

## **IMPROVING STUDENT LEARNING OUTCOMES ON HEAT MATERIAL USING THE STEM APPROACH AT SMP NEGERI 2 JULI**

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### **ABSTRACT**

This study aims to examine the effectiveness of the STEM (Science, Technology, Engineering, and Mathematics) approach in improving student learning outcomes on heat material at SMP Negeri 2 Juli. The research employs an experimental method with a pre-test and post-test design involving two groups of students: an experimental group that received instruction using the STEM approach and a control group that used conventional methods. The results show that students who participated in learning with the STEM approach experienced a significant improvement in their understanding of heat concepts, as reflected in the higher average post-test scores compared to the control group. These findings indicate that the STEM approach is not only effective in enhancing learning outcomes on heat material but also motivates students to be more active, creative, and critical in the learning process. Therefore, the STEM approach is recommended for broader implementation in science education at SMP Negeri 2 Juli.

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## **1. INTRODUCTION**

The teacher is a person who plays a very important role within educational institutions. A teacher has duties and responsibilities for the success of students, whether in formal, informal, or non-formal education. Therefore, activities related to the development of teachers' competencies in the learning process are necessary in the 21st century (Zuhra et al., 2023). In improving education in Indonesia, the role of teachers cannot be separated from various factors related to their existence, according to Hamdayama in Naerih et al. (2022). Teaching is one of the noble professions, and through the role of teachers, students are prepared to become independent individuals and to develop a strong sense of patriotism and good knowledge. According to Maemunawati S., Alif M., in Handayani et al. (2022), the teacher's role as a facilitator is to provide ease for students who are experiencing

difficulties and obstacles. Teachers play a crucial role in helping and developing students to live their lives optimally. This reality arises because humans are inherently weak from birth until death. This indicates that every human being needs others for their development, and the same applies to students (Handayani et al., 2022).

Haifaturrahmah et al. (2020) stated that students living in the 21st century must master knowledge, have metacognitive skills, think critically and creatively, and be able to communicate and collaborate effectively. This situation reflects a gap between expectations and reality. Therefore, in the 21st century, these skills must be mastered and possessed by every student to face the Industrial Revolution 4.0. In this era, people are required to have balanced knowledge and skills as a foundation to adapt to the current development and changes (Haifaturrahmah et al., 2020).

In formal schools, the learning process is already oriented towards the 21st century, which includes 1) critical thinking skills, 2) creative thinking skills, 3) communication skills, and 4) collaboration skills (Haifaturrahmah et al., 2020). In this study, the researcher conducted research at SMP Negeri 2 Juli in grade VII due to the lack of students' understanding of science-related material, their lack of skills in integrating IT (technology), and their reluctance to engage with science topics that involve numbers (mathematics). The researcher found a solution to several student learning problems by using the STEM (science, technology, engineering, and mathematics) approach, which can make the teaching and learning process easier for students. Science learning requires tangible representations to be more easily understood by students (Khoiriyah et al., 2018).

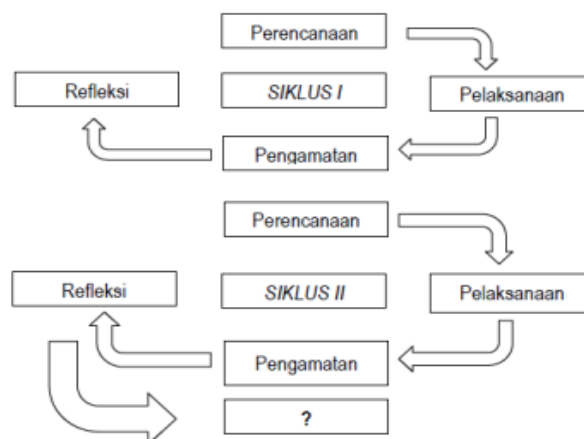
The STEM learning approach is suitable for science subjects because science learning is not only related to facts and concepts but also to the discovery process. Learning science, technology, engineering, and mathematics plays a crucial role in determining the progress and development of a nation. These four disciplines can be taught integratively. The STEM approach requires students to be able to solve problems, innovate, discover or design new things, understand themselves, think logically, and master technology. Davidi et al. (2021) revealed that learning with the STEM approach can enhance students' skills, particularly in problem-solving and investigative abilities.

## **2. RESEARCH METHODOLOGY**

Research using a qualitative approach involves using students as subjects to understand the improvement in their learning outcomes. This type of research is known as classroom action research (CAR). According to Moleong, as cited in Kojongian et al. (2022), qualitative research aims to understand phenomena related to what is perceived about the research subjects, such as perceptions, behaviors, motivations, actions, and others, in a holistic manner. It involves describing these phenomena in words and language within a specific natural context using various natural methods.

This type of research is CAR. According to Arikunto, as cited in Fidiyawati et al. (2020), classroom action research (CAR) is a study where the method involves intentionally planned actions that occur collectively within the classroom. Mulyasa, as cited in Itaria et al. (2020), states that one of the goals of CAR is to improve and enhance the quality of classroom teaching by increasing professional teaching services in the classroom, which provides teachers with the opportunity to evaluate their teaching processes.

Arikunto, as cited in Fidiyawati (2020), outlines four main stages in classroom action research (CAR): 1) planning, 2) implementation, 3) observation, and 4) reflection. Each of these stages is as follows:



The data required for this research includes: Learning Outcomes Data, Teacher and Student Activity Data, and Response Data. The data collection techniques used are tests, observation, questionnaires, and field notes. The data analysis techniques in this research include analysis of learning outcomes data, analysis of teacher and student activity data, and analysis of student responses.

### 3. RESULTS AND DISCUSSION

The research conducted at SMP Negeri 2 Juli shows that the use of the STEM (Science, Technology, Engineering, and Mathematics) approach in the learning process generally has a positive impact on teacher and student activities as well as student learning outcomes. In Cycle I, although teacher and student activities were classified as good, there were still some weaknesses, particularly in classroom management and student group collaboration. The test results in Cycle I showed that only 40% of students achieved mastery with an average score of 65.6%, indicating that improvements need to be made in the subsequent cycle. In Cycle II, improvements were made to address the weaknesses identified in Cycle I, including increasing student motivation and reorganizing study groups. The results showed a significant improvement in both teacher and student activities, with the percentage of activities reaching the "Very Good" category. The average student test score increased to 90.1%, and 90% of students achieved mastery. Reflections on the research results indicate that the implementation of the STEM approach has successfully enhanced the quality of teaching and student learning outcomes, as well as created a more conducive classroom environment. Student responses to the STEM approach were also positive, with most students enjoying the method and feeling more active and skilled in their learning.

### 4. DISCUSSION

Based on the research findings, there was a significant improvement in student learning outcomes after the implementation of the STEM (Science, Technology,

Engineering, and Mathematics) approach for the temperature and heat material at SMP Negeri 2 Juli. In Cycle I, the percentage of students achieving mastery was only 40%, but it increased to 90% in Cycle II. This improvement indicates that the STEM approach is not only effective in enhancing student understanding but also in promoting cooperation and active participation during the learning process.

Teacher and student activities also showed significant improvement from Cycle I to Cycle II. Teachers became more effective at managing the classroom, including conducting effective questioning and providing clear explanations. On the other hand, students began to demonstrate abilities in group collaboration, interacting well, and assisting peers who faced difficulties. Observations revealed that the STEM approach helped students understand the material better, as well as improve their motivation and critical thinking skills.

Overall, the results of this study support the use of the STEM approach as an effective method for improving learning outcomes and student engagement, especially for material that requires deep conceptual understanding. Student responses to this approach were also positive, with the majority of students showing enthusiasm and improved comprehension after participating in STEM-based learning.

## **5. CONCLUSIONS**

1. The improvement in student learning outcomes on the material of temperature and heat is categorized as good. In Cycle I, the mastery percentage was 40% and non-mastery was 50%, whereas in Cycle II, the mastery percentage increased to 90% and non-mastery decreased to 15%, showing a 40% improvement.
2. The teacher and student activities in the learning process on the material of temperature and heat using the STEM approach can be considered optimal as the process went smoothly. The increase in teaching and learning activities was also well-executed, as observed from the results in Cycle I and Cycle II. In Cycle I, the teacher received a score of 87.4%, which improved to 98.3% in Cycle II. Similarly, student activity scores improved from 86.6% in Cycle I to 97.7% in Cycle II.
3. The responses of students to the material of temperature and heat using the STEM approach showed an increase in the category of "Very Satisfied" at 40% and "Satisfied" at 60%, while those who answered "Very Unsatisfied" were at 25% and "Unsatisfied" at 68%. Overall, it can be seen that the majority of seventh-grade students enjoyed the learning process and were willing to participate in science lessons on the digestive system using the STEM approach (Science, Technology, Engineering, and Mathematics).

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