



# Efforts to Improve Science Learning Outcomes Through Experimental Methods in Grade IV Students

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**Abstract:** The learning outcomes of students' science content are still low. The minimum completeness criteria (KKM) of 70 is not met by most students who take the class IV test. This is because students do not want to participate in learning because learning activities are still dominated by lectures. The purpose of the study was to improve the learning outcomes of science material on changes in the form of objects based on the problem. Data from 27 fourth grade students were collected and presented using an experimental approach. There were two cycles when the research was conducted in the even semester of the 2022/23 academic year. Planning, implementing, observing, and reflecting are part of the research procedure. In terms of pre-cycle learning results, the average benefit of learning outcomes reached 60 or 33%, the first cycle benefited the average learning outcomes reached 72 or 67% of students mastered the learning completely while the second pattern increased. student learning outcomes increased to 83 or 92.5% of students achieved learning authority. Therefore, the material changes in the form of objects in class IV SDN 1 Kertaraharja can be improved by the experimental method.

**Keywords:** Experimental methods; Learning outcomes; science

## Introduction

Human efforts to understand the universe through precise observations, precise procedures, and reasoning-based explanations are known as science or science education (Indiana, 2024). In primary schools, science education aims to teach students to master the knowledge, facts, concepts, principles, discovery processes, and scientific mindsets (Lederman & Lederman, 2020; Letina, 2020), that will help them study the natural world. In order for students to investigate and describe the biological world around them scientifically, science knowledge emphasizes giving them hands-on experience in doing so. According to Sofyatinigrum (2016) "The factors that influence student learning itself are inseparable from the factors that influence student learning outcomes.

The problem that often arises in learning science is students' indifference to learning (Chew & Cerbin, 2021).

This also happened in class IV at SDN 1 Kertaraharja, Pedes District, Karawang Regency. Moreover, most students consider science as a challenging subject. This is because instructors at the school have adopted the implementation of substandard educational experiences. Learning that takes place so far focuses more on the ability to memorize information rather than developing thinking skills. According to Supriyadi (2011), science as a product, process, and attitude are three components that make up the nature of science learning, which is defined as natural science and referred to as IPA in Indonesian.

Based on the problems that arise in class IV SDN 1 Kertaraharja the author wants to improve not only the learning itself but also the accuracy of the teacher in choosing media, learning materials, and learning methods. Teachers greatly benefit from choosing the right method to ensure the success of the material being taught (Russell & Martin, 2023). Students will

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automatically be able to follow the learning process more easily and of course mastery of the subject matter will increase if the teacher is able to choose the right learning method. The following are possible problem formulations: 1) How do students learn about changes in the form of objects in class IV at SDN 1 Kertaraharja, Pedes District, Karawang Regency? 2) How does the experimental approach affect students' science learning outcomes when studying material on changes in the form of objects in grade IV students of SDN 1 Kertaraharja, Pedes District, Karawang Regency?

The definition of experimental technique is an approach to handling topics where students test directly by facing to prove themselves an investigation or speculation that is being studied (Sagala, 2011). Students conduct experiments to experience and validate what they have learned as part of the experimental or trial method (Rezlescu et al., 2020; Zandler & Greiner, 2020), which is usually used to deliver teachings. The experimental approach has the following advantages and objectives: with the aim that learners (understudies) are able to find answers to the problems they face without the help of others by directing their own tests; Students can receive teaching in science thinking; Learners prove what they see is true. The ability to formulate hypotheses in science learning through experimental methods can increase through experimental methods (Kwangmuang et al., 2021). So it can be stated that through experimental methods can help improve in science learning. Analysis of Science Process Skills Based on Observation Instruments and International Student Assessment Test Programs, Agustiani et al. (2022) with very satisfying results all students can master science learning based on observation instruments and tests.

The learning theory of science subjects in grade IV elementary school is the change in the form of objects (Budiastra et al., 2020). The changes in the form of objects means that the objects around us are substantial and have mass. There are three categories of objects: solid, liquid and gas (Stejskal et al., 2021). The following is a complete explanation of the changes that occur in the three objects: a solid object has a shape that does not follow the shape of its container and has a fixed volume. They can change shape by being cut or heated, for example, and the substances that make up solids are very dense. Solids include things like rocks, wood, and plastic; liquid objects have a shape that conforms to the shape of their container, a fixed volume that presses in all directions, and a smooth, flat surface that flows from high to low points. Water, oil, and syrup are some examples of liquids. Gaseous objects have a shape that occupies the entire space, follows its container, and can be pressed in all directions. Change of state from solid to liquid occurs when an object melts or fuses. For example,

frozen yogurt melts at room temperature, candles burn, and margarine melts when warmed. The change of state from liquid to gas is called vaporization. Water, for example, will eventually evaporate when heated. If alcohol and gasoline are kept in an open container, both will evaporate. The condition of objects to be consolidated is the adjustment of the type of gaseous objects to fluid. Examples are the development of dew in the morning and water droplets in a glass filled with cold water. Sublimation refers to the transformation of a solid into a gas. Chalk, for example, dries up over time when left in an open area. We can smell the framed gas. The process of heat energy release changes the state of crystallized objects from gas to solid. Example: turning water vapor in the air into snow. The change from liquid to solid is the state of freezing. Cooling is the process by which a liquid turns into a solid to the edge of freezing. An example of changing the state of an object by freezing is when water is put into a cooler it will become ice or freeze.

## Method

The stages of this research in each cycle are 4 stages, namely the planning stage, the implementation stage, the observation stage and the reflection stage consisting of pre-cycle, cycle 1 and cycle 2. The research subjects took a sample of 27 fourth grade students of SDN 1 Kertaraharja, Pedes District, Karawang Regency. The implementation time of learning improvement was carried out in April-June 2024 with 2x35 minutes in each meeting. Data collection techniques by means of tests, data collection is done through written tests in the form of essay questions consisting of questions done in groups. Student observation, data is taken from student activities through observation by filling out an observation sheet in the form of a check list filled in by the observer during the learning process.

## Result and Discussion

### Result

Pre-cycle is the initial condition before making improvements, in this initial condition there are several weaknesses in the learning process. This resulted in low student understanding of science subjects. The implementation of teaching and learning activities for the pre-cycle was carried out on Friday, April 21, 2023, in class IV SDN 1 Kertaraharja. The researcher acted as a teacher. The learning process refers to the lesson plan that has been prepared. After the initial test, the initial test scores were used as a reference to determine the science learning abilities of grade IV Cibodas Pacing students before using the experimental method. Observation activities in PTK can be carried out with

data collection activities. The term observation is used because the data is collected through observation techniques. Observation (observation) is carried out simultaneously with the implementation of teaching and learning.

The results of the pre-cycle research are that students still do not seem to understand science learning about changes in the form of objects, still look bored and bored, because the delivery of material still uses the lecture method only and there are no props. The author wants to make improvements not only teachers who need to make lesson plans, but accuracy in the selection of media, learning resources, and teaching strategies is also very important. Instructors can achieve the success of learning activities carried out by determining the right way. Students will naturally be able to follow the learning process more easily and will certainly have a better understanding of the science material if the teacher is able to choose the right learning technique.

Cycle 1 was carried out on Monday, May 08, 2024 referring to the improvement plan using the experimental method. The teacher gave an explanation about the changes in the form of objects using lecture, question and answer, discussion and assignment methods. The teacher gives examples of objects around us related to the material of changes in the form of objects such as ice cubes, glasses, ice cream. Students pay attention to the teacher's explanation. The teacher provides opportunities for students to ask questions about the material taught. The teacher gives exercise questions to do. The teacher provides reinforcement and motivation to students.

The results of Cycle I research, namely the teacher held a reflection to find out the shortcomings of obstacles and obstacles in the learning process were the teacher gave exercises/questions on the material of the form of objects such as ice cubes, candles and ice cream, only some students could answer the questions correctly. The teacher did not provide opportunities for students to ask questions about the material taught. So that the results of the analysis are used to plan the next action in cycle II. That in cycle I learning still has to be improved by providing more examples of changes in the form of objects and the teacher must provide reinforcement and motivation for students to remain enthusiastic about learning.

The implementation of cycle II was carried out on Monday, May 22, 2024 teacher learning using the experimental method with the steps being the teacher repeats the previous learning material about the material changes in the form of objects. The teacher gives examples of props that are around us related to the material of changes in the form of objects such as wax, ice cubes and butter. Students pay attention to the teacher's explanation of the properties of changes in the

form of objects The teacher gives exercise questions to do. The teacher provides conclusions on the learning material.

The results of Cycle II research, namely using experimental methods in science subjects on the material of changes in the form of objects obtained results, namely learning activities carried out according to the stages of activities contained in the cycle II lesson plan starting from the initial, core and final activities can run well, where the teacher provides examples of changes in the form of objects such as water, butter and erasers. The use of experimental methods in learning science material changes in the form of objects has increased student learning outcomes. All students are active and very enthusiastic in participating in Mathematics learning activities, especially the Multiplication material delivered by the teacher. The success obtained in cycle II simulation learning activities shows that student learning outcomes have increased very significantly. This shows that the use of experimental methods can help students to master science subject matter, especially the material on changes in the form of objects well, so that student learning outcomes have increased above the school's standart setting (KKM) value of 70.

#### *Discussion*

The factors that affect student learning itself are inseparable from the factors that affect student learning outcomes, Sofyatiningrum (2016) internal elements, such as physical, psychological, interest, motivation, and learning styles. External variables, such as family, school, and society, are things that cannot be controlled. School factors, which include teaching strategies, curriculum, relationships between teachers and students, facilities, and other elements, are one of the external factors that affect student achievement. Learning outcomes in the learning process show themselves as shifts in behavior across cognitive, emotional, and psychomotor domains (Darniyanti et al., 2021). Experimental technique is an approach to handling topics where students test directly by facing to prove for themselves an investigation or speculation under study (Sagala, 2011). Desmiawati et al. (2023) the application of photosynthesis experiments at home will help students' scientific reasoning skills through experiments and the results are very satisfying all students master photosynthesis.

According to the quotation above, the use of experimental methods can help students' enthusiasm in learning science (Safaruddin et al., 2020), the learning results of grade IV students at SDN 1 Kertaraharja, Pedes District, Karawang Regency in the pre-cycle achieved normal results of 60 with a difference of 27 students. Of the 27 students who scored less, there were 18 students

who scored 40-60, and 9 students who scored 70-100, considering that the standart setting (KKM) was 70.

**Table 1.** Distribution of Pre-Cycle Learning Outcome

Interval	Frequency	Percentage (%)
10-30	0	0
40-60	18	67
70-100	9	33
Total	27	100

In her journal, Salsiah (2015) stated that the ability to formulate hypotheses in science learning through experimental methods can increase through experimental methods. So it can be stated that through experimental methods can help improve science learning (Djamarah, 2012; Huang et al., 2022). The experimental method or experiment is usually used as a medium for presenting lessons, where students experiment by experiencing and proving what they have learned. The experimental approach has the following advantages and objectives: with the aim that students (understudies) can endlessly find answers to the problems they face without the help of others by directing their own tests; students can receive teaching in scientific thinking; and students find evidence that the theory they learn is correct.

**Table 2.** Distribution of Cycle I Learning Outcomes

Interval	Frequency	Percentage (%)
10-30	0	0
40-60	9	33
70-100	18	67
Total	27	100

Judging from Table 2, it can be seen that the learning outcomes of fourth grade students at SDN 1 Kertaraharja, Pedes District, Karawang Regency in cycle 1 reached the normal level of 70 with a difference of 27 students. Of the 27 students who scored less, there were 9 students who scored 40-60, 18 students who scored 70-100, considering that the standart setting (KKM) is 70. The average student is classified as very good.

There are three categories of objects, namely solid, liquid and gas. The following is a complete explanation of the changes that occur in these three objects: Solid objects have a shape that does not follow the shape of the container and has a fixed volume. They can change shape by being cut or heated, for example, and the substances that make up solids are very solid. Solids include things like rocks, wood, and plastic. Liquid objects have a shape that matches the shape of their container, a fixed volume that presses in all directions, and a smooth, flat surface that flows from high to low points. Water, oil, and syrup are some examples of liquid objects. Gaseous objects have a shape that occupies the

entire space, follows its container, and can be pressed in all directions.

Change of state from solid to liquid occurs when an object melts or fuses. For example, frozen yogurt thaws at room temperature, candles burn, and margarine melts when warmed. The change of state from liquid to gas is called vaporization. Water, for example, will eventually evaporate when heated. If alcohol and gasoline are kept in an open container, both will evaporate. The condition of the object to be compressed is the adjustment of the type of gas object to liquid. Examples are the development of dew in the morning and water droplets in a glass filled with cold water. Sublimation refers to the change of a solid object into a gas. Chalk, for example, will dry up over time if left out in the open. We can smell the gas being formed. The process of releasing heat energy changes the state of a crystallized object from gas to solid. Example: turning water vapor in the air into snow. The change from liquid to solid is the state of freezing. Cooling is the process by which a liquid turns into a solid until it reaches the freezing point. An example of changing the form of objects by freezing is when water is put into the cooler it will become ice or freeze.

Masus et al. (2020), in her journal, stated that in primary grades, science process skills are improved through experimentation. Based on the research findings, the sufficient group had a percentage of 69.23% in cycle I, while the good category had a percentage of 84.61% in cycle II. Thus, the application of the experimental approach helps improve scientific reasoning skills.

Analysis of science process skills based on observation instruments and international student assessment test program, Agustiani et al. (2022) with very satisfying results all students can master science learning based on observation instruments and tests. Science as a product, process, and attitude are three categories that can be used to categorize the nature of science learning (Hikmawati et al., 2020; Treagust & Won, 2023), which is described as science about nature and known as natural science in Indonesian (Nurâ et al., 2023; Parmin et al., 2020; Sumarni et al., 2022; Supriyadi, 2011).

In line with the journal, research in cycle 2 also experienced an increase, seen from Table 3 it can be seen that the learning outcomes of fourth grade students of SDN 1 Kertaraharja, Pedes District, Karawang Regency in cycle 2 reached normal results of 70 with a difference of 27 students. Of the 27 students whose scores were fragmented, there were 2 students who scored 40-60, 25 students scored 70-100, considering that the KKM set was 70. The average student is in the good rank.

**Table 3.** Distribution of Cycle II Learning Outcomes

Interval	Frequency	Percentage (%)
10-30	0	0
40-60	2	7.5
70-100	25	92.5
Total	27	100

After making observations, it can be compared that the completeness of student learning outcomes is very clear that the level of mastery of material in science subjects on the material of changes in the shape of objects. Pre-cycle did not meet the final results of students, namely 33% of 27 students. Cycle 1 student mastery results of 67%, better than pre-cycle. Cycle II, the value of student success reached 92.5% where out of 27 students only 2 students did not meet the KKM score of 70.

## Conclusion

Looking at the results and discussion above, it can be assumed that the use of experimental techniques can further develop the material of science learning outcomes for changes in objects in grade IV students at SDN 1 Kertaraharja, Pedes District, Karawang Regency. This can be seen from the pre-cycle score of 33%, still below the normal KKM value of 70, so it is continued, cycle 1 culmination score of 67%, still controlled by smart students. Cycle 2 score of 92.5% only 2 students are still less than ideal. The experimental strategy can make students more imaginative and brave in expressing their opinions and can solve questions/tasks based on their involvement in understanding the material being taught, so they don't just know. With an increase in learning outcomes, learning through experimental strategies can be said to be effective or improved.

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## Conflicts of Interest

The authors declare no conflict of interest.

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