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Portraits of Science Misconceptions in Plant Adaptation and Breeding Materials in Elementary Schools

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ABSTRAK

Miskonsepsi adalah kesalahpahaman suatu konsep pada seseorang. Miskonsepsi bisa dialami di berbagai situasi, salah satunya dalam proses pembelajaran. Penelitian ini mengambil pembelajaran yang dilakukan di SD terutama pada materi adaptasi dan perkembangbiakan pada tumbuhan. Miskonsepsi sendiri terjadi karena banyak faktor. Tujuan dari penelitian ini adalah untuk mengetahui ada tidaknya miskonsepsi materi adaptasi dan perkembangbiakan tumbuhan di sekolah dasar yang diteliti. Menggunakan pendekatan kualitatif deskriptif. Jenis penelitian kualitatif dengan menggunakan pendekatan deskriptif. Populasi dalam penelitian ini berjumlah 47 siswa. Pengambilan sampel tersebut dilakukan dengan cara probability sampling. Teknik pengumpulan data yang digunakan adalah tes dan wawancara. Instrumen tes yang digunakan adalah dengan memberikan 15 nomor soal pada siswa. Teknik analisis data yang digunakan yaitu analisis deskriptif kualitatif. Hasil penelitian yaitu dari sampel tersebut ternyata mengalami miskonsepsi sebesar 19% materi perkembangbiakan tumbuhan secara vegetatif, 13% perkembangbiakan tumbuhan secara generatif, dan 2% materi adaptasi tumbuhan. Guru juga menjelaskan kalau siswanya hanya sedikit yang mengalami miskonsepsi dan sisanya hanya kurang paham konsep. Cara mengatasi miskonsepsi sangatlah banyak, mulai dari media pembelajaran, penggunaan lks, pengembangan berpikir kritis pada siswa, dan masih banyak lagi. Disimpulkan bahwa siswa sekolah dasar memiliki miskonsepsi.

ABSTRACT

A misconception is a misunderstanding of a concept by someone. Misconceptions can be experienced in various situations, one of which is in the learning process. This research takes the learning in elementary schools, especially on plant adaptation and reproduction. Misconception itself occurs due to many factors. This study aimed to determine whether there were misconceptions about plant adaptation and reproduction in the elementary schools studied. The researcher used a descriptive qualitative approach. This type of qualitative research uses a descriptive approach. The population in this study amounted to 47 students. Sampling was done using probability sampling. Data collection techniques used were tests and interviews. The test instrument used is to give 15 question numbers to students. The data analysis technique used is descriptive qualitative analysis. The study results showed that 19% of the samples had misconceptions about vegetative propagation of plants, 13% of generative plant propagation, and 2% of plant adaptation material. The teacher also explained that only a few students needed clarification, and the rest needed help understanding the concept. There are many ways to overcome misconceptions, starting from learning media, using worksheets, developing critical thinking in students, and many more. It was concluded that elementary school students have misconceptions.

1. INTRODUCTION

The essence of natural science is a branch of science that investigates nature and various phenomena, attitudes, and characteristics assembled into a collection of ideas and conceptions through a series of scientific procedures by humans (Hidayah, Untari, & Wardana, 2018). The characteristics of science as a mode of thinking commonly called scientific behavior are curiosity, trust, objectivity, critical thinking, openness, discipline, conscientiousness, and other characteristics supporting science learning

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(Sayekti, 2019). Therefore, this scientific behavior must be developed in any subject to form good student character. IPA is a science that examines the causes and effects of events that occur in nature (Susanti, 2021). IPA is a methodical study of nature. Natural Science is the process of discovering or discovering and mastering a body of information in the form of facts, concepts, or principles (Sayekti, 2019). It means that understanding the concept of science is also very important. So when giving material in learning activities, the teacher is expected to be able to master and understand the material presented. So that students can understand the material and there is the understanding of concepts.

Preconceptions and misconceptions of concepts are two categories that describe concepts (Indrajatun & Desstya, 2022). Preconceptions are the first ideas a person has about anything a young person has that cannot be imagined to be the same as the ideas taught in class (about the same object) (Rahayu & Afriansyah, 2021). Preconceptions lead to misconceptions (Anggraini, Fitri, & Insani, 2019; Nurdiansyah, Hartati, & Paujiah, 2022). The misconception is the difference between an idea that someone adheres to but contradicts their understanding of science (Bayuni, Sopandi, & Sujana, 2018). The misconception is also a misunderstanding of a concept to someone. Several factors cause misconceptions. Associative thinking, prejudice, humanistic beliefs, false intuitions, and student motivation in learning can all be sources of misunderstanding (Rizki & Setyarsih, 2022). In addition, the students themselves, wrong initial ideas, student reasoning, wrong cognitive development processes, wrong initial concepts, learning resources, and teacher delivery of subjects can all cause misconceptions (Mukhlisa, 2021).

Misconceptions can be experienced in various situations, one of which is in the learning process. Learning is a process that involves interaction between stimulus and reaction. The stimulus here means the teacher and the student's meaningful response. If misconceptions occur during the learning process, meaningful learning may not occur (Nasir, 2020). This misconception can also occur in all subjects, including science. From several articles researchers have read, misconceptions about science are found at many levels, starting from elementary, junior high, and high school (Dwilestari & Desstya, 2022). Misconceptions can be caused by students, teachers, teaching materials, and many other things. Online learning greatly affects student understanding and is generated by up to 8% false positives, which causes misconceptions (Rizki & Setyarsih, 2022). Research conducted by other researchers also confirms that the students themselves, the environment, and learning methods are all elements that contribute to students' misunderstanding of concepts (Nasution, Wijaya, Adi Putra, & Hermita, 2021). If misconceptions are immediately cleared up, it will be safe in science learning (Fenditasari, Jumadi, Istiyono, & Hendra., 2020). Therefore, research must be conducted to determine the level of students' misconceptions about learning science. Physics, Biology, and Chemistry are topics in science learning materials. However, this research only looks at one of these topics, Biology.

Previous studies have shown that research on natural science misconceptions in elementary schools is also often carried out, such as on the topics of force and motion, the properties of light, the human digestive system, and many more (Indrajatun & Desstya, 2022; Riti, Sar'iyyah, & Bito, 2022). The way to overcome this misconception is very diverse, from learning, media, teaching materials, lesson plans, and others. Several studies state that it can be overcome by using guided discovery techniques and analogy strategies, learning media, providing cognitive conflict, providing scaffolding, and re-explanation, and others (Heryandi & Nur'aini., 2022; Sari & Masriyah, 2022). It is a method to avoid misconceptions.

This study explores how many elementary school children have misconceptions about plant adaptation and propagation. Plant adaptation is modifying to survive in a changing environment (Ajem, 2022). Cacti also experience adaptations, such as surviving in a dry place (Edvan et al., 2020). Mangrove forests adapt to their root system. The benefits of mangrove forests are numerous, such as reducing abrasion (Rudianto, Darmawan, Isdianto, & Bintoro, 2022). One of the strategies used to keep plants awake is plant propagation. Vegetative and generative are two categories in which plant propagation is often categorized. When two plants mate, they reproduce by sexual reproduction, in which the genitals are the flowers (Ruslaini & Avisha, 2020). Vegetative reproduction, often known as sole propagation, involves the use of parts of the mother's body. This reproduction is divided into two types, artificial and natural. Techniques for artificial vegetative propagation of plants include grafting, cuttings, grafting or patching, and grafting (Metayanti, Abadi, & Sujana, 2022). Naturally, vegetative shoots include adventitious shoots, tubers, shoots, tubers, and spores (Salmah, 2019).

Plant adaptation and reproduction material is one of the science materials that students must be able to master. Therefore it is important that the teacher can provide material properly so that there is a clear understanding of the understanding obtained by students. Several previous studies have shown that it is important to analyze students' misconceptions to minimize misconceptions about a learning material (Hasanti & Zulyusri, 2022; Setyaputri & Destya, 2022). Other studies have shown that the causative factor for misconceptions is the lack of students' interest in learning science (Heryandi & Nur'aini., 2022; Islami, Munawaroh, Hadi, & Wulandari, 2018). Differences in methods, instruments, and research locations are one

of the differences in this study. It will impact research results that will be different. Researchers also examine misconceptions about plant propagation using multiple-choice tests with the Certainty of Response Index (CRI) (Uriyah, Hutama, & Nuriman., 2018). The gap taken from the research lies in the instrument used. This study only tested essay questions, not the description, filling questions, and interviews. The material only focuses on plant breeding. SD and time of research were also different. It will impact the problems that arise, which differ from the investigation findings (Uriyah et al., 2018).

This study aimed to determine whether there were misconceptions about plant adaptation and reproduction in the elementary schools studied. To find out, the researcher uses multiple choice questions and essays. When knowing the existing data on the spread of misconceptions, teachers or related parties can find the solutions needed immediately. This solution is made so that misconceptions in students will disappear quickly. If misconceptions are not resolved immediately, they may last longer (Annuru, Maria, & Oktaviany, 2018). To overcome learning problems related to misconceptions, new learning models, teaching materials, assessment methodologies, and curriculum revisions were created at all levels of education (Yani et al., 2021) (Yani, Amin, Rohman, Suarsini, & Rijal, 2021). This research can help teachers to resolve the misconceptions experienced by their students. In addition, this research is also beneficial for individuals who will use the same theme to conduct research.

2. METHOD

This type of qualitative research uses a descriptive approach. The researchers used a descriptive qualitative research design due to wanting to learn more deeply about the various distribution of misconceptions regarding the adaptation and reproduction of plants in elementary schools and the description of the phenomena. This research was conducted at Kepanjenlor 3 Elementary School, Blitar City, on November 4, 2022, and at Klitik 1 Elementary School, Ngawi Regency, on November 19, 2022. The population in this study were grade 6 students at the two elementary schools and their teachers. The sample consisted of 47 students at the two elementary schools and one teacher at SDN Klitik 1, Ngawi Regency. Sampling was done using probability sampling.

Data collection techniques used were tests and interviews. The test instrument used is to give 15 question numbers to students. Meanwhile, interviews were shown for teachers: twelve multiple-choice questions and three open questions are to be tested on students. The researcher chose the usual multiple-choice questions because he also wanted to know student learning outcomes. Learning outcomes are closely related to misconceptions. The widespread misunderstanding of basic concepts that disrupts students' knowledge of certain ideas is one of the reasons students need better learning outcomes (Irani, Zulyusri, & Darussyamsu, 2020). The validity of the questions done by students has also been checked. Examinations were carried out on students who were not the sample in this study, and the results were valid. A validity test is a stage of examining the contents of an instrument to determine whether it is accurate enough to be used in a study. By using SPSS, validity will be tested. SPSS is a software tool widely used to analyze statistical data, one of which is validity (Janna & Herianto., 2021). Table 1 displays the questions that have been tested, and Table 2 displays the assessment indicators in the questions.

Table 1. Question Grids

Material	Sub Material	Question Number
Adaptation in plants	Adaptation of xerophytic plants, lotus, nitrogen-poor plants, cacti, mangroves, and shy daughter	1, 2, 3, 4, 5, 15
Propagation of plants in a vegetative way	Algae breeding	6
	Characteristics of tubers	7
	Definition of pollination	8
	Definition of vegetative propagation	9
	Grafting steps	14
Reproduction of plants in a generative way	Breeding tool	10
	Definition of generative reproduction	11
	Pollination	12
	Flower parts	13

Table 2. Indicators for Assessing Essay Questions in Understanding the Concept

No	Metacognitive Level	Evaluation Criteria
1	No reaction	Do not answer, make up answers, and do not know
2	misconceptions	The explanation is inappropriate and does not make sense. Even if a small part is true, it may be due to making up.
3	Some minor misconceptions	Some of the explanations are inappropriate and do not make sense
4	Understand Some concepts	The responses are reasonable and correct but not complete
5	Understand concept	The responses are reasonable and correct, and complete.

Data reduction, data presentation, and conclusions are used for data analysis techniques (Purnamasari & Afriansyah, 2021). The first research data reduction examined students' test results to identify misconceptions students had when answering test questions about plant adaptation and propagation. Second, the transcript of the teacher interview findings. All previously detailed data is presented more concisely and easily understood at this data presentation stage. This information is often presented in the form of tables or graphs. The results achieved must be able to overcome the challenges of previous research. At this point, new findings were also announced apart from providing solutions to the formulation of the study problem. The conclusion can be a description or description of an item that has been researched and studied scientifically and needs to be studied further for its truth. The chart of data analysis can be seen in Figure 1.

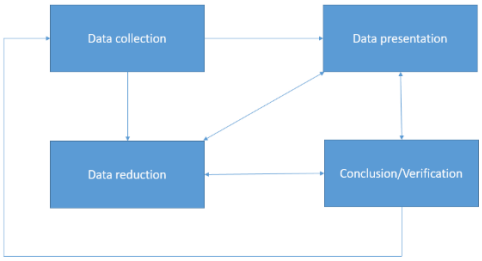

Figure 1. Data Analysis Chart (Rijali, 2019).

3. RESULT AND DISCUSSION

Result

The results of this study are presented in Table 3, Table 4, Table 5, and Table 6 below.

Table 3. Percentage of Correct Answers to Multiple Choice Questions

Question Number	Correct Percentage
1	21%
2	64%
3	28%
4	38%
5	32%
6	38%
7	51%
8	64%
9	53%
10	28%
11	49%
12	13%

Table 4. The Average Percentage of Correct Answers to Each Multiple-Choice Item

No	Material	Correct percentage
1	Adaptation in plants	37%
2	Propagation of plants in a vegetative way	48%
3	Reproduction of plants in a generative way	38%

The researcher then used SPSS to test the validity. It turned out that numbers 1, 5, and 12 needed to be validated in the sample studied. In questions number 1, 5, and 12, many students experienced difficulties. In question number 1, the teacher explained that the students did not know what sun dew was, and the teacher did not remember having discussed it with the students. In addition, question number 1 is also invalid. The plant known as sundew contains slime resembling drops of morning dew in each tentacle of its leaves (Rusmin & Pitopang, 2020). Number 5, only 7 out of 25 students answered correctly. The teacher explains that the material is not the subject matter. In question number 5, this is also invalid. The teacher explained that question number 12 had also entered the material, but this question needed help. It was also proven by only one student who answered correctly. However, the teacher must determine if the student understands the material. The low grades of these students also evidence this. Question number 12 is also invalid.

Table 5. Categories of Misconceptions

No	Metacognitive Level				
	No Reaction	Misconceptions	Few Misconceptions	Understanding Some Concepts	Understanding Concepts
13	32%	13%	26%	2%	28%
14	15%	19%	30%	6%	30%
15	43%	2%	4%	0%	51%

Table 6. Categories of Misconceptions for Each Elementary School

Question Number	Misconceptions	
	SDN Klitik 1	SDN Kepanjenlor 3
13	8,668%	4,334%
14	4,3%	14,7%
15	0%	2%

Tables 5 and 6 show that at the elementary level, things still need to be clarified. In question 13, a question is given about the parts of a perfect flower. Most students who experience misconceptions answer one correct answer, and the other is inappropriate. Students were asked to write down the parts of a perfect flower, but many wrote down the parts of plants, such as roots, stems, etc. Apart from that, some answered correctly but only incompletely.

In number 14, students are asked how the steps are in grafting. Many students write down one correct answer while the others are wrong or do not make sense. These wrong or nonsensical answers are like stem cuttings. Even though the steps in cuttings and grafting are very different, some students answered one, but the answer was inappropriate, such as a rod being scraped off. Scraped plant stems can also be used for grafting if the cambium is visible when scraping it. However, the student did not explain how deep the scrapes were on the stems. In number 15, there was only one student who needed clarification. The question in this number relates to why the daughter is embarrassed to cover her leaves. The student did not answer this reason and instead answered about the parts of the embarrassed daughter's body. The student is categorized as a misconception because the answers to the questions are inappropriate.

There are various reasons why someone might need help understanding the concept. One of them is the teacher's teaching strategy of only noting topics without showing or practicing them, which assumes that students already have a certain level of learning readiness (Suryani, 2018). However, the teacher explained that the teacher had also practiced learning. One example is the material of the flower parts. The teacher asks some students to bring flowers and show them the parts of the flower together in class. In addition, before carrying out these practices, the teacher also asks students to read the material that will be studied the next day. Some students may need to pay more attention to the teacher's instructions, so before the day of bringing flowers, some students do not study. The transmission of information between teachers and students at different levels of thinking is a common source of misconceptions (Kusno & Sutarto., 2022). A concept is not fully understood or obtained when the teacher explains the various levels of thinking about a thing to students. Teachers need to be aware of the level of understanding of their students. Students need appropriate instructional assignments and evaluations to develop meaningful conceptual understanding.

The results of interviews about the condition of students in all classes obtained several interesting findings. More than half of the students at SDN Klitik 1 seem to be concentrating on learning. Functional concentration is crucial because problems will develop with completing the task if disturbed. It will affect the concepts that the teacher will convey. A child with a high concentration level can accept learning easily. The teacher also explained that plant adaptation material is easier than plant propagation. It is also shown in Table 5, which shows the lowest level of misconceptions about adaptation material. The teacher also explained that students had the most difficulty learning vegetative plant material between vegetative and generative plant propagation materials. It is because there are many materials for vegetative plant development, which makes it difficult for students. In addition to the material classified as a lot, the teacher also explains the limited time in learning. The teacher also explained that almost half of the students mastered the material for artificial vegetative propagation of plants. Whereas if it is natural vegetative, it is difficult for students to distinguish the types, especially in tubers, stem tubers, and root tubers. It was also shown in question number 7; as many as 24 out of 47 students from the two elementary schools answered the question incorrectly. This question relates to the characteristics of the stem tubers.

From tables three to six, misconceptions are distributed in the two elementary schools. The average overall grade of the two Elementary Schools is 47.0851. There are 21 students whose scores are above. The highest student score is only one child, with a score of 85. While the average score of students at SDN Klitik 1 Ngawi Regency is 55.52, and at SDN Kepanjenlor Blitar City is 37.5. Nine students from SDN Klithic 1, Ngawi Regency, and 18 from SDN Kepanjenlor 3, Blitar City, scored below 50. Because there were already many students in elementary school with scores above 50, the researchers chose nine students from SDN Klithic 1, Ngawi Regency. The scores of nine students at SDN Klitik 1 Ngawi Regency are shown in Table 7. Researchers conducted in-depth interviews with teachers at SDN Klitik 1 Ngawi Regency. The teacher explains that the material for plant adaptation and reproduction has been studied.

Table 7. Students at SDN Klitik 1, Ngawi Regency, Whose Scores are Below 50

No	Initial	Score
1	a	13
2	b	23
3	c	28
4	d	30
5	e	35
6	f	39
7	g	40
8	h	41
9	i	46

From the interviews conducted with the teacher regarding the nine students, initial student a, almost all of the essay questions needed to be corrected. The student's very low grades of A's in both the multiple choice and essay sections serve as evidence of this. After being asked by the teacher, it turns out that student A needs help to understand various concepts. Student b can be categorized as needing help understanding the concept. The student's low grades in multiple choice and essay sections prove this. The teacher explains that student b tends to be less able to read. It will certainly affect the understanding of the concept and will experience learning difficulties. Then between students c and d, the teacher said that student d was better in class than student c. The teacher also said that students c and e behaved almost the same. The teacher also mentioned that students d, e, f, g, h, and i needed help understanding the concept. The student's deficient scores in the multiple-choice sections and essays prove this. Of the nine students, the one who experienced a misconception in number 13 was student d. Students who experience misconception number 14 are student e, and student number 15 is student f.

According to the teacher, the students only needed to understand several concepts. Even if there were misconceptions, the number was also small. It is also to the data that the researchers described. So there are still misconceptions experienced by elementary school students about plant adaptation and propagation material even though the distribution is small. 19% misconception on vegetative plant propagation material, 13% generative plant propagation material, and 2% plant adaptation material.

Discussion

From the research results presented, there are still things that need to be clarified about the adaptation and reproduction of plants in elementary schools. The misconceptions experienced by students from highest to lowest fall on the material of vegetative, generative, and plant adaptation plant propagation. There are indeed many types of plant propagation material, to what was described in the introduction

(Metayanti et al., 2022; Salmah, 2019). That is what causes this material to have the highest misconception. Misconceptions have many causes. It can be caused by books, classes, student learning methods, and educators (Desstya, Prasetyo, Suyanta, Susila, & Irwanto, 2019; Ferguson et al., 2022).

The distribution of science misconceptions is still found in elementary schools (Fajriyanti & Sayekti, 2022; Permadani, Aini, & Thohir, 2022). Even though the material is different, several experts researched to discover misconceptions in elementary schools (Munastiwi, Saputro, Fatonah, & Suhendro, 2022; Permadani et al., 2022). Differences in methods, types of research, instruments used, and the results of the subjects are still to determine whether there are misconceptions in elementary school. The same goals and methods, of course, the misconceptions will be different if the subjects, instruments, and research sites are different (Fajriyanti & Sayekti, 2022; Setyaputri & Destya, 2022). If this research is generalized to identify misconceptions in Indonesia, it cannot. This research was only conducted in two elementary schools and was only sufficient to determine the distribution of misconceptions in the two elementary schools.

The existence of students who were absent when the researcher conducted the test with questions was a limitation in this study. This research has advantages in the instruments used. This study conducted in-depth interviews with teachers regarding the misconceptions experienced by their students. In addition, the researcher also presented the percentage of correct answers to multiple-choice questions. It can be used as an initial reference for determining whether there are misconceptions in elementary school. It is also because misconceptions are closely related to learning outcomes (Noviliani, Sitompul, & Hamdani, 2022). Where the learning outcomes in this study can be shown by the correct percentage of imperfect multiple-choice questions, and it is proven that there are misconceptions. The widespread misunderstanding of basic concepts that disrupts students' knowledge of certain ideas is one of the reasons why students need better learning outcomes (Irani et al., 2020). The students' low scores proved this in multiple-choice, and some needed clarification. Another advantage lies in the selection of elementary schools used. Where one of the elementary schools is a driving school, it is done because Indonesia's driving school distribution is less than 100%.

The contribution of this study is to show that there still needs to be more natural science material for plant propagation and adaptation in elementary schools. As a result, the teacher must think of ways to overcome misconceptions. One of them is avoiding techniques and applications that convey material conceptually or instruct students to remember, which is very important when teaching science (Gul, 2021). In making teaching materials, misconceptions can be eliminated based on metacognitive abilities (Nasrudin & Azizah, 2020). A well-known theory in cognitive psychology called metacognition is largely concentrated on how people think dynamically (Marantika, 2021). Utilization of e-module teaching resources based on themes, student worksheets, and learning models is a choice for overcoming misconceptions (Damayanti, Sarwi, & Astuti, 2018; Yenita, Syuhendri, & Siahaan, 2022). Another way is to improve students' critical thinking skills (Maison et al., 2022). One of the skills seen as essential for student learning in the twenty-first century is critical thinking, which relates to stakeholders and is employed in ordinary family life (Ramadani, Susilo, Suhadi, & Sueb., 2018). Several previous studies have shown that it is important to analyze student misconceptions to minimize misconceptions about learning material (Hasanti & Zulyusri, 2022; Setyaputri & Destya, 2022). Other studies have shown that the causative factor for misconceptions is the lack of students' interest in learning science (Heryandi & Nur'aini., 2022; Islami, Munawaroh, Hadi, & Wulandari, 2018).

A three- or four-tier test should be used for further research on the multiple-choice instrument. It was done so that the multiple-choice questions could better identify misconceptions. The three-tier test is enough to identify misconceptions, but the four-tier test is much better. However, this four-tier test has several drawbacks, such as requiring quite a long time for the testing process and being quite difficult to use in achievement tests; In addition, the possibility of students' answer choices at the first level can affect responses to questions at the next level (Soeharto, Csapó, Sarimanah, Dewi, & Sabri, 2019).

4. CONCLUSION

From the facts and analysis of the results and discussion, it can be concluded that sixth-grade elementary school students need clarification about plant adaptation and reproduction. It has answered the purpose of this research.

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