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Preliminary Study of Grade Five Students' Critical Thinking Skills on Plants Material

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Abstract: This study investigated the initial critical thinking skills of grade five students on plant materials and explored a suitable learning model solution method for the students' conditions. The study used a preliminary design and a critical thinking skills test instrument to collect data. The results showed that students' critical thinking skills varied widely, with none of the students scoring in the very good category, 11.00% of students scoring in the good category, 58.00% of students scoring in the fair category, 26.00% of students scoring in the poor category, and 5.00% of students scoring in the very poor category. These findings suggest that students need more support to develop their critical thinking skills, particularly in the areas of deduction, inference, and evaluation of arguments. Future researchers could design learning tools using specific learning methods/models to address these areas and improve students' critical thinking skills.

Keywords: critical thinking skills; science learning; preliminary study

Abstrak: Studi ini menyelidiki keterampilan berpikir kritis awal siswa kelas lima pada materi tumbuhan dan mengeksplorasi model pembelajaran yang cocok sebagai solusi untuk kondisi siswa. Studi ini menggunakan desain pendahuluan dan instrumen tes keterampilan berpikir kritis untuk mengumpulkan data. Hasil penelitian menunjukkan bahwa keterampilan berpikir kritis siswa sangat bervariasi, dengan tidak ada siswa yang mendapat skor pada kategori sangat baik, 11,00% siswa mendapat skor pada kategori baik, 58,00% siswa mendapat skor pada kategori sedang, 26,00% siswa mendapat skor pada kategori buruk, dan 5,00% siswa mendapat skor pada kategori sangat buruk. Temuan ini menunjukkan bahwa siswa membutuhkan lebih banyak dukungan untuk mengembangkan keterampilan berpikir kritis mereka, terutama di bidang deduksi, inferensi, dan evaluasi argumen. Peneliti di masa depan dapat merancang alat pembelajaran menggunakan metode/model pembelajaran khusus untuk mengatasi bidang-bidang ini dan meningkatkan keterampilan berpikir kritis siswa.

Kata kunci: kemampuan berpikir kritis, pembelajaran IPA, studi pendahuluan

INTRODUCTION

Education is one of the efforts to improve the quality of human life. In education, especially elementary school, science education is one of the branches of science that is taught with the aim of analyzing facts, concepts, principles, and scientific relations in everyday life. Education can change and develop according to the development of the times. One of them in the era of the 4th industrial revolution today, Indonesia has the challenge of being able to provide quality education that is integrated with technology and accommodates students to be able to achieve 21st century thinking skills (Rahmawati, Pujiastuti, & Cahyaningtyas, 2023).

The knowledge, skills, and attitudes required for 21st century education include mastery of information and communication technology (ICT), social and communication skills, problem-solving skills, critical thinking, and collaboration skills (Pratiwi, Suryanti, & Sudibyo, 2021). Learning that reflects 21st century skills refers to the skills and activeness of students in analyzing and building their own understanding based on their knowledge and experience. One of the thinking skills that is directed at learning in school is high-level thinking skills. One of the high-level thinking skills is critical thinking (Rachamatika, et al., 2021).

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According to Anugraheni (cited by Rachamatika et al., 2021), critical thinking skills are the ability of students to solve problems and draw conclusions from multiple perspectives. Critical thinking skills are a skill that must be improved and are an important component of a person's character (Rahmawati, Pujiastuti, & Cahyaningtyas, 2023). According to Utami et al. (2017), the goal of education should be to improve critical thinking skills. The ability of students to think critically according to Nafi'ah & Prasetyo cited in (Febriana, Suryani, & Taufik, 2023) can be seen from the efforts of students to obtain reliable information; students will use open, careful, and precise thinking to find facts or solutions. Therefore, it is important in the era of the 4th industrial revolution, the education system prioritizes critical learning (Kawuryan et al., 2022)

However, a gap was found between the importance of critical thinking skills and Indonesia's performance in the field of Science. This is evident from the results of the Programme for International Student Assessment (PISA) assessment organized by the Organisation for Economic Co-operation and Development (OECD). PISA is an international test that assesses the reading, mathematics, and science skills of students around the world. The results of PISA 2022 showed that the critical thinking skills of elementary school science students in Indonesia were below the OECD average. Indonesian elementary school students only managed to achieve a score of 383, while the OECD average was 485 (Programme for International Student Assessment (PISA), 2022). In addition, according to the TIMSS and PIRLS International Study Center 2015 survey, the quality of basic education in Indonesia, especially in the field of Science, was only able to rank 44th out of 47 countries with an average Science score of 397 (Rachamatika, et al., 2021). In 2021, Indonesia held the *Asesmen Nasional* (AN) organized by the Ministry of Education, Culture, Research, and Technology (Kemendikbudristek). AN is a national test that assesses the literacy, numeracy, and character skills of elementary school, junior high school, and high school students. The results of AN 2021 showed that the critical thinking skills of elementary school science students in Indonesia were still below average. Indonesian elementary school students only managed to achieve a score of 29.27, while the national average was 32.56. These results show that the critical thinking skills of elementary school science students in Indonesia are still considered low and need to be significantly improved (Rahmawati, Pujiastuti, & Cahyaningtyas, 2023).

In the age of the 4th industrial revolution, critical thinking skills are no longer luxuries but necessities. Yet, alarmingly, Indonesian elementary school students' critical thinking abilities in science fall significantly below international benchmarks. This gap is particularly evident in their understanding of plant science concepts, as demonstrated by low scores on national and international assessments. In this research, the researcher employed five crucial measuring indicators of critical thinking skills, outlined by Watson and Glaser (2002). Inference refers to the process of students leveraging their existing knowledge to form new conclusions based on presented information. This skill evaluates their ability to think beyond the surface and establish logical connections. Assumption identifies student-held beliefs considered true without concrete evidence, measuring their capacity to acknowledge and address potential biases and uncertainties in their thinking. Deduction focuses on drawing conclusions based on applied rules or principles in relation to available information, gauging their ability to follow logical reasoning and reach valid conclusions. Interpretation involves analyzing and comprehending the meaning of information, identifying evidence, and determining if conclusions align with supporting data, assessing their skill in critically evaluating information and forming informed judgments. Finally, evaluation of argument focuses on judging the strength and relevance of presented arguments, measuring their ability to differentiate strong from weak arguments, identify logical fallacies, and determine if arguments are supported by evidence. By employing these indicators, the researcher was able to gain a comprehensive understanding of the students' critical thinking abilities.

This study addresses this critical concern by investigating the initial critical thinking abilities of students regarding plants and identifying areas where teaching strategies and models can be improved to foster deeper learning and enhance their critical thinking skills. By exploring novel approaches and optimizing existing methods, it is aim to equip the future generation with the

critical thinking tools they need to thrive in a world increasingly driven by scientific knowledge and technological advancement.

METHOD

The design of this investigation was preliminary study. A preliminary study is a small-scale study that researchers conduct to collect initial data and information about a topic before doing a larger, more detailed study. It can help researchers figure out what their main research questions are, come up with hypotheses, test whether their research method will work, find any potential problems or challenges with their research, and get feedback from people who know a lot about the topic (Creswell, 2014).

Nineteen fifth-graders from a private school in Surabaya, Indonesia participated in this study. The first step was to conduct a literature review to focus the research. Next, the researchers gathered the necessary research tools; including learning materials and test items for critical thinking skills. The next stage was to collect research data, which required at least two direct learning sessions in class. The following step was to analyze the research data, including looking at students' initial critical thinking skills on plants in learning. The final step of the research was to summarize the findings.

The data collection technique used a test method using critical thinking skills test instrument. The test instrument includes ten questions about plants part and reproduction of plants with five measuring indicator of critical thinking skills; inference, assumption, deduction, interpretation, evaluation argument. The scores for critical thinking abilities were converted to percentages and categories of critical thinking skills, which are shown in Table 1 (Riduwan as cited in Effendi & Farlina, 2017). After that, each indicator is analyzed descriptively.

Table 1. Tables interpretation level of critical thinking.

Percentage of Critical Thinking Indicators Achieved (%)	Critical Thinking Category Level
81 – 100	Very Good
61 – 80	Good
41 – 60	Fair
21 – 40	Poor
0 – 20	Very Poor

RESULT AND DISCUSSION

Grade five students' critical thinking skills showed different results when tested on their ability to think critically about plants topic. Figure 1 shows the overall percentage of original critical thought on plants.

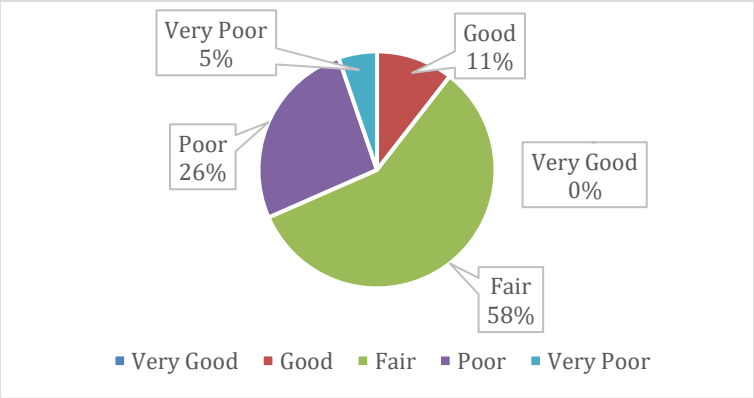


Figure 1. Graph of Students' Critical Thinking Score Category

According to the Figure 1, 0% of students scored 81-100 in the very good category, 11.00% of students scored 61-80 in the good category, 58.00% of students scored 41-60 in the fair category, 26.00% of students scored 21-40 in the poor category, and 5.00% of students scored 0-20 in the very poor category.

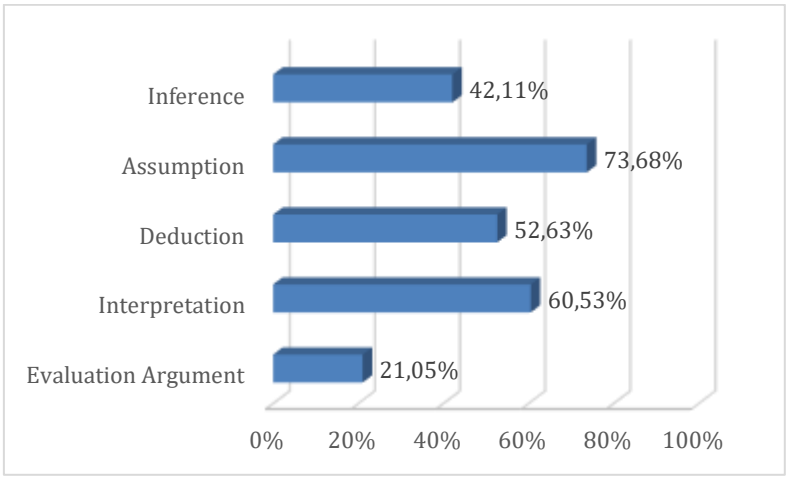


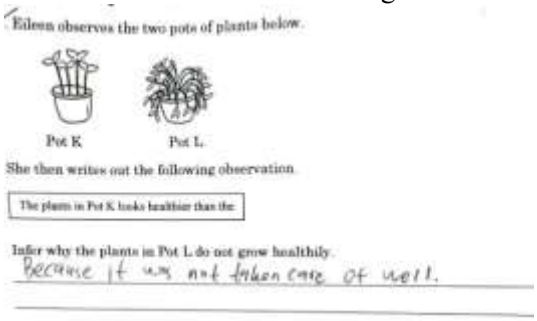
Figure 2. Graph of Students' Critical Thinking Skills Indicators Achievement

Figure 2 depicts a bar graph of grade five students' abilities related to critical thinking skills, with assumption representing the highest percentage indicator and evaluation of argument representing the lowest percentage signal. The assumption indication percentage is 73.68% in the good category, the interpretation indicator percentage is 60.53% in the good category, the deduction indicator percentage is 52.63% in the fair category, the inference indicator percentage is 42.11% in the fair category, and the evaluation of argument indicator percentage is 21.05% in the poor category.

Critical Thinking Skills Indicator Analysis

The indicators of critical thinking skills used by researchers are taken from Watson and Glaser, with the following indicators: inference, assumption, deduction, interpretation, and argument evaluation (Watson & Glaser, 2002). Based on Watson & Glaser explanation (2002), an inference is a guess or judgment that is made based on what students already know or have seen. In other words, it is a process of using students existing knowledge to come up with a new conclusion. Some students were able to correctly answer the questions in the first indicator by assessing whether the conclusion was supported by the evidence and by providing clear and specific reasons to support their answers. However, some students were still unable to explain

their answers in detail. This is because most students did not provide specific scientific justifications for why a plant does not develop healthily when asked to do so on this test. The result of students' work on this indicator can be seen in Figure 3.


Eileen observes the two pots of plants below.

Pot K Pot L

She then writes out the following observation.

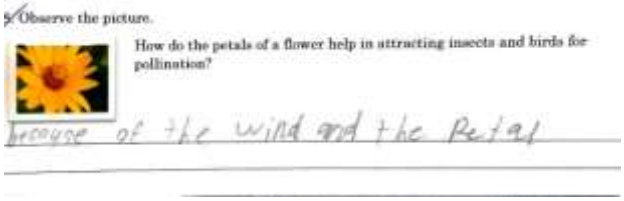
The plants in Pot K looks healthier than the

Infer why the plants in Pot L do not grow healthily.

Because it was not taken care of well.

Figure 3. The Result of Student Work on the First Indicator (Inference)

An assumption is something that students believe to be true without having proof (Watson & Glaser, 2002). This is the highest-achieving indicator. Some students performed well on the assumption indication indicator, which measures their ability to identify and explain biases in accordance with the given data. However, some students still struggled to correctly identify and explain biases. Following is the results of the students' work on this indicator.

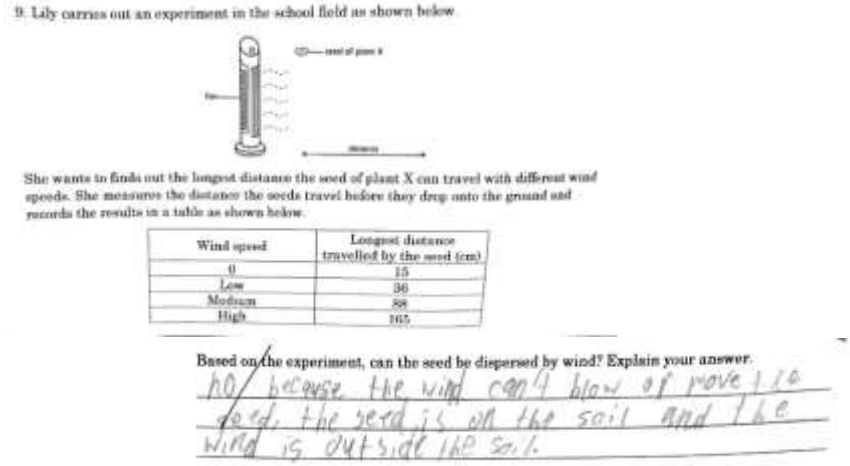

5. Observe the picture.

How do the petals of a flower help in attracting insects and birds for pollination?

because of the wind and the Petal

Figure 4. The Result of Student Work on the Second Indicator (Assumption)

Deduction is the ability to use logic to draw conclusions from premises. In other words, it is the ability to figure out whether something must be true based on what is already known to be true (Lestari, Ahmadi, & Rochmad, 2020). The third indicator was deduction, which measured students' ability to draw conclusions based on given information. Some students were able to determine whether a conclusion was consistent with the data, but many struggled to explain their reasoning. The following figure shows the result of student's work on this indicator.


9. Lily carries out an experiment in the school field as shown below.

She wants to finds out the longest distance the seed of plant X can travel with different wind speeds. She measures the distance the seeds travel before they drop onto the ground and records the results in a table as shown below.

Wind speed	Longest distance travelled by the seed (cm)
0	15
Low	36
Medium	88
High	165

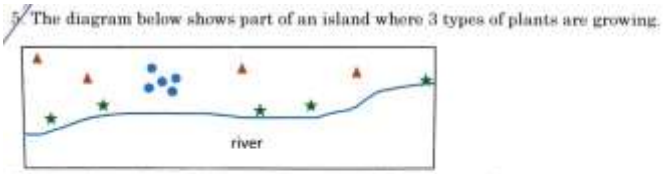
Based on the experiment, can the seed be dispersed by wind? Explain your answer.

no/ because the wind can't blow of move the seed, the seed is on the soil and the wind is outside the soil.

Figure 5. The Result of Student Work on the Third Indicator (Deduction)

Interpretation is the ability to understand and explain the meaning of information. This includes the ability to identify and evaluate the assumptions and biases that may be present in the

information (Lestari, Ahmadi, & Rochmad, 2020). The fourth indicator is interpreting information. This indicator measures students' ability to identify evidence and determine whether conclusions are supported by the data. Some students can interpret the information correctly and determine whether a conclusion is supported by the data. Following is the results of the students' work on this indicator.



	▲	★	●
a.	water	explosive action	wind
b.	explosive action	animal	water
c.	explosive action	water	animal
d.	animals	water	explosive action

Figure 6. The Result of Student Work on the Fourth Indicator (Interpretation)

Evaluation of arguments is the ability to assess the strength of an argument. This includes the ability to identify the logical fallacies that may be present in the argument and to evaluate the evidence that is presented to support the argument's claims (Lestari, Ahmadi, & Rochmad, 2020). The fifth indicator, evaluating arguments, measures students' ability to determine whether arguments are strong or weak and relevant or irrelevant to the given data. Some students were able to answer correctly, identifying which arguments were correct and which were not. However, students scored lowest on this indicator compared to the others, which may be due to their inability to judge which arguments are correct.

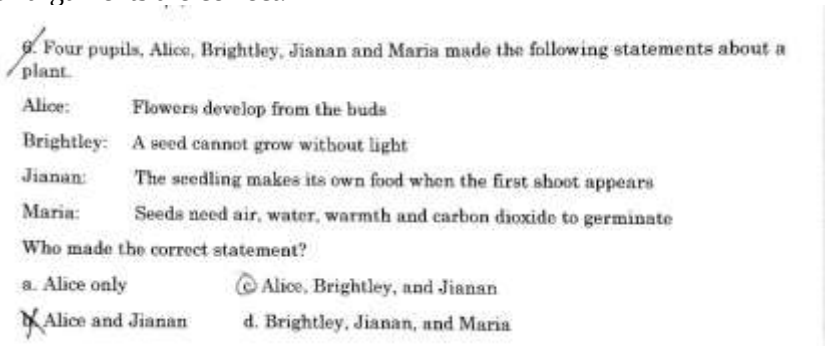


Figure 7. The Result of Student Work on the Fifth Indicator (Evaluation of Argument)

The Need for Further Research

Research results has shown that students' critical thinking skills are low. This is partly because science learning is often just about memorizing facts. This is supported by Pratiwi, Suryanti, and Sudibyo (2021), who state that science teaching and learning should be engaging and relevant to students so that they can apply the concepts they learn to solve real-world problems. This would make science learning more fun and meaningful, and it would also improve students' critical thinking skills.

According to (Rahmawati, Pujiastuti, & Cahyaningtyas, 2023), critical thinking skills can be improved by using learning strategies. Therefore, it is important for researchers to conduct this preliminary research to analyze students' basic critical thinking skills so that further research can be conducted to improve the critical thinking skills of elementary school students.

CONCLUSION AND SUGGESTIONS

Research has shown that fifth-grade students' critical thinking skills on the topic of plants are still low. This may be because the teaching methods used have not been effective in developing students' critical thinking abilities. Based on these findings, teachers should be able to provide teaching strategies and models that can be improved to foster deeper learning and enhance their critical thinking skills. Additionally, students should continue to practice and develop their critical thinking skills by applying scientific facts and concepts to their everyday lives. The findings of this study can provide teachers and researchers with an overview of the current state of fifth-grade students' critical thinking skills on the topic of plants, as well as a reference and a primary alternative for future researchers who are developing educational tools to improve students' critical thinking skills.

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