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Improving Students' Understanding of Substance Changes through the Use of Household Materials in Science Practicum at Private Junior High School

Winda Putri Alyani Hulu[1*], Dimas Gigih Damarsari[2]

[1)] SMA Negeri 1 Botomuzoi, Nias, North Sumatera, Indonesia
[2)] MAS As Surkati, Salatiga, Central Java, Indonesia

E-mail*: *windaputrialianihulu@mail.com*

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ABSTRACT

This study aims to improve students' understanding of substance changes using household materials that are easily obtained. The concept of substance changes, which encompasses both physical and chemical changes, can be challenging for students to grasp when presented solely through lecture methods or visual media. Limited laboratory facilities in schools pose a significant challenge for many teachers, particularly at Abdi Pusaka Indonesia Private Junior High School, which has a limited number of students and resources. This study used the one-group pretest-posttest method with a subject of 10 students in class VIII. Materials used in the practicum included ice cubes, candles, paper, baking soda, and vinegar. The results showed an increase in student understanding, with an average pretest score of 60 to 85 in the posttest. The average gain score calculated is 0.63, which is included in the moderate category. In addition, student activity during the practicum increased significantly, and almost all students stated that this method was interesting and helpful in understanding the material. This study shows that the use of household materials in science practicum is effective in improving students' understanding of the concept of substance changes.

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INTRODUCTION

Science education, especially natural science, plays a crucial role in shaping students' understanding of natural phenomena and processes that occur around them. However, in many schools, including Abdi Pusaka Indonesia Private Junior High School, the limitations of practicum tools and materials often hinder the implementation of effective learning. Based on observations made by the author at SMP Negeri 7 Alla, Enrekang Regency, Hasmiati et al. (2017) noted that the school lacks complete practicum tools, resulting in the science practicum being rarely conducted. This limitation not only hampers the learning process but also affects students' low cognitive abilities, including their ability to remember, understand, reason, and apply the knowledge they learn.

Although limited facilities are a challenge, this should not hinder the learning process. Practicum can be done by utilizing simple materials or items that are easily found around the environment. Research conducted by Akhmad et al. (2022) showed

that the use of simple science tools can facilitate learning at home and support students during online learning. By utilizing materials that are around, students can be directly involved in the learning process, thus increasing their interest and understanding of the material being taught.

Practicum not only improves concept understanding but also students' skills in preparing, using, and storing practicum tools and materials. Komisia et al. (2019) emphasized that through practicum activities, students can better understand Integrated Science material and compile good practicum reports. This shows that practicum has a central role in science learning, because students not only learn theoretically, but also practically, which allows them to link the concepts learned with real experiences.

The application of the practicum method in learning, especially on the material of changes in the form of substances, has proven effective in improving various aspects of learning. Ardiansyah and Muthi (2024) reported that this method succeeded in improving concept understanding, science process skills, and student learning motivation. Students who participated in practicum activities experienced a significant increase in understanding the concept of changes in the form of substances, as evidenced by the 30% increase in the average score. The active involvement of students in practicum learning supports their increased participation and activity in class, as well as developing science process skills such as observing, measuring, concluding, and reporting the results of experiments.

Classroom action research conducted by Erviana (2015) showed that the use of environment-based learning media can improve student learning outcomes. In two research cycles, student learning completeness increased from 70% in cycle I to 93% in cycle II. This shows that the application of appropriate practicum methods can have a significant positive impact on student learning outcomes. Thus, it is important to integrate practicum in science learning so that students can learn in a more interactive and fun way.

One way to improve students' understanding of science learning is to use scientific inquiry. Azizah et al. (2023) stated that this method can develop the ability to think, work, and behave scientifically, which is an important aspect in students' life skills. By applying scientific inquiry in practicum, students not only learn to understand concepts but are also trained to think critically and creatively in dealing with problems.

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The science literacy movement implemented in SMP Negeri 11 Kota Bima showed significant results through a simple science practicum. Jayanti and Nurfathurrahmah (2023) reported that student achievement in the indicators of drawing conclusions and providing explanations increased significantly after the application of simple practicum. This shows that by using the correct method, students can more easily understand the concepts taught and be able to apply this knowledge

in real situations. Thus, it is important to develop and apply innovative and relevant learning methods, especially in the context of science learning at the junior high school level.

In the context of Abdi Pusaka Indonesia Private Junior High School, this study aims to explore how the use of household materials in practicum can improve students' understanding of substance changes. By utilizing easily accessible materials, it is expected that students can be more actively involved in the learning process, thus increasing their motivation and interest in science. In addition, this research aims to provide alternative solutions for teachers in overcoming the limitations of practicum tools and materials available at school.

Through this research, it is hoped that an effective method can be found to improve students' understanding of substance changes, as well as make a positive contribution to the quality of science learning at Abdi Pusaka Indonesia Private Junior High School. Thus, this research not only focuses on improving student learning outcomes but also on developing critical and creative thinking skills that are indispensable in facing challenges in the era of globalization.

Finally, it is hoped that the results of this study can serve as a reference for teachers and other educators in designing and implementing more engaging and effective learning, as well as encouraging students to play a more active role in exploring and understanding science in their surrounding environment. Thus, science education at the junior high school level can run better, and students can prepare themselves to become a smart and innovative generation in the future.

METHODS

This study used a one-group pretest-posttest design to evaluate the improvement of students' understanding before and after practicum-based learning. The research subjects consisted of 10 grade VIII students at Abdi Pusaka Indonesia Private Junior High School, selected due to the limited availability of students in the small class. The study was conducted over four weeks, which included three main stages: preparation, practicum implementation, and evaluation of learning outcomes.

In the preparation stage, researchers compiled a practicum-based Learning Implementation Plan (RPP) that utilized household materials as media learning. This lesson plan was designed to create an interactive and engaging learning atmosphere and to facilitate students' understanding of the concept of substance changes. In the lesson plan, researchers set clear learning objectives, namely that students can understand and explain various types of physical and chemical changes through experiments conducted. In addition, the researcher also prepared research instruments consisting of pretest and posttest questions designed to measure students' understanding of the concept of physical and chemical changes. These questions covered various aspects of the material taught, including definitions, examples, and applications of substance changes. In addition, observation sheets were prepared to evaluate student activities during the practicum activities, which included observations of engagement, collaboration, and discussion in groups.

The implementation phase involved five simple experiments designed to illustrate physical and chemical changes, namely: (1) melting ice cubes (physical change), (2) dissolving salt in water (physical change), (3) burning candles (physical

change), (4) reaction of vinegar with baking soda (chemical change), and (5) burning paper (chemical change). Each experiment was chosen because it can be easily done using materials available at home, allowing students to better understand the concepts taught. During the practicum activities, students were divided into small groups to make observations, record results, and discuss the observed phenomena. Each group was given a guide to record their observations systematically, including the changes that occurred, the time taken, and the results of each experiment. The researcher acted as a facilitator who provided guidance and answered students' questions during the practicum.

After all practicum activities are completed, a teacher-guided class discussion is held to clarify and strengthen the understanding of key concepts. This discussion aims to provide opportunities for students to share their findings, ask questions, and deepen their understanding of the changes in substances that have been observed. Through this discussion, students are expected to connect practical experience with the previously learned theory, thereby deepening their understanding.

The evaluation was conducted by measuring the improvement of students' understanding through a posttest, which was compared with the pretest results using the gain score for quantitative data. The gain score was calculated to determine how much the students' understanding improved after practicum-based learning. Qualitative data obtained from student activity observation sheets and questionnaires were analyzed descriptively to provide an in-depth picture of student involvement and understanding during learning. The researcher also noted the limitations of the study, especially related to the relatively small number of subjects, to provide a clearer context in interpreting the results of the study. The calculation of the gain score was done using the following formula:

$$Gain\ Score = \frac{Pretest}{Maximum\ pretest} \quad (1)$$

Researchers also reflected on the learning process that had been implemented. This reflection included an analysis of the successes and challenges encountered during the practicum activities, as well as feedback from students on their experiences. With this approach, it is hoped that the research can provide better insight into the effectiveness of the use of materials.

This research is expected to serve as a reference for other teachers in designing more engaging and effective learning experiences, as well as encouraging students to be more active in their learning process. This research is expected to serve as a reference for other teachers in designing more engaging and effective learning experiences, as well as encouraging students to be more active in their learning process. Thus, this study aims not only to evaluate the improvement of students' understanding but also to contribute to the development of innovative and relevant learning methods that meet the needs of students in this modern era.

RESULT AND DISCUSSION

The results of this study are organized based on the aim to improve students' understanding of substance changes through practicum using household materials. The research data showed a significant increase in pretest and posttest scores. The

average pretest score was 60, which increased to 85 on the posttest, resulting in a gain score of 0.63, which is included in the moderate category. With a maximum score of 100, the data from the calculation of the gain score is presented in Table 1.

Table 1. Results of pretest, posttest and gain score

No.	Student	Pretest Score	Posttest Score	Gain Score
1.	Student A	60	85	0.63
2.	Student B	60	85	0.63
3.	Student C	65	90	0.71
4.	Student D	55	80	0.55
5.	Student E	60	85	0.63
6.	Student F	65	85	0.57
7.	Student G	55	80	0.55
8.	Student H	60	85	0.63
9.	Student I	55	80	0.55
10.	Student J	65	95	0.85

In addition to the increase in scores, observation data showed that about 90% of students actively participated in practicum activities. Student activities included group discussions, observation of phenomena, and recording of experimental results. Most students reported that the use of household materials made learning more interesting and relevant to daily life.

The discussion of the results of this study shows compatibility with previous studies. Research by Akhmad et al. (2022) highlighted that simple tools can improve understanding of science concepts. In addition, this study supports the findings of Hasmiati et al. (2017), which showed that the limitations of laboratory equipment can be overcome by utilizing alternative methods. In this context, this study confirms that the use of household materials is not only relevant but also effective in increasing student engagement.

A unique aspect of this research is the integration of household materials into structured learning, which has not been widely implemented in junior high school science learning curricula. In contrast to previous studies, this approach bridges the gap between theoretical concepts and students' practical experiences, thus increasing the relevance of learning. The significant gain score further indicates the success of this strategy in answering the research hypothesis.

However, this study has some limitations. The small sample size of only 10 students limits the generalizability of the results. In addition, the teacher's involvement as a facilitator in the group discussion may affect the students' activity level. Further research is recommended to involve more subjects, use a control group, and explore the impact of this approach. Recommended next steps include developing learning modules based on household materials that teachers can widely use. In addition, training for teachers to effectively utilize alternative materials is also needed to improve science learning outcomes in various school contexts.

CONCLUSION

After conducting in-depth research and analysis on practicum-based learning using household materials, the researcher can draw several important conclusions. First, this learning method has been proven effective in enhancing the understanding of grade VIII students at Abdi Pusaka Indonesia Private Junior High School, particularly in physics and chemistry concepts related to physical and chemical changes. The pretest and posttest results showed a significant increase, with the average student score rising from 60 to 85. This shows that students are not only able to remember information, but also understand and apply the concepts that have been taught. Second, the active involvement of students during the learning process greatly influences the results achieved. Through practicum activities, students are allowed to interact directly with the materials and tools used, so that they can see and feel the phenomena being studied. Group discussions conducted after the practicum also provide space for students to share their understanding, ask questions, and explain to each other, which in turn strengthens their understanding of the material. Third, the use of household materials as teaching aids in learning not only makes the learning process more interesting but also more relevant to students' daily lives. This can increase students' motivation and interest in science lessons, which are often considered complex and tedious. Thus, we recommend that this practicum-based learning method be applied more widely at various levels of education and integrated with the existing curriculum to improve the quality of science learning in Indonesia.

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