

Identification of Misconceptions in the Material of the Origin of Life in terms of Student Learning Outcomes

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DOI: [10.29303/jppipa.v8i3.1651](https://doi.org/10.29303/jppipa.v8i3.1651)

Article Info

Received: May 17, 2022

Revised: July 3, 2022

Accepted: July 20, 2022

Published: July 31, 2022

Abstract: Madrasah Aliyah as an Islamic-based school is assumed to be influenced by polemics between clergy and scientists about evolutionary material, especially in the theory of the origin of life. Often teachers try to relate the material about the origin of life to the study of the Qur'an and hadith, but students still experience difficulties and errors in understanding concepts. This raises the curiosity of researchers to find out how big the percentage of misconceptions experienced by students on the origin of life material and what factors influence it. This study uses a qualitative method with purposive sampling technique. Based on the identification results, it was found that in the material origin of life there were still misconceptions in the sub material of Abiogenesis theory with a percentage of 47.00%, Biogenesis theory with a percentage of 41.00%, and Cosmozoa Theory with 35.00%. Some of the factors that influence it come from students, teachers and the teaching materials used.

Keywords: Misconceptions; Theory of the origin of life; Learning outcomes

Citation: Abdila, A. N., & Khairuna, K. (2022). Identification of Misconceptions in the Material of the Origin of Life in terms of Student Learning Outcomes. *Jurnal Penelitian Pendidikan IPA*, 8(3), 1350–1354. <https://doi.org/10.29303/jppipa.v8i3.1651>

Introduction

Understanding the concept of biology is one of the important things in the study of biology which has the aim of providing understanding, so that it not only teaches students to study, but also must be able to understand (Leadbeater, 2014). Understanding the concept of biology is also one of the learning objectives given by the teacher because the teacher acts as a student tutor during learning in order to achieve the expected learning concept (Satar et al., 2016). To understand a study, one must be able to distinguish one from another (Nurkamilah & Afriansyah, 2021), one event from another (Qurrota & Nuswowati, 2018). In addition, the concept explained must be the correct concept, in the sense that there are no misconceptions (Irwansyah et al., 2018).

Entering the education level at the school level, students gain prior knowledge from experiences and different sources of information, so that the accuracy

obtained is lower. Which results in the knowledge possessed by students can be real or false (Sutrisno, 2019). Even when knowledge is acquired in school, it will be influenced by the previous knowledge of some people who have had this experience (Araújo, 2022). Conceptual errors at the beginning of learning will have a major effect on understanding the concept of the next material, because they will be interconnected (Puspitasari et al., 2019).

Misconceptions are erroneous opinions or views about a concept that is understood by someone (Maison et al., 2020) that is not in accordance with the agreed concept and is considered correct by experts (Suwono et al., 2021), often having different opinions. Usually, misconceptions are resistant and tend to persist because this view is difficult to change (Irani et al., 2020).

Biological material is basically a very broad, complex, and specific science (Dikmenli, 2010). However, this biological material can be abstract because the processes and mechanisms cannot be seen

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with the naked eye (Jago Duda et al., 2020). So that this incident also provides an opportunity for misconceptions about the material origin of life. In this case, students' original ideas may not match the views expressed by experts in their fields.

Differences of opinion about the concept of the origin of life can cause some teachers to experience complications in teaching. For example, the concept of Darwin's theory of evolution is still polemic until now. This is because the concept of evolution is considered contradictory to religious beliefs and teachings, especially the concept of the theory of the origin of life. Religious scholars, such as Harun Yahya openly oppose Darwin's theory of evolution and claim that evolution is only a theory. This opinion is explained by the fact that no real evidence has been found that supports the origins of life (Saputra, 2017).

Madrasah Aliyah as an Islamic-based school is assumed to be influenced by polemics between religious scholars and scientists about evolutionary material, especially in the theory of the origin of life (Fajriana et al., 2017). The interesting thing is that the results of initial observations made with biology teachers at MAN 3 Langkat stated that the students' process on the origin of life material took quite a long time, this was because the students themselves were still confused to digest the material.

Often teachers try to relate the material about the origin of life to the study of the Qur'an and hadith, but students still experience difficulties and errors in understanding concepts. This raises the curiosity of researchers to find out how big the percentage of misconceptions experienced by students on the origin of life material. In addition, this study also intends to find out what factors cause misconceptions in the origin of life material so that improvements can be made and treatment according to the identified misconceptions, so that similar problems in the next time can be avoided.

Method

This study uses a qualitative method. The technique used to take samples in this study is a purposive sampling technique, which is a sampling technique with certain considerations (Darmalaksana, 2020). The purposive sampling technique was used because the researcher had a target sample with characteristics that matched the research (Hammersley, 1990).

In this case, the authors took samples based on observations of the students' scores. The sample used is

a class that has an average value lower than other classes. In this study, a sample of 60 students consisted of two classes, namely class XII IPA 2 and XII IPA 3 at MAN 3 Langkat.

The data collection technique used in this research is using multiple choice objective tests which are equipped with the CRI method, in-depth interviews, and observation of learning activities. The CRI (Certainty of Response Index) method is a method introduced by Saleem Hasan, Diola Bagayoko, and Ella L. Kelley to measure current misconceptions (Muna, 2016). With the CRI method, respondents are asked to provide a level of certainty about their abilities by associating this level of trust with knowledge, concepts, or laws (Ritchie, 2001). This CRI method asks respondents to indicate the degree or scale (level) of confidence in answering questions (Wilson, 1997). So, this method can describe students' beliefs about the truth of the alternative answers they respond to (Irani et al., 2020).

Result and Discussion

Results of Observation of Learning Process and Interview of Biology Subject Teachers

The subject that becomes the benchmark in this study is the misconceptions that occur among students. Therefore, one of the techniques used in this research process is the observation of the learning process in the classroom. After conducting observations accompanied by interviews with biology subject teachers, it was found that when the learning process took place on the origins of life material, the teacher still implemented an online learning system.

This is due to the limited time of learning that takes place in face-to-face learning, besides that it is not uncommon for teachers to only apply lecture and discussion learning methods. The learning media that support the learning process of the subject of the origin of life include the 2013 Curriculum Biology Textbook, Power Point, and simple practicum.

Description of Student Percentage Based on Answers and CRI Index

Based on the results of the objective test data as many as 60 questions using the CRI method, Figure 1 proves that there are still many students who experience misconceptions. The following is a tabulation of data for students who have misconceptions, understand concepts, and do not understand concepts.

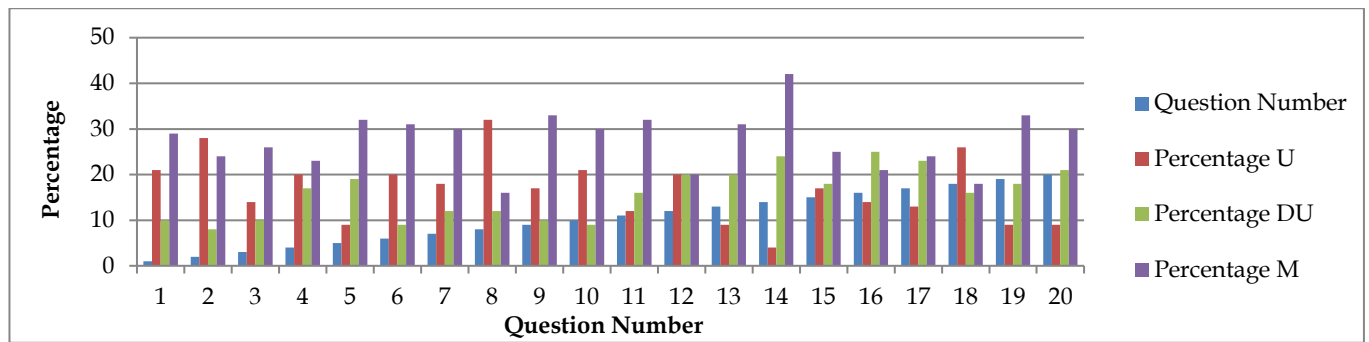


Figure 1. Diagram of the percentage of students who experience misconceptions, understand concepts, and do not understand concepts.

From the picture, it can be seen that some of the number of questions have a percentage with the number of students experiencing misconceptions very much compared to those who know the concept and do not know the concept. Some of the number questions are 5, 9, 11, 14, 19, 20.

Students who experience misconceptions or do not understand the concept can be distinguished by seeing whether the answer to a question is correct or not and seeing the high or low answer certainty index (CRI) that students provide so as to produce student percentage data based on answers and index (CRI) in the understanding category, misconceptions, do not understand the concept (Putri & Hindrasti, 2020).

The data from the results of the analysis is then used to obtain interview data for further deepening of the student's concept mastery, to find out the items that are misconceived by students and not understood by students (Agustina et al., 2016).

The percentage of students who understand concepts, misconceptions, and do not understand the concept of each item tested shows that of the 20 questions there are still many students who misconceived and not a few students understand, while students who do not understand the concept are few in

number. Table 1 shows the dominant questions for understanding concepts, not understanding concepts, and misconceptions.

Table 1. Group of Understanding Concepts, do not Understand Concepts, and Misconceptions

Category	Question Number
Understand Concept	2, 8, 18
Misconception	5, 9, 11, 14, 19, 20
Don't Understand the Concept	1, 3, 4, 6, 7, 10, 13, 15, 16, 17
Neutral	12

Misconception Factors on the Origin of Life that Occur in Students

Interviews were conducted on several students who had dominant misconceptions. Students who experience a lot of misconceptions are taken 6.00% of all students, namely 10 people. The type of interview used is a guided free interview. Based on the results of the in-depth interviews, 6 questions were identified that students misconceived in understanding the animal world material, namely numbers 5, 9, 11, 14, 19 and 20 which are tabulated in Table 2.

Table 2. Misconceptions and Reasons for Their Occurrence in Students

Basic competencies	Question Number	Misconception	Reason
3.9 Explain the theory, principles, and mechanisms of evolution as well as the current views of experts on speciation.	5	Identify experimental results that support the theory of the origin of life	Students reveal that the emergence of life is only possible if there has been a previous life.
	9	Investigate early signs of evolution.	Students revealed that the origin of the signs of evolution began with the theory that humans came from apes.
	11	Analyzing elements related to the theory of the origin of life	Students reveal that carbon dioxide is a gas that was not present in the early Earth's atmosphere.
	14	Estimating characters who express opinions about the origin of life	Students reveal that the theory of spontaneous generation is a theory about the origin of life which states that life on planet earth comes from the universe
	19	Adjusting the experimental results with the theory put forward	Students misinterpret a picture of Spallanzani's experiment.
	20	Demonstrate theories related to the origin of life	Students make a mistake in determining who the character is related to one of the experimental pictures displayed

The causes of misconceptions were identified based on the students' written answer choices and continued with interviews. Based on the data analysis as shown in Table 2, it is shown that the misconceptions are caused by the students' own thinking.

This is in line with the research of Duda et al, (2020) in their research on Identifying the Misconceptions of Biology Education Students on Animal Biotechnology Concepts revealed that the high level of misconceptions caused by students' thinking is in accordance with constructivist theory, where in the learning process students build their own concepts that are being studied. An understanding that is in accordance with the conceptions of experts will cause students to understand the concept well, while an understanding that is not in accordance with the conceptions of experts will cause misconceptions (Maison et al., 2012). Factors that cause misconceptions from teachers are still closely related to students' ability to build concepts, often students understand differently about what is being explained by the teacher.

Conclusion

Based on the research that researchers have done, it can be concluded that misconceptions are still found in two sub materials of the origin of life, namely the Abiogenesis Theory with a percentage of 47.00%, Biogenesis Theory with a percentage of 41.00% and Cosmozoa Theory with 35.00%. Based on the reasons for the students in the interviews, the misconceptions were caused by several factors including, students understanding incomplete concepts and connecting one concept to another based on partial understanding so students made the wrong summary. The causes of misconceptions experienced by students, apart from the students themselves are also caused by teachers and teaching materials used during learning activities.

Acknowledgments

The author thanks to his parents, loved ones, and mentors who have supported and guided the author so that this article can be completed. Thank you also to various parties who have helped provide input and suggestions, it is hoped that this article can be useful in the future.

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