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Culture-Based Physics Experiment Training to Foster Student Creativity

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Abstract: The Community Service Program (PkM) titled "Culture-Based Physics Experiment Training to Develop Students' Creativity" aims to integrate local wisdom into physics education to enhance students' creativity. This initiative was undertaken because of the laboratory's limited equipment, low levels of student creativity, and the absence of learning activities that integrate local culture or wisdom. Through a culture-based approach, papeda—a traditional Maluku dish—was used as an experimental medium to explain viscosity. The process of making papeda—which involves heating water, temperature changes, heat transfer, and the characteristics of fluid viscosity and flow—served as a real-world context for the lab activity. Thus, students could directly observe physical phenomena in their daily lives. The implementation method included the stages of socialization, training, technology application, mentoring and evaluation, as well as program sustainability. Students were trained to design and conduct simple experiments using materials and tools that are easily obtained in their local environment. Additionally, this activity encouraged students to think creatively in modifying experimental tools and procedures. The results included (1) culture-based physics experiment training can improve students' creative thinking skills, with the majority falling into the "high" category; and (2) student responses to the PkM program were positive.

Keywords: Maluku Culture, Physics Education, Creative Thinking.

Introduction

Indonesia's cultural richness can be optimally utilized as an educational tool by integrating culture into the context of physics (Almuharomah et al., 2019; Tumanggor et al., 2025). Physics education has tended to be presented in an abstract manner, detached from students' real-life contexts. This creates a disconnect between the knowledge learned in school and the social and cultural realities students experience daily (Nugroho, 2020). In fact, learning becomes more meaningful when linked to direct experiences and local values that have long been part of the community. Field experience shows that cultural contexts or local wisdom are rarely used in learning, which causes students to struggle to connect theory with reality (Hake, 1998; Sugara et al., 2017).

On the other hand, the local culture of Negeri Hatu and Central Maluku in general has considerable potential for integration into physics education. For example, the concept of waves in marine activities, equilibrium and force in traditional boats, resonance in traditional musical instruments, energy and work in coastal community activities, and even Papeda, a distinctive local dish, all demonstrate physical phenomena, including temperature, heat, fluids, and viscosity. However, this potential has not yet been systematically integrated into school instruction. This situation highlights a gap between the cultural environment's potential and current physics teaching practices, as well as the "Merdeka Belajar" curriculum.

The "Merdeka Belajar" curriculum, currently being implemented in Indonesia, provides educational institutions with the flexibility to develop learning

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materials based on local contexts. This presents an opportunity to develop innovative, relevant, and impactful models for physics education. Education that does not take local values into account loses its social meaning and risks fostering cultural alienation among students (Tilaar, 1999). However, the integration of physics and culture has yet to be systematically developed within the curriculum or the learning process. Many teachers lack the appropriate references or pedagogical strategies to integrate the two. This integration requires teachers to employ creative thinking skills. Therefore, an in-depth study is needed on how local culture can be used as a contextual medium for physics learning that not only enhances conceptual understanding but also fosters cultural awareness and the development of creative thinking skills.

Creative thinking skills are part of higher-order thinking skills and are among the 21st-century skills. In physics education, teaching creative thinking skills is crucial because they help students generate new ideas, solve problems using their own ideas, and make new discoveries (Mu'minah, 2021). Creative thinking skills encourage students to articulate and elaborate on new ideas during problem-solving (Artika et al., 2023). Several indicators can be used to measure creativity, such as fluency, flexibility, elaboration, and originality (Ali, 2009).

Based on the initial needs assessment at State High School 14 in Central Maluku, several partner issues were identified as the primary basis for implementing this community service program, including (1) teachers lacked the knowledge or resources to identify local phenomena relevant to physics concepts; (2) the physics laboratory was not being used optimally due to limited equipment and materials, as well as a lack of innovation in designing simple, environment-based experiments; (3) instruction was not fully contextual and did not utilize local culture as an authentic learning resource; (4) a lack of training and structured instructional models resulted in local potential not being fully harnessed in the teaching-learning process, thereby impacting the development of students' creative thinking skills; and (5) low levels of creative thinking skills among students, although creative thinking is a key 21st-century skill.

Based on the issues outlined above, the team decided to adopt the title "Culture-Based Physics Experiment Training to Develop Students' Creativity." The primary objective of this community service activity is to integrate local culture with physics instruction so that students can develop creative thinking skills. The expected benefit is that students and teachers can to connect physics concepts with local culture, making physics learning more creative and meaningful.

Method

The community service activities were carried out based on the results of a situational analysis, the problems identified at the partner school, and the solutions agreed upon by the PKM implementation team and the school. The stages of implementing these community service activities are listed as follows:

1. Socialization
   a. The team began by explaining the objectives of the Community Service Program (PkM) and the benefits of the activity to the physics teachers and students at State High School 14 in Central Maluku.
   b. The team presented material on viscosity, integrating it with the traditional Maluku dishes papeda and ne porridge.
2. Training
   a. The team provided students with opportunities to conduct experiments.
   b. The team assisted students during experiments using papeda and ne porridge.
3. Application of Technology
   The team aimed to help students integrate local culture into their physics studies and develop their creative thinking skills.
4. Mentoring and Evaluation
   The team provided students with a response instrument regarding the training and assessment questions to measure improvements in creative thinking skills. The results can serve as evaluation material for the next PkM program.
5. Program Evaluation and Sustainability
   The evaluation of the PkM program, conducted during implementation, served as the basis for planning the following activities to sustain the program:
   a. Develop a plan for follow-up activities that can deepen teachers' understanding and skills regarding the integration of physics and culture, as well as the development of creative thinking skills.
   b. Provide additional resources or support to schools, especially teachers, to further improve creative thinking skills.
   c. Consider collaboration between FKIP and schools to hold similar activities on a regular basis.

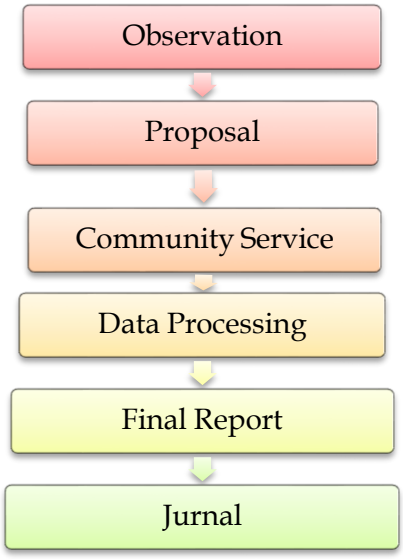


Figure 1. Community Service Program Workflow

Results and Discussion

The PkM activity was carried out in August 2026. During the observation and interview phase, the team identified several issues, which the team then analyzed. The community service activity took place on August 27, 2026, from 8:00 a.m. WIT until completion. The instruments consisted of a creative thinking skills test and a questionnaire assessing responses to the PkM program. This community service activity was opened by the principal of State Senior High School 14 in Central Maluku. The team then led the activity. Documentation of the activity is presented in Figure 2.



Figure 2. The Community Service Activity

The principal and teachers strongly supported this community service activity, as reflected in the principal's welcoming remarks and the appreciation expressed by both teachers and students for participating in the event. The material presented focused on viscosity and its connection to local culture (through traditional dishes such as papeda and ne porridge), enabling students to conduct experiments and analyze the resulting data. The improvements in creative thinking skills are presented in Figure 3. The data on creative thinking skills by indicator will be described in the research report.

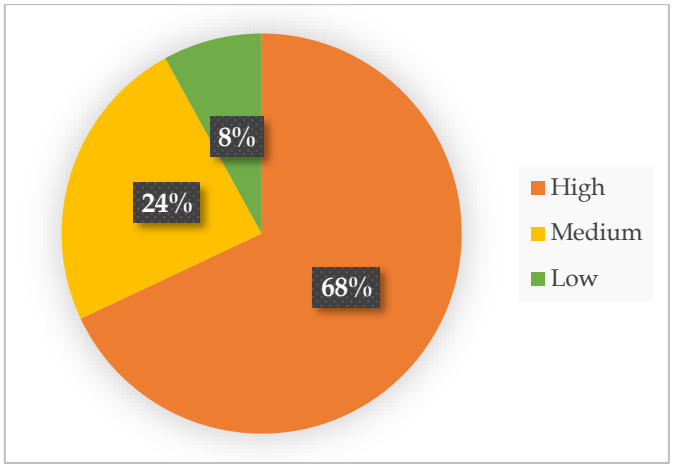


Figure 3. Overall Improvement in Creative Thinking Skills.

Based on Figure 3, the greatest improvement in students' creative thinking skills was observed in the "high" category at 68% (17 students), while the smallest improvement was in the "low" category at 8% (2 students), in a sample of 25 students. These results indicate that many students tend to find it easier to improve their creative thinking skills when these skills are linked to local culture. Integrating science (physics) learning with local culture or traditional wisdom provides students with opportunities to develop their creativity. Students become active participants in the learning process and in conducting experiments within discussion groups.

Discussion provides students with opportunities to express their ideas and encourages them to be more active, thereby enhancing their creative thinking (Pamungkas et al., 2017). Students begin to organize their ideas in a more coherent, original, and contextually relevant manner. They also demonstrate confidence in voicing their ideas and are able to connect the subject matter to their own experiences and the local culture familiar to them (Rosiana & Lestari, 2024). This indicates that students do not merely grasp the material superficially but also begin to analyze and establish connections between concepts. The learning process thus becomes more engaging and meaningful for them (Apriyanti et al., 2023). Using culture as a foundation helps students to become more attached to the material.

This connection gives rise to intrinsic motivation because students feel that what they are learning is relevant to their daily lives. In addition, they are more active in discussing, asking questions, and sharing their opinions during class activities. Teachers also observed

positive changes in students' attitudes and participation during instruction. The classroom atmosphere became more lively, collaborative, and characterized by mutual respect for peers' opinions (Priyanata et al., 2025). These observations suggest that physics instruction integrating culture or local wisdom can enhance students' creative thinking skills at State High School 14 in Central Maluku. These findings align with the results of a student survey regarding physics instruction centered on traditional Maluku cuisine. The data are presented in Figure 4.

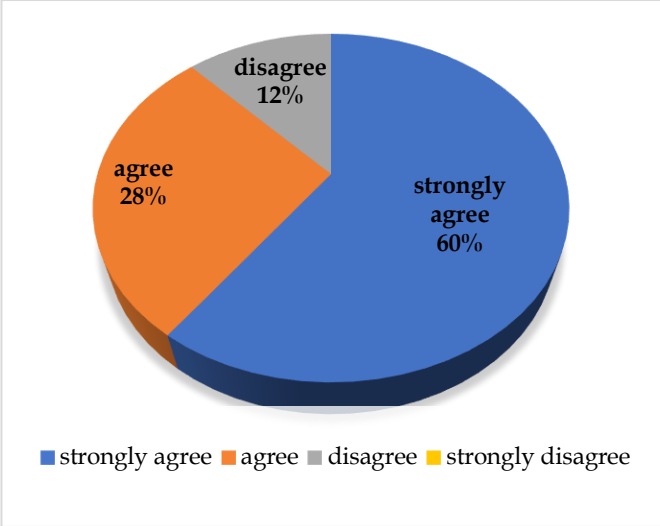


Figure 4. Survey Results

Based on the survey results shown in Figure 4, the community service program at State Senior High School 14 in Central Maluku had a positive impact. Most students "strongly agreed" (60%, or 15 students) or "agreed" (28%, or 7 students), while 12% (3 students) "disagreed." This aligns with the improvement in creative thinking skills described above, as students gained a better understanding of viscosity-related material when it was linked to local culture (traditional regional foods such as papeda and bubur ne) during the learning process. When students understand the material more easily, they can develop creative thinking skills and complete the assigned tasks related to viscosity.

Preserving local culture or wisdom is crucial because it serves as a means of upholding the nation's cultural values and moral integrity (Komariah et al., 2018; Meilana & Aslam, 2022). Culture integrated into the learning process can make students more creative and better equipped to address problems in their surroundings or daily lives (Immaniar et al., 2019). A learning process that incorporates the local culture or wisdom of the community can focus on fostering creative thinking and cultivating innovative individuals.

The event proceeded smoothly according to the schedule, beginning with an opening ceremony presided over by the Principal of State Senior High School 14 in Central Maluku, followed by an icebreaker led by the community service team to help students remain focused. The main training activities then commenced.

Conclusion

The conclusions are as follows: (1) culture-based physics experiment training can improve students' creative thinking skills, with most students falling into the "high" category; and (2) students responded positively to the questionnaire on the implementation of the Community Service Program (PkM).

The team's recommendation is that teachers should integrate local culture into their lessons so that learning feels more meaningful and is easily understood by students.

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