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Exploration Activities through Discovery Learning: Developing Students' Learning Activeness and Conceptual Understanding of States of Matter

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Abstract This study aims to describe the implementation of exploration activities through the Discovery Learning model and how they develop students' learning activeness and conceptual understanding of states of matter and their changes in Natural and Social Sciences (IPAS) for Grade IV Phase B students at SDN 02 Wangandowo. This research employed a descriptive qualitative design involving 27 Grade IV students and their classroom teacher. Data were collected through structured and participatory observation, student worksheets (LKPD), field notes, and documentation, and analyzed using the Miles, Huberman, and Saldaña interactive model with technique triangulation. The results showed that students were actively engaged in all six stages of Discovery Learning: they raised questions about phenomena at the stimulation stage, related them to everyday experiences, conducted simple group experiments, and presented their findings. Worksheet analysis showed that 22 of 27 students correctly classified changes of state into melting, evaporation, and condensation, while the others confused evaporation with condensation, a difficulty resolved through the teacher's guiding questions during verification. Students also showed growth in curiosity, critical thinking, collaboration, and the ability to relate concepts to everyday events. Therefore, Discovery Learning-based exploration activities effectively develop students' activeness and conceptual understanding and support meaningful, student-centered science learning.

Keyword: Exploration Activities, Discovery Learning, Learning Activeness, Conceptual Understanding, States Of Matter

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Abstrak *Penelitian ini bertujuan mendeskripsikan pelaksanaan kegiatan eksplorasi melalui model Discovery Learning serta perkembangan keaktifan belajar dan pemahaman konsep siswa pada materi wujud zat dan perubahannya dalam mata pelajaran IPAS kelas IV Fase B SDN 02 Wangandowo. Penelitian ini menggunakan desain deskriptif kualitatif. Subjek penelitian adalah 27 peserta didik kelas IV dan guru kelas. Data dikumpulkan melalui observasi terstruktur dan partisipatif menggunakan lembar observasi aktivitas siswa, lembar kerja peserta didik (LKPD), catatan lapangan, dan dokumentasi, kemudian dianalisis menggunakan model interaktif Miles, Huberman, dan Saldaña dengan triangulasi teknik. Hasil penelitian menunjukkan bahwa siswa terlibat aktif pada keenam tahap Discovery Learning: siswa mengajukan pertanyaan tentang fenomena pada tahap stimulasi, mengaitkannya dengan pengalaman sehari-hari, melakukan percobaan sederhana secara berkelompok, dan mempresentasikan temuannya. Analisis LKPD menunjukkan bahwa 22 dari 27 siswa mampu mengelompokkan perubahan wujud zat menjadi mencair, menguap, dan mengembun dengan benar, sedangkan siswa lainnya masih tertukar antara menguap dan mengembun; kesulitan ini teratasi melalui pertanyaan pemantik guru pada tahap verifikasi. Siswa juga menunjukkan perkembangan rasa ingin tahu, kemampuan berpikir kritis, kolaborasi, serta kemampuan mengaitkan konsep dengan kejadian sehari-hari. Dengan demikian, kegiatan eksplorasi melalui model Discovery Learning efektif mengembangkan keaktifan dan pemahaman konsep siswa serta mendukung pembelajaran IPAS yang bermakna dan berpusat pada siswa.*

Kata kunci: kegiatan eksplorasi, Discovery Learning, keaktifan belajar, pemahaman konsep, wujud zat dan perubahannya

A. INTRODUCTION

Natural and Social Sciences (IPAS) learning in the Merdeka Curriculum invites students to learn through direct experience. Students do not merely receive material from the teacher; they are also encouraged to inquire and discover the concepts being studied on their own. In this way, learning is expected to become more engaging and easier to understand.

One of the IPAS topics in Grade IV is states of matter and their changes. This topic is closely related to everyday life, for example ice melting, water evaporating, or vapor turning into water droplets. For this topic to be mastered well, two aspects are particularly important: learning activeness and conceptual understanding. Learning activeness refers to students' behavioral, emotional, and cognitive engagement in learning activities, which is closely associated with academic achievement (Fredricks et al., 2004). A meta-analysis by Freeman et al. (2014) also showed that active learning produces higher achievement in science than lecture-dominated instruction. Conceptual understanding of changes of state is equally

important, as it provides the foundation for understanding more complex natural phenomena.

Ideally, learning about states of matter allows students to observe phenomena directly, ask questions, conduct simple experiments, and draw conclusions based on evidence they discover themselves. Such learning is consistent with the principles of the Merdeka Curriculum, which places students at the center of learning, and with the ICAP framework, which posits that the higher students' cognitive engagement (from passive, active, and constructive to interactive), the better their learning outcomes (Chi & Wylie, 2014).

However, this ideal condition has not yet been fully realized. Some students still find it difficult to understand the process of changes of state when it is explained only through theory or lectures. Children also frequently hold misconceptions about changes in the state of water, for instance regarding the origin of water droplets during condensation (Osborne & Cosgrove, 1983). Similar problems were found in Grade IV of SDN 02 Wangandowo. Similar problems were found in Grade IV of SDN 02 Wangandowo: preliminary observations showed that 6 of the 27 students (22.2%) remained passive during learning. As a result, these students were less engaged and had a weaker understanding of the concepts being taught. As a result, students became less active and did not fully understand the concepts being taught.

To help students understand the material better, learning that involves them directly is needed. One model that can be used is *Discovery Learning*. Through this model, students are guided to observe, ask questions, experiment, and discover answers to the problems presented on their own. The teacher acts as a facilitator who guides students throughout the learning process (Ni et al., 2025). This model is rooted in the view of Bruner (1961) that knowledge discovered by students themselves is more meaningful and more easily remembered. Nevertheless, a meta-analysis by Alfieri et al. (2011) showed that guided discovery is more effective than unassisted discovery, so teacher guidance remains necessary to keep students on track (Kirschner et al., 2006).

Exploration activities in *Discovery Learning* give students the opportunity to carry out observations and simple experiments. Through these activities, students can directly observe the changes that occur in a substance, making the material

easier to understand. In addition, students become more active in discussing, asking questions, and expressing their opinions (Sayangan et al., 2024).

Accordingly, this study aims to describe: (1) the implementation of exploration activities on the topic of states of matter and their changes through the *Discovery Learning* model for Grade IV Phase B students at SDN 02 Wangandowo; and (2) students' learning activeness and conceptual understanding during the exploration activities. This study is expected to provide an overview of the learning process and the benefits students gain from the learning activities.

B. METHOD

This study employed a descriptive qualitative design. This approach was chosen because the study aimed to describe in depth the implementation of exploration activities as well as students' activeness and conceptual understanding in a natural classroom setting, rather than to test the effect of a treatment (Creswell & Poth, 2018). The study was conducted in Grade IV Phase B of SDN 02 Wangandowo. The subjects were 27 Grade IV students and their classroom teacher. The researchers acted as participant observers who were directly involved in the lessons in order to observe all teacher and student activities during the exploration process.

Data were collected using four techniques: (1) structured observation using a student activity observation sheet at each stage of *Discovery Learning*; (2) participatory observation recorded in field notes; (3) analysis of student worksheets (LKPD) to examine students' conceptual understanding in classifying types of changes of state; and (4) documentation in the form of activity photographs and the results of group discussions. The observation focused on two aspects: learning activeness (observing, asking questions, discussing, conducting experiments, and presenting results) and conceptual understanding (the ability to identify and distinguish melting, evaporation, and condensation).

The lessons were conducted using the *Discovery Learning* model, which consists of six stages. The activities at each stage are presented in Table 1.

Table 1. Stages of *Discovery Learning* in the Exploration Activities

No	Stage	Learning Activities
1.	Stimulation	The teacher stimulated students by showing phenomena of changes of state, such as melting ice cubes, to attract their attention and arouse their curiosity.
2.	Problem identification	Students were encouraged to ask questions about the observed phenomena, for example why ice can turn into water.
3.	Data collection	Students explored and directly observed various changes of state, then recorded the results on the worksheets provided.
4.	Data processing	Students classified their observations according to the type of change of state that occurred, such as melting, evaporation, or condensation.
5.	Verification	Students discussed their observations in groups and compared them with the material they had learned.
6.	Drawing conclusions (generalization)	Students concluded the concepts of states of matter and their various changes based on the results of the exploration.

The data obtained during the study were analyzed descriptively to determine the process and outcomes of IPAS learning through exploration activities using the *Discovery Learning* model (Dita Asendra Marcesa, Nur Samsiyah, 2023). The qualitative data were analyzed using an interactive model comprising data condensation, data display, and conclusion drawing and verification (Miles et al., 2014). The LKPD results were analyzed by calculating the number and percentage of students who correctly classified each type of change of state. Data credibility was established through technique triangulation, namely by comparing the results of observations, LKPD, field notes, and documentation, so that conclusions were drawn only from findings that were consistent across these data sources.

C. RESULTS AND DISCUSSION

IPAS learning on states of matter and their changes at SDN 02 Wangandowo was carried out by applying the *Discovery Learning* model, which consists of six stages. Throughout the learning process, students showed a fairly high level of

engagement in every planned activity. The learning activities did not focus solely on the teacher's delivery of material but also gave students opportunities to acquire knowledge through direct experience (Sayangan et al., 2024). A summary of the observation results on student activeness at each stage is presented in Table 2 and elaborated in the following paragraphs.

Table 2. Observation Results of Student Activeness at Each Stage of *Discovery Learning*

No	Stage	Observed Student Activities	Findings
1	Stimulation	Observing ice cubes in a cup and cold water releasing vapor; asking questions about the causes of the changes.	Curiosity emerged and served as the initial basis for engaging in the lesson.
2	Problem identification	Relating the phenomena to everyday experiences.	Students recognized the phenomena but did not yet understand the scientific reasons; learning became contextual.
3	Data collection	Conducting simple experiments in groups; recording the state of the substance before and after the change; presenting the results of the discussion.	Students observed systematically; cooperation and communication among students went well.
4	Data processing	Classifying observations in the LKPD (melting, evaporation, condensation).	Most students classified correctly; some still confused evaporation with condensation.
5	Verification	Discussing the results and comparing them with theory; answering the teacher's guiding questions.	Students discovered the difference between evaporation and condensation on their own; critical thinking developed.
6	Drawing conclusions	Concluding the concepts of states of matter and their changes based on the exploration results.	Material previously perceived as abstract became easier to understand.

At the initial or stimulation stage, the teacher presented several phenomena related to changes of state, such as ice cubes placed in a cup and cold water releasing vapor. These phenomena attracted students' attention and prompted various questions about the causes of the changes in the observed objects. The

curiosity that emerged became the initial capital for students to engage in the subsequent learning process (Rahyu Setiani, Rohmatus Syafi'ah□, Dian Septi Nur Afifah, Eka Yuliana Sari, 2024).

The problem identification stage showed that students began to relate the observed phenomena to their everyday experiences. Some students stated that they often saw the phenomena demonstrated in their daily lives but did not yet understand the scientific reasons behind them. This indicates that exploration activities can build connections between learning concepts and real life, making learning more contextual (Rudi Rutonga, 2017).

At the data collection stage, students observed several simple experiments in groups. Each group recorded the changes that occurred in the substance before and after a particular change. Through this activity, students learned to observe clearly and systematically, record their observations, discuss their findings with group members, and then present the results of their discussion in front of their classmates. The interactions that took place during the activity demonstrated good cooperation and communication among students (Sayangan et al., 2024).

The LKPD analysis in Table 3 shows that most students were able to identify various types of changes of state, such as melting, evaporation, and condensation. This ability was evident from the students' worksheets, which showed that they could classify phenomena according to the type of change that occurred. Nevertheless, some students still had difficulty distinguishing evaporation from condensation. This difficulty is consistent with the finding of Osborne and Cosgrove (1983) that children's conceptions of condensation are often inaccurate. The teacher then provided guidance through guiding questions so that students could discover the difference between the two concepts on their own.

Table 3. LKPD Analysis Results on Types of Changes of State

No	Type of Change of State	Number of Students Classifying Correctly	Percentage (%)
1.	Melting	26	96,3
2.	Evaporation	24	88,9
3.	Condensation	16	59,3
	Average	22	81,5

At the data processing and verification stages, students discussed the observations they had obtained. The discussion gave them opportunities to develop critical thinking skills by comparing their observations with the theory they had learned. Students did not simply receive information directly from the teacher but also sought to construct understanding based on the evidence they found during the exploration activities. This shows that the *Discovery Learning* model can encourage students to play an active role in the learning process (Arum Winarni, 2024). The role of the teacher's guiding questions at this stage underscores the importance of guided discovery, as argued by Alfieri et al. (2011).

Based on the reflection on the lessons, the application of the *Discovery Learning* model had a positive impact on students' conceptual understanding. Material previously perceived as abstract became easier to understand because students could directly witness the process of changes of state. The experience gained during the exploration activities helped students build a deeper understanding than learning that relies solely on lectures.

In addition to improving conceptual understanding, the exploration activities also contributed to the development of 21st-century skills, particularly critical thinking, communication, collaboration, and creativity. Students were seen actively asking questions, expressing opinions, and working together to complete group tasks. This shows that IPAS learning is oriented not only toward mastery of content but also toward developing the competencies needed in everyday life (Adi Darma Surya, Sumarno, 2023). This finding is consistent with the meta-analysis by Freeman et al. (2014), which found that students' active engagement in science learning is associated with better learning outcomes.

Based on the triangulation of observation data, LKPD, field notes, and documentation, these findings indicate that the *Discovery Learning* model is suitable for teaching states of matter and their changes in Grade IV Phase B. The characteristics of the model, which emphasize independent discovery of knowledge, give students opportunities to construct concepts based on real experiences. Consequently, learning becomes more meaningful, student participation increases, and students understand science concepts more comprehensively (Masayu Diska Prilliza, Nur Lestari, Wayan Merta, 2020).

D. CONCLUSION

The application of the *Discovery Learning* model in IPAS learning on states of matter and their changes in Grade IV Phase B at SDN 02 Wangandowo was effective in developing students' learning activeness and conceptual understanding. Through systematically designed stages, from stimulation to drawing conclusions, students no longer merely received material from the teacher but were directly involved in discovering the concepts being studied. The LKPD results showed that 22 of 27 students correctly classified the types of changes of state. This made material that previously seemed difficult and abstract easier to understand, as students could see and experience for themselves how changes of state occur before their eyes.

Beyond understanding the material, the exploration activities also had other equally important effects. Students became more confident in asking questions, more active in discussions, and accustomed to working together in groups. They also began to relate what they learned in class to events they frequently encounter in everyday life. The *Discovery Learning* model is well suited to IPAS learning because, in addition to helping students understand concepts more deeply, it also encourages them to think more critically and independently.

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