

## GROUP EXPERIMENTAL ACTIVITIES TO UNDERSTAND CHANGES IN THE STATES OF MATTER AMONG THIRD-GRADE STUDENTS

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**Abstract:** Science learning in elementary school requires activities that allow students to directly observe natural phenomena. Changes in the state of matter include melting, evaporation, and condensation, which occur in everyday life but may require concrete learning experiences to support students' understanding. This community service activity aimed to describe the implementation of group experiments on changes in the state of matter among third-grade students at SDK Bengga, Kotodirumali Village, Keo Tengah District, Nagekeo Regency, Indonesia. The activity consisted of planning, introductory instruction, experiments, group discussions, and evaluation using student worksheets. The experiments used ice cubes, hot water, a glass, a plate, and a pot lid to observe changes in the state of matter. Students were given opportunities to observe phenomena, discuss their findings, complete worksheets, and present group results. The implementation demonstrated that group experiments using simple materials can serve as an alternative approach to elementary science learning. The activity also provided opportunities for students to participate in observations and group discussions. However, because quantitative measurements before and after the activity were not available, improvements in students' conceptual understanding could not be statistically established. Similar activities should incorporate structured assessment instruments to evaluate conceptual understanding and science process skills more systematically.

**Keywords:** changes in the state of matter, elementary school students, group experiments, science learning

**Abstrak:** Pembelajaran Ilmu Pengetahuan Alam (IPA) di sekolah dasar memerlukan kegiatan yang memberikan kesempatan kepada peserta didik untuk mengamati fenomena alam secara langsung. Materi perubahan wujud zat mencakup proses mencair, menguap, dan mengembun yang dapat dijumpai dalam kehidupan sehari-hari, tetapi tetap memerlukan penjelasan konkret agar mudah dipahami siswa. Kegiatan pengabdian kepada masyarakat ini bertujuan mendeskripsikan penerapan metode eksperimen kelompok pada materi perubahan wujud zat bagi siswa kelas III SDK Bengga, Desa Kotodirumali, Kecamatan Keo Tengah, Kabupaten Nagekeo. Kegiatan dilaksanakan melalui tahap perencanaan, pengenalan materi, pelaksanaan percobaan, diskusi, dan evaluasi menggunakan Lembar Kerja Peserta Didik (LKPD). Percobaan memanfaatkan es batu, air panas, gelas, piring, dan tutup panci untuk mengamati perubahan wujud zat. Selama kegiatan, siswa memperoleh kesempatan untuk mengamati fenomena, mendiskusikan hasil pengamatan, mengisi LKPD, dan menyampaikan hasil diskusi. Hasil pelaksanaan menunjukkan bahwa eksperimen kelompok dapat digunakan sebagai alternatif pembelajaran IPA dengan memanfaatkan alat dan bahan sederhana. Kegiatan ini juga menyediakan kesempatan bagi siswa untuk berpartisipasi dalam pengamatan dan diskusi kelompok. Namun, karena kegiatan tidak dilengkapi dengan pengukuran kuantitatif sebelum dan sesudah pembelajaran, peningkatan pemahaman siswa belum dapat ditentukan secara statistik. Kegiatan serupa perlu dilengkapi instrumen evaluasi yang terstruktur untuk menilai pemahaman konsep dan keterampilan proses sains secara lebih sistematis.

**Kata Kunci:** eksperimen kelompok, perubahan wujud zat, pembelajaran IPA, siswa sekolah dasar

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## INTRODUCTION

Natural Sciences (Science) is a field of learning that helps students understand natural phenomena through observation, investigation, reasoning, and scientific communication. Science learning in elementary schools should not focus solely on the acquisition of information



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but should also provide opportunities for students to construct understanding through learning experiences. Activities involving observation and experimentation can help students connect scientific concepts with events encountered in everyday life (Hidayah & Pujiastuti, 2016; Andriani, 2016; Trisnawati, 2018).

Science process skills are an essential component of this learning process. These skills include the ability to observe, classify, predict, ask questions, interpret results, and communicate findings. Angelia et al. (2022) explained that inquiry-based learning can be used to support elementary school students' science process skills. Previous studies on inquiry-based and experiential learning have also highlighted the importance of providing students with opportunities to participate in scientific activities rather than merely receive information from teachers (Nahdiyah et al., 2019; Anjarwani et al., 2020; Puspito et al., 2021). In particular, Anjarwani et al. (2020) demonstrated the relevance of guided inquiry combined with outdoor activities for supporting the development of science process skills and critical thinking among elementary school students.

One science topic that can be learned through direct experience is changes in the states of matter. This topic includes melting, freezing, evaporation, condensation, sublimation, and deposition. Several of these processes can be easily observed in everyday life, such as ice cubes turning into water and water droplets forming on a cooler surface. However, observing a phenomenon does not necessarily mean that students understand its scientific explanation. Students also need guidance in identifying the changes that occur and explaining the relationship between their observations and the concepts being studied.

Herawati et al. (2019) examined the use of the experimental method to improve students' understanding of the properties and changes in the states of matter at an Islamic elementary school (madrasah ibtidaiyah). Basri Ishak et al. (2019) also investigated the application of experiments to the topic of changes in the states of matter in elementary schools. More recently, Efendi et al. (2025) examined the implementation of group experiments using ice cubes to help students understand changes in the states of matter. Mustika and Lauren (2025) and Putri and br Karo (2026) also investigated the application of the experimental method to the same topic. Collectively, these studies indicate that experimental activities are a relevant instructional approach for teaching changes in the states of matter in elementary schools.

International research further supports the relationship between inquiry-based learning, conceptual understanding, and science process skills. Şimşek and Kabapinar (2010), for example, investigated the effects of inquiry-based learning on elementary school students' conceptual understanding of matter, science process skills, and attitudes toward science. Their study provides a theoretical and empirical basis for incorporating active scientific investigation into science instruction. Similarly, Suryawanto et al. (2022) examined the implementation of guided inquiry to develop elementary school students' science process skills. These studies suggest that opportunities to investigate scientific phenomena, interpret observations, and discuss findings are important components of meaningful science learning.

In addition to conceptual understanding, experiments can provide students with opportunities to develop science process skills. These skills include observing changes, recording findings, comparing results, and presenting explanations based on the evidence obtained. Wulandari et al. (2019) discussed the development of performance assessment instruments integrated with twenty-first-century skills to measure science process skills during experimental activities among elementary school students. Khasna and Fatmawati (2023) also developed science teaching materials based on the experimental method to foster science process skills and critical thinking. Research on inquiry-based learning has likewise emphasized the importance of developing students' abilities to observe, classify, conduct investigations, and communicate results (Anjarwani et al., 2020; Suryawanto et al., 2022). These skills are particularly relevant to experiments on changes in the states of matter because students must identify observable changes and relate them to the scientific concepts being introduced.

Experimental learning activities can also be adapted to the availability of school facilities. Simple scientific activities do not always require a laboratory equipped with specialized instruments. Materials available in everyday environments can be used to demonstrate

scientific phenomena, provided that the procedures align with the learning objectives and ensure student safety. Milla et al. (2026), for example, discussed a community service program involving simple science experiments using locally available materials to support elementary school students' scientific literacy. Such activities are relevant to efforts to provide more contextual learning experiences, particularly in schools with limited instructional facilities.

The group experimental method provides students with opportunities to participate in experiments and engage in discussions with their peers. Assigning different tasks can help students participate in observation, recording, and reporting results. However, group work needs to be properly facilitated to ensure that students do not merely participate passively but also have opportunities to observe and explain the experimental results themselves. Previous studies on inquiry-based learning, science process skills, and experimental activities emphasize the importance of student engagement in scientific processes and the support provided by teachers or facilitators throughout the activities (Prastiwi et al., 2018; Nahdiyah et al., 2019; Anjarwani et al., 2020; Rahma Wardani et al., 2024). Accordingly, group experiments should be designed to encourage active participation, collaborative discussion, and evidence-based explanations.

Based on these considerations, a community service activity was conducted at SDK Bengga, Kotodirumali Village, Keo Tengah District, Nagekeo Regency, Indonesia. The activity focused on implementing group experiments to introduce the processes of melting, evaporation, and condensation using simple tools and materials. The distinctive feature of this activity lies in its implementation within a community service program at an elementary school, with an emphasis on conducting experiments, engaging in group discussions, and using student worksheets (*Lembar Kerja Peserta Didik*, LKPD).

Accordingly, this activity aimed to describe the implementation of the group experimental method for teaching changes in the states of matter, explain the phenomena observed by students during the experiments, and describe student participation in observation and discussion activities. This article also compares the implementation of the activity with findings from previous studies to identify its practical benefits and areas for further development.

## METHOD

### Activity Location and Target Participants

The community service activity was conducted at SDK Bengga, Kotodirumali Village, Keo Tengah District, Nagekeo Regency, East Nusa Tenggara, Indonesia. The target participants were third-grade students who took part in science learning activities on changes in the states of matter. The activity was designed using a group experimental method. Students received an introductory explanation, observed changes in the states of matter, discussed their observations, completed student worksheets (*Lembar Kerja Peserta Didik*, LKPD), and presented the results of their discussions. This approach was selected because it allowed students to interact directly with the phenomena being studied. Hands-on experimentation can support students' conceptual understanding and science process skills (Şimşek & Kabapinar, 2010).

### Activity Planning

The planning stage was conducted to ensure that the activities were aligned with the learning objectives. Preparations included determining the learning materials, preparing the equipment and materials, organizing the activity sequence, and preparing the student worksheets.

### Activity Implementation

The activity began with an introduction to changes in the states of matter and examples of these processes in everyday life. Students were then divided into small groups and received explanations about the objectives and stages of the experiments. In the first experiment, students observed ice cubes and the changes that occurred as the ice melted. In the second experiment, students observed hot water and the formation of water vapor. The subsequent

experiment demonstrated the formation of water droplets on the surface of a pot lid or another cooler surface as water vapor condensed.

Throughout the experiments, students were guided to observe the changes, discuss their findings, and record their observations on the student worksheets. Facilitators provided additional explanations when students needed help connecting the observed phenomena with the scientific concepts of changes in the states of matter. After completing the experiments, each group discussed its observations and presented the results. This stage was intended to give students opportunities to communicate their findings and reinforce their understanding of the concepts through guidance from the facilitators. The sequence of observation, experimentation, and discussion is consistent with inquiry-based approaches to science learning (Şimşek & Kabapinar, 2010).

## RESULTS AND DISCUSSION

The community service activity in Grade III at SDK Bengga, Kotodirumali Village, Keo Tengah District, Nagekeo Regency, was carried out in several stages, beginning with the delivery of learning materials and followed by simple experiments on changes in the states of matter. The activity was designed to help students understand the concepts of changes in the states of matter through direct observation of phenomena encountered in everyday life (Şimşek & Kabapinar, 2010; Lott & Wallin, 2012). The results of the activity are described based on the stages of implementation, the observation process, and student participation throughout the activities.

### Delivery of Learning Materials on Changes in the States of Matter

The initial stage of the activity involved presenting learning materials on changes in the states of matter to Grade III students at SDK Bengga. The materials covered the definition of changes in the states of matter and examples of such changes in everyday life, such as melting and evaporation. The materials were presented in simple language appropriate to the comprehension level of elementary school students. The explanation of the learning materials served as a foundation for students before participating in the experiments. At this stage, students were introduced to the phenomena they would observe so that they could develop an initial understanding of the relationship between the concepts explained and the events occurring during the experiments. The presentation of the materials was then followed by experimental activities using simple materials that were readily available in the surrounding environment (Lott & Wallin, 2012).



**Figure 1.** *Delivery of learning materials on changes in the states of matter*

### Group Experimental Activities

The activities at SDK Bengga were conducted through an introduction to the learning materials, group experiments, completion of student worksheets (LKPD), discussions, and

presentation of observations. The use of simple tools and materials enabled students to observe changes in the states of matter without requiring specialized laboratory equipment. During the introduction, students received explanations about changes in the states of matter and examples encountered in everyday life. Subsequently, students participated in group experiments. The facilitators explained the procedures and guided students to pay attention to the changes occurring in the materials used.

The group-based implementation provided opportunities for students to participate in observations and discuss their findings. Students were not limited to receiving verbal explanations but also had opportunities to observe phenomena directly. This approach is consistent with science learning principles that emphasize experiential learning and scientific investigation, as discussed in studies on science process skills and experimental learning in elementary schools (Hidayah & Pujiastuti, 2016; Herawati et al., 2019; Efendi et al., 2025).

Nevertheless, group activities do not automatically indicate that all students have mastered the concepts. Understanding needs to be examined through students' abilities to explain phenomena, record observations, and connect their findings with scientific concepts. Therefore, experimental activities should be followed by structured discussions and evaluation.



**Figure 2.** *Students observing changes in the states of matter through simple experiments.*

### **Observation of the Melting Process**

The first experiment used ice cubes to observe melting, which is the change of state from solid to liquid. Students were able to observe the changes in the ice during the experiment. This phenomenon was used to introduce the concept that changes in the state of matter can be observed through physical changes in a substance. Direct observation of melting ice provided students with a concrete example to understand the concept of changes in the states of matter. However, observation should be followed by questions that help students explain the process, such as what changes occur and what conditions allow ice to turn into water. Studies by Herawati et al. (2019), Basri Ishak et al. (2019), and Efendi et al. (2025) demonstrate the relevance of the experimental method in teaching concepts related to changes in the states of matter in elementary schools. These findings support the use of simple experiments as a means of connecting scientific concepts with observable phenomena.

### **Observation of Evaporation and Condensation**

The next experiment used hot water to demonstrate evaporation. When water receives thermal energy, some of it changes into water vapor. In explaining this phenomenon, facilitators need to distinguish gaseous water vapor from the white mist sometimes visible above hot water, which generally consists of tiny liquid water droplets. In the condensation experiment, water vapor met the cooler surface of a pot lid, resulting in the formation of water droplets. This phenomenon was used to explain the change of state from gas to liquid. The facilitators' explanations were important in helping students understand that the droplets formed through condensation rather than appearing without a process.

Using directly observable phenomena helps connect scientific terminology with everyday events. Putri and br Karo (2026) discussed the application of experiments to teaching changes in the states of matter, including melting, evaporation, and condensation. Sudrajat et al. (2026) also explained that direct observation can help students identify changes in the states of matter, although students may still experience difficulties explaining the scientific causes of these changes. Therefore, experiments should be accompanied by discussions and conceptual clarification.

These activities were also related to science process skills, particularly observing, recording, interpreting, and communicating findings. Angelia et al. (2022), Wulandari et al. (2019), and Rahcma and Taofik (2026) emphasized the importance of scientific activities and supporting instruments in learning processes designed to develop students' science process skills. Nevertheless, if students' worksheet responses are not analyzed using clearly defined indicators, the activity alone is insufficient to establish each student's level of conceptual mastery. In future activities, students' responses could be classified according to the accuracy of their identification of changes in the states of matter, their ability to explain the processes, and their ability to connect observations with scientific concepts.



**Figure 3.** Group photo following the community service activity

### Comparison with Previous Studies and Activities

The implementation of group experiments at SDK Bengga is consistent with previous studies that used experiments to teach changes in the states of matter. Herawati et al. (2019) examined the influence of the experimental method on students' understanding of the properties and changes in the states of matter. Basri Ishak et al. (2019) also discussed the application of the experimental method to the topic of changes in the states of matter in elementary schools. Efendi et al. (2025) specifically examined group experiments on changes in the states of matter using ice cubes as one of the materials for observation.

More recent studies have further demonstrated the relevance of simple experiments in science learning. Mustika and Lauren (2025) discussed experiments on changes in the states of matter in elementary schools, while Putri and br Karo (2026) described the application of experiments to several processes involving changes in the states of matter. Rahcma and Taofik (2026) reviewed the relationship between simple experiments and elementary school students' science process skills.

The activity at SDK Bengga differs in its implementation context as a community service program. Rather than testing the superiority of the experimental method over other instructional methods, the activity focused on describing the implementation of simple experiments to provide students with direct learning experiences. Since the activity did not involve a comparison group or quantitative measurements before and after the intervention,

the findings cannot be used to conclude that this method is more effective than other approaches.

This comparison indicates that the activity at SDK Bengga aligns with efforts to provide concrete and participatory science learning experiences. Its practical value lies in the use of simple tools and materials, student participation in experiments, and the use of worksheets and discussions to reinforce observations. In future activities, more systematic evaluation could help identify which concepts students have understood and which still require further explanation.

## CONCLUSION

The community service activity using the group experimental method in Grade III at SDK Bengga provided students with opportunities to observe changes in the states of matter directly. The experiment using ice cubes demonstrated melting, while the use of hot water and a cooler surface was intended to explain evaporation and condensation. The use of simple tools and materials enabled the experiments to be conducted within the context of elementary school science learning. Completing student worksheets and participating in group discussions provided opportunities for students to record observations, compare findings, and communicate explanations based on the observed phenomena.

However, the available data are insufficient to determine the extent of students' conceptual improvement quantitatively. Therefore, future activities are recommended to incorporate more structured evaluation instruments, such as rubrics for analyzing student worksheets or pre- and post-activity tests. These evaluations could help assess students' conceptual understanding and science process skills more systematically.

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