: Physics education; research facility; physical sciences instruction; experimental

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INTRODUCTION

Education plays a crucial and foundational role in shaping an individual's character, as outlined in Law No. 20 of 2003, which asserts that education fosters inherent potential manifested as spiritual and religious strength, self-discipline, character, intellect, ethical values, and the competencies necessary for conscious and deliberate engagement in society [1]. The aims of this educational endeavour are likely to encounter significant disruptions, rendering optimal achievement challenging, particularly in the aftermath of COVID-19 and at the onset of a new academic year following an extended break. The educational

environment loses its appeal for students when it is characterised by monotony, a phenomenon particularly evident in the schools of the Meranti Islands Regency. This presents a significant challenge for educators and other stakeholders in enhancing curriculum proficiency and developing instructional materials that effectively facilitate the attainment of learning objectives, ensuring that students grasp the content thoroughly [2].

Meranti Islands Regency constitutes one of the administrative divisions within Riau Province, Indonesia, with Selat Panjang serving as its capital [3]. The district boasts a population of 206,116 individuals as of 2020, encompassing an area of 3,707.84 square

kilometres [4]. The Meranti Islands Regency is situated at geographical coordinates ranging from approximately 0°42'30" to 1°28'0" N, and 102°12'0" to 103°10'0" E, positioned along the eastern coastline of Sumatra Island [5]. The Regional Government of the Meranti Islands Regency, particularly the Head of the Education Office, has endeavoured to enhance and uphold the quality of teacher competency annually by persistently assessing teacher evaluations at the conclusion of the academic year.

Science lessons, particularly in Basic Physics, necessitate educators to possess a wide array of competencies. It is insufficient to merely engage in the transmission of theoretical knowledge or rely solely on visual representations. A comprehensive grasp of science and Basic Physics demands an appreciation of extensive natural phenomena, logical reasoning, sensory experiences, and the assurance of observable natural facts [6]. Nonetheless, the implementation of the learning process may encounter challenges owing to the scarcity of resources for demonstrating scientific and fundamental physics practical work. Consequently, the majority of instruction is relegated to structured assignments for students, encompassing both theoretical frameworks and preliminary exposure to practical knowledge, primarily facilitated through accessible online platforms [7]. Consequently, students exhibit diminished motivation and enthusiasm during the learning process, leading to a less comprehensive understanding of the material [8]. The aforementioned explanation leads to the conclusion that one of the contributing factors is the insufficient competence of educators concerning the learning tools that may serve as effective media for instruction. Consequently, the endeavours and resolutions to these challenges present a chance for contemplation, broadening the perspectives on harnessing environmental potential. Furthermore, the use of straightforward equipment and materials as demonstrative tools by educators during the instruction of science and fundamental physics in the classroom is advocated.

MATERIALS AND METHODS

Community Service Location

The community service was carried out directly in Selat Panjang Timur, Tebing Tinggi District, Meranti Islands Regency, Riau Province, Postal Code 28753 as seen in Figure 1. Community service activities were carried out in several nearby Middle Schools throughout the Meranti Islands Regency which were carried out in one location in the Multipurpose Building Room of SMA N 1 Tebing Tinggi, Meranti Islands (see Figure 2).

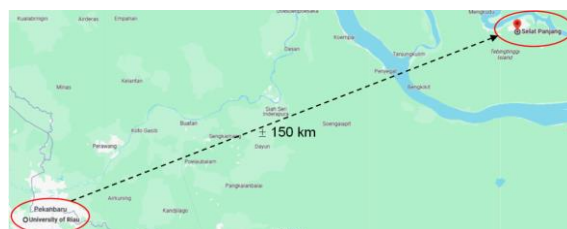


Figure 1. Community service location in Selat Panjang, Meranti Islands Regency.



Figure 2. View of the interior of the Multipurpose Building.

There are several nearby Middle Schools at the SMA, MTs, MAN, and SMP levels in Selat Panjang that were invited to participate in the Fostered Village Program, such as:

- SMA Negeri 1 Tebing Tinggi, Jl. Pembangunan 2, Selat Panjang Tim., Kec. Tebing Tinggi, Meranti Islands Regency, Riau.
- SMA Negeri 2 Tebing Tinggi, Jalan Tutwuri, Selat Panjang Tim., Kec. Tebing

Tinggi, Meranti Islands Regency, Riau 28753.

- State Senior High School 3 Tebing Tinggi, Banglas, Tebing Tinggi, Meranti Islands Regency, Riau 28753.
- State Senior High School 1, Meranti Islands, located on Jl.
- State Junior High School 1, Meranti Islands, located on Jl.
- Teuku Umar, Selat Panjang Bar., Tebing Tinggi District, Meranti Islands Regency, Riau.
- State Junior High School 2 Tebing Tinggi, South Selat Panjang, Tebing Tinggi, Meranti Islands Regency, Riau.
- State Junior High School 3 Tebing Tinggi, Jl. Siak No.5, Selat Panjang Bar., Tebing Tinggi District, Meranti Islands Regency, Riau.
- SMP Negeri 4 Tebing Tinggi, Banglas Bar., Tebing Tinggi District, Meranti Islands Regency, Riau 28753.



Figure 3. Distance of each Senior High School to the service location.

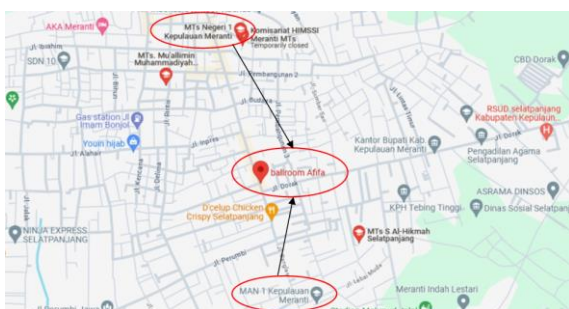


Figure 4. Distance of MTs and MAN Senior High Schools to the service location.

Service Design

The proposed form of activity is in the form of teaching and learning through experimental

guidance and demonstration tools for science or science teachers. Basic experimental learning about understanding concepts from simple to complex natural phenomena by displaying equipment and materials for practical work as well as demonstration tools directly. Furthermore, it will be tested on students and introduced to parents. This practical experiment tool can be displayed both in mechanical and non-mechanical (electromagnetic) forms physically in the form of simulations and real practices that can be accepted by the senses, hearing, and sight.

This activity is also carried out using synchronous and asynchronous methods. The development of innovation and creativity in the learning process of practical work with this demonstration includes understanding:

- Systematic approach: understanding natural events that have a causal relationship, a sequence of events that produce a work or product that can then be concluded.
- Historical approach: activities in the process and timeline and changes in events that show the effects and gains that produce an understanding.
- Summary approach: clearly and precisely related event premises from a series of natural events, connected, analogized and compared to produce a conclusion of an event.
- Comparative approach: providing analogies of events and comparisons of both the process and results of a natural phenomenon that can be developed and concluded.

Activity and evaluation methods include in this empowerment:

- Providing material: Basic concepts of science / Basic Physics.
- Demonstration of equipment and materials for practical work.
- Process and testing of experimental tools and materials.
- Repetition and simulation understanding approach: Measurement and calculation.
- Oral and written evaluation: Simulation exercises and independent demonstrations.

The activities are detailed in the following modules:

- Uniform straight motion.
- Spring constant and Hooke's law.
- Standing waves and sound.
- Magnetism and electromagnetic induction.
- Ohm's law and electrical circuits.
- Fluid viscosity and Archimedes' Law.
- Potential and Coulomb Field.
- Capacitor plate electric field and potential.
- Wheatstone bridge.

RESULTS AND DISCUSSION

Overview of the Target Community

In general, teaching staff in secondary schools in the Meranti Islands are relatively young, around 25-30 years old, with little teaching experience. The ratio of male teaching staff is very small compared to female teaching staff, around 1:4 of the total attendance. However, the enthusiasm for learning for teaching staff can be seen from the success of improving teaching skills from online practical simulations. With this program and the potential of teaching staff, it is hoped that physics or science teachers will be able to develop teaching methods using simple practical tools to attract students' interest in learning and increase their knowledge of learning and teaching in class [9].



Figure 5. Implementation of community service activities in the meeting room.

Potential for Community Development (Empowerment)

Teachers in secondary schools in the Meranti Islands Regency who are relatively young have the potential to increase their knowledge with enthusiasm for learning.

Therefore, innovative learning service activities need to be carried out with interesting methods with simple practicals. In addition, in today's modern technological world, learning can be done via the internet or online with several interesting methods and videos of course [10].

Educators or teachers are required to have an up-to-date spirit or know the development of existing science, especially physics and science at the secondary school level. However, this requires motivation and guidance for teachers to realize innovative and interesting learning with community service activities carried out online by lecturers from the University of Riau.

Community Empowerment Solutions

Increasing the knowledge of educators or teachers needs to be done by delivering motivation and innovative learning of physics and science using simple practical methods. This activity is very important with a visual approach and interesting things that have never been practiced. This activity was carried out online at the end of the COVID-19 pandemic to minimize the rise of new variants [11].

The community service program for teachers was carried out in various secondary schools in the Meranti Islands Regency in a hybrid manner. The development of student insight is also carried out by providing practical videos or simple research on physics and science phenomena. In addition, the assessment of the achievement indicators of community service is carried out with short and quick tests for teachers. The indicators in question are increasing the knowledge and skills of students in learning physics in the classroom [12].



Figure 6. Enthusiasm of community service participants.

Level of Achievement of Program Targets

Community service activities in developing creativity in physics learning using simple online practical tools have been successfully implemented. The Meranti Islands community has a high level of enthusiasm for working together to make the community service activities that have been carried out online a success. The level of achievement can be seen from the indicators obtained from short and quick tests for teachers. However, before starting the learning activities, students were given a test first to measure how far their insight and knowledge they had. The results of the first test obtained were still less than satisfactory from all teacher participants. Thus, innovative learning and motivation by lecturers were carried out for teachers [13].

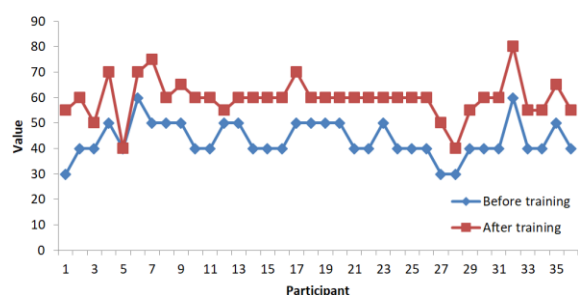


Figure 7. Statistical data on increasing teacher knowledge and skills.

This learning activity is carried out offline by practicing several phenomena of physics and science using simple tools. Then for each experiment, teachers are given the opportunity to ask questions and try them, then given some interesting materials from the lecturers. After the learning activity is carried out, a short and quick test is carried out to determine changes in achievement indicators in increasing knowledge and skills. The results of the second test obtained were very satisfactory with an increase in indicators of 20% (see Figure 7). These results prove that learning physics and science can be more easily understood with the help of a visual approach from practicums using simple tools [14].

CONCLUSION

An innovative learning model to encourage teachers' self-confidence in conducting experiments through simple practical media, believing that science and physics experiments can be carried out with simple equipment and tools, and successfully revealing some misconceptions about science and physics materials that have not been fully revealed, among others, have been successfully resolved and provided significant results.

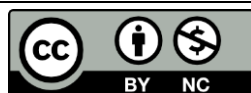
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