

A LITERATURE STUDY: MISCONCEPTIONS OF BIOLOGY MATERIALS IN HIGH SCHOOL IN JAMBI CITY

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Abstract

The purpose of learning in high school is to achieve student understanding of the concept of learning, because it is the basis for formulating biological principles. Biological material is known for its broad and abstract material coverage because it contains concepts about life, so that new difficulties are experienced by students in understanding the material. This situation can lead to misconceptions in students, namely errors in interpreting the concept of biological material. Class XI biology material consists of cell material, plant tissue structure and function, animal tissue structure and function, locomotion system, and circulation system. This material is discussed in more depth in class XI by closing the possibility that misconceptions in students can affect student learning processes and outcomes, so it is necessary to know the causes of misconceptions in students so that an action can be taken to overcome or reduce misconceptions in students. This study aims to determine the causes of high school students' misconceptions on biology material for class XI Semester 1. The method used in this research is library research by examining the results of the analysis of the causes of students' misconceptions from various literatures. The results obtained are the occurrence of misconceptions in students caused by the student's own factor, the teacher's teaching factor, the student and teacher handbooks, the learning method used.

Keywords: Study : Misconceptions ; Biological Materials

INTRODUCTION

In general, the learning objectives at the high school level and equivalent are the achievement of students' conceptual understanding of the concepts of the subject matter. Concept understanding is the ability of students to understand the concepts of subject matter and be able to apply them in their daily lives (Astuti et al., 2018). Especially in the subject of biology which is considered a science that seeks to describe and explain the laws of nature and events in nature with a picture according to human thought. Septiana, Zulfiani, & Noor (2015) explain that biology is one part of science that has a fairly broad scope because it contains concepts about life.

The tendency of students in biology learning to read biology material is low (Hikmawati & Taufik, 2017). According to Best & Ogzur (2005) this is due to

the existence of abstract concepts in scientific texts on biological material, which makes it difficult for students to understand the contents of the text. Meanwhile, to understand biological material, it is necessary to read the text well and in an organized manner so that the terms and concepts contained in the material can be understood properly.

Students' strong understanding of concepts allows them to develop and understand higher concepts (Ramadhani et al., 2016). The concept itself can be interpreted as objects, events, situations or characteristics that are unique and represented in every culture by an object or symbol. The reality that occurs, in the process of learning biology in class, it is often found that students do not understand the concept of biology in depth. This is because the understanding of concepts built by students is different from the concepts put forward by experts, giving rise to conceptual errors (misconceptions).

Students' misconceptions can affect the teaching and learning process in the classroom. This is in accordance with the opinion of explaining that whatever the form of the misconception and no matter how small the percentage, the misconception will have a bad impact on students. However, based on research by Utami, Agung, & Bahriah (2017), it is explained that students who experience misconceptions sometimes do not realize that they are experiencing misconceptions because these students believe that their concepts are correct.

Many misconceptions arise not only during the learning process, but before the teaching and learning process begins (Handoko & Sipahutar, 2016). Misconceptions can occur in students, namely in the initial concepts that have been brought by students before they enter the learning process. When students are faced with the learning process at school, it will have a big effect on students' thinking. Students will have difficulty understanding and connecting the concepts in the newly studied material with the concepts they already have. The existence of misconceptions in students can prevent students from mastering more deeply about biological material, because it will hinder the process of accepting and integrating new knowledge about a concept in students' thinking.

Research on this misconception has been widely carried out in various fields, both in science, especially in biological material. Several research results show the occurrence of misconceptions in a number of topics (concepts) of biology learning. These concepts are the concept of the circulatory system in humans and plants; The concept of Archaeobacteria and Eubacteria; Enzyme Concept (Puspitasari & Yuliani, 2020); and the concept of the Human Reproductive System (Ramadhani et al., 2016).

The biology material for class XI semester 1 consists of 5 topics, namely, Cells, Structure and Function of Plant Tissues, Structure and Functions of Animal Tissues, Movement Systems, and Circulation Systems. These five subjects include material that has many concepts because it has many texts and terms. In class XI the subject matter is discussed in more depth than the previous grade level, and in this case students' understanding of a concept must be in accordance with the actual concept.

Based on initial observations at SMA N 5 Jambi City and SMA N 12 Jambi City, from interviews with biology teachers who teach in class XI in the first semester, it is explained that misconceptions occur in students, especially the concepts of Diffusion and Osmosis. This is caused by the lack of motivation and desire to learn students in reading biology books, seeking information from various sources regarding the material to be or has been studied. Another factor is the existence of sentences and terms that are different between those conveyed by the teacher and those in the book; between sentences and terms in one book with another book or with other learning resources that students read.

This statement is reinforced by the results of testing on biology questions regarding cell material, plant tissue structure and function, animal tissue structure and function, locomotor systems, and circulation systems with a total of 30 students at SMA N 5 Jambi City and 32 students at SMA N 12 Jambi City. . Overall, the data from the trial show that misconceptions occur in every given question. For students of SMA 5 N Jambi City, of the 50 questions given there are 3 questions in which students experience the most misconceptions, namely 81.3% in the motion system material, namely the concept of bone tissue; 75% on the cell material, the concept of membrane permeability ; 71.9% in plant tissue material. Meanwhile, for students at SMA 12 N Jambi City, of the 50 questions given, there are 2 questions in which students experience the highest misconceptions. Students have misconceptions on cell material, namely the concept of miosis by 76.7%, and the concept of membrane permeability by 66.7%.

Based on the background described above, the researcher wants to conduct a study on the causes of misconceptions in biology material for class XI semester I students in high school to find out the causes of misconceptions that occur in students in class XI semester I biology material so that improvements can be made and appropriate treatment to avoid misconception.

RESEARCH METHODS

This research is a type of research in the form of library research. Literature study is a series of activities to collect, read, and process information and data obtained from various materials such as books, documents, thesis/thesis, internet as research material (Zed, 2010). According to (Hamzah, 2020), this library research is a qualitative research, works at the analytical level and is perspective emic, that is, obtaining data is not based on the researcher's perception, but based on conceptual facts and theoretical facts.

Qualitative research is research that focuses its attention on the general principles that are fundamental to the manifestation of existing phenomena in human social life. Descriptive research is a research that assesses and reveals problems regarding what they are in accordance with the reality on the ground (Fuad & Nugroho, 2014). Sources of data used in this study are data related to

misconceptions and the causes of misconceptions that occur in students, namely secondary data such as articles and proceedings of seminars and theses.

The data collection technique used in this research is documentation technique. Arikunto (2010) explained that research using the documentation method is looking for data about things or variables in the form of notes, books, papers or articles, journals, and so on. In this study, data collection was carried out with documentation, namely by searching, reading, and collecting data related to the causes of misconceptions in students.

Data collection in this study was carried out in several steps, namely looking for information that supports the topic by searching for thesis in the Jambi University library and searching on the Internet via Google Scholar with the keyword "Students' misconceptions on biology material for Class XI High School". on the internet through Google Scholar regarding "The Causes of Student Misconceptions", collecting reading materials in the form of research journals, seminar proceedings, and thesis on "The Causes of Student Misconceptions", reading and making research notes, reviewing and enriching reading materials, and finally classifying reading materials and start writing research results

Data analysis is the process of arranging the sequence of data, organizing it into a pattern, category, and basic unit of description (Wandi et al., 2013). In this study, the data analysis technique was carried out by selecting, focusing, simplifying or summarizing the data so that it was easy to understand and interpret objectively and logically. This stage is often referred to as data reduction; Presentation of data, which is done by classifying data by writing organized data so that it is possible to draw conclusions from the data; Conclusion Drawing, is making conclusions that are the core of the findings based on the results of data analysis on the data that has been collected (Hamzah, 2020)

RESULTS AND DISCUSSION

Misconceptions in students can occur because it is caused by several factors that influence it, including the students themselves, teachers, student handbooks, learning methods, and student worksheets.

1. Student Factor

The main cause of misconceptions comes from the students themselves. This can be caused by preconceptions or initial concepts that students have before participating in learning, lack of ability or low IQ of students, incomplete reasoning or student reasoning, and lack of motivation and interest in student learning.

a) Students' Preconceptions or Initial Concepts



Preconception or initial concept is a concept that has been embedded in the mindset of students before entering the school environment and learning in the classroom. This initial concept can be obtained by students from their environment, both parents, playmates, and the surrounding community. One example of the initial concept that students bring from their environment is everyday language which will then be constructed by the students themselves in the development of their thinking.

Misconceptions occur in students because the initial knowledge that students have about a concept has been firmly embedded obtained from the previous education level (Nusantari, 2011). This causes the concept to conflict with the student's mind, even though it has been repeatedly explained about the concept. The student's thinking makes students believe in themselves more than the new understanding they get. This opinion is supported by Fadillah (2014) explaining that students experience misconceptions in the material of the circulatory system, namely the concept of blood components, blood clotting mechanisms, blood groups, heart, blood vessels, circulatory system, and disorders and diseases of the blood circulatory system. Misconceptions occur because students are more confident in themselves in discussing the material. Students understand a concept according to what is learned and known without any justification or acceptance of the correct concept about the material.

b) Student Ability

If a student's ability (IQ) is low, it will be difficult for him to understand a lesson concept. Lack of students' understanding of a concept because of a low IQ will cause students difficulty in constructing knowledge completely and completely. Pradina & Yuliani (2020) explained that misconceptions occur in students because of the students themselves, namely where students experience difficulties because they are less able to accept and understand the subject matter.

Students need explanations many times to be able to catch the meaning of the concepts conveyed by the teacher. This situation makes students construct their knowledge incompletely. This is supported by Rafika (2015) who explains that misconceptions occur in students in the concept of cell organelles and functions with a percentage of 17.97%. In this case, it is explained that students do not fully understand the material being taught, so students only understand part of the material. Students experienced a misconception in determining the structure of the organelle attached to the ribosome by giving a sure answer to the answer that the organelle attached to the ribosome was lysosomes, smooth endoplasmic reticulum and peroxisomes, while the correct answer was Rough Endoplasmic Reticulum.

Misconceptions also occur in the concept of cells, namely the chemical components of cells by 61.3%, cell structure and function 33.23%, organelles of plant and animal cells by 31.78%, and membrane transport mechanisms by 31.69% (Mahardika, 2014). Students experience the highest misconceptions on

questions regarding the types of unit cell functions. Students answered that they were sure that the various types of cell function were the smallest structural and functional unit and the genetic unit, on the grounds that the cell was the smallest and functional unit and played a role in heredity, namely genetics. While the real answer is that the various functions of the cell are as the smallest structural and functional unit, and the unit of heredity. The misconception that occurs is that students' understanding of the cell concept is not intact so that it is less precise in connecting the concepts.

A similar opinion was conveyed by Anwar et al, (2019:5 who explained that students' misconceptions occur in the concept of cells where students experience confusion in distinguishing between cell organelles and non-cell organelles (Mustakim et al., 2015). Students also experience misconceptions about the concept of gametogenesis, where students assume that gametogenesis only goes through meiosis, and that in fact gametogenesis takes place through two stages, namely mitosis and meiosis. This proves that students' understanding of the cell material is incomplete, so that students answer with their own understanding.

c) Student Reasoning

Limited, incorrect or erroneous reasoning about a concept can also cause misconceptions. This is because students misunderstand the meaning of a concept, it can also be because students form their own knowledge of a concept, which is different from existing concepts about a material. Istighfarin (2015) explains that there are misconceptions that occur to students, namely 1) on the concept of evaporation, where students assume that the function of the stomata on both leaf surfaces is to keep the plant surviving in a dry environment because with the stomata it will be easier for plants to grow. Plants undergo evaporation and respiration. 2) The concept of the location of the meristem tissue in plants, namely students cannot distinguish between the tip of the root and the tip of the shoot because they are located at the same end. 3) the concept of Adult Tissue, that is, students cannot distinguish between sclerenchyma and collenchyma tissue from the shape of their cells. 4) on the concept of type or form of epidermal derivatives. Based on this research, it is known that the factors that cause students' misconceptions are where students try to connect two interrelated concepts, but their reasoning on these concepts is not appropriate. This shows that students' knowledge is not complete.

Misconceptions can also be caused by a lack of information obtained by students from the teacher about a material. This can happen, for example, due to inappropriate time allocation. If a little time is used, while a lot of material is delivered, it can cause the complete material not to be delivered.

2. Student and Teacher Handbooks

Textbooks used in learning are usually updated according to curriculum changes. However, the arrangement of sentences in this textbook cannot be



separated from errors that may be made by the author of the book. Often textbooks have a writing difficulty level that is too high for students. The use of language that is too difficult and complex, differs from one book to another even though it has the same meaning, especially biology textbooks which are identical with scientific terms. This causes students to not be able to digest well what is written in the book, as a result students misunderstand the concept of the book. Students' misconceptions caused by textbooks can be caused by the analogy used in an inappropriate material, there is incomplete or incorrect material, and the use of ambiguous language and terms (Nusantari, 2011).

There is a misconception in textbooks due to the use of complex language, where the concept of the book states that "leukocytes are produced in red bone marrow (Astuti et al., 2018) and yellow bone marrow and are able to survive in the blood circulation for only 1 day before entering the tissue. Leukocytes in the tissue can last for several days to several months depending on the type of leukocyte. While the actual concept in the reference book used is to explain that leukocytes are mostly produced by bone marrow (granulocytes, monocytes, and some lymphocytes) and mostly in lymph tissue (lymphocytes). Granulocytes circulate for 4-8 hours then migrate into the tissue and live for 4-5 days. Monocytes circulate for 10-20 hours and then migrate into the tissue and turn into macrophages that live for several years. While lymphocytes are responsible for immunity which has a life span of about 1 year.

Another problem that causes misconceptions that are often found in textbooks is the quality of images that are not sharp in textbooks, the arrow lines used to show parts of an image are not clear and precise with the actual image or concept. This causes students to have difficulty recognizing the intended image and will lead to misunderstanding the concept and meaning of the image. This is evidenced by research Wijiningsih, Harjana, & Sukiya (2016) which states that misconceptions are often found in books on text analysis units on muscle tissue and images on epithelial tissue, namely providing information on images of inappropriate types of epithelium, namely images found which is described as a simple cuboidal epithelium actually has a cylindrical shape. Farihah, Pukan, & Marianti (2016) found misconceptions in students caused by textbooks, namely because of unclear images.

3. Teacher Teaching Factor

The ability to master the material by the teacher has an important role in learning activities. Chaniarosi (2014) revealed that a significant factor in the misconceptions that occur in students cannot be separated from the role of the teacher who teaches. This is because the teacher in question has a misconception about the subject matter itself. Thus it can be said that if the teacher misunderstands a learning concept and provides presentation and explanation of the wrong concept to students, then students will accept the wrong concept as well.

Misconceptions brought by teachers/teachers are often not realized, so that teachers pass down the same wrong understanding to students. Even misconceptions that occur in students caused by teachers can occur because the teacher does not provide learning to students about a material concept. Suparno (2005) states, sometimes some teachers in delivering subject matter provide very simple explanations with the real goal of making it easier for students to grasp the concept of the lesson. So sometimes in explaining incomplete or omitting some important elements that should be conveyed to students.

The misconceptions that occur in students are caused by the teacher because they only explain the learning process without being interactive with students and the explanation given is also not comprehensive because it only explains what is in the teacher and student handbooks (Ainiyah et al., 2018). Students have difficulty understanding concepts because there is no opportunity for students to ask questions about concepts they have not understood, and teachers tend to give assignments at every meeting.

4. Learning Methods Used

According to Gardner dalam Dewi & Ibrahim (2019) there are at least three factors as the main barrier to understanding for students, namely: (1) the selection of learning methods that tend to tolerate unitary ways of knowing, (2) the substance of the curriculum which tends to be decontextual, and (3) the formulation of learning objectives that are rarely oriented towards achieving deep understanding.

The use of inappropriate learning methods, the disclosure of the wrong application and the use of teaching aids, learning media that do not properly represent the concept of the material described or conveyed can lead to misconceptions. Teaching methods in learning must be adapted to the content of the text of the subject matter, so that the delivery of the concept of the lesson can be precise and complete, especially on biological material which is known to include subject matter which is dominated by text and has many terms. The learning method used in learning must also be adjusted to the time allocation used. Inappropriate learning methods can cause difficulties for students in understanding the material, this can lead to misconceptions in students student.

Septiana et al (2015) stated that a student has not been able to master a concept can be caused because the learning material is not conveyed properly, then allows students to try to understand the concept themselves through books or other references that allow misconceptions to occur. Suparno (2005) explains that teaching methods that only use one intelligence, for example the lecture method and problem solving that emphasize mathematical-logical and linguistic intelligence only, will be difficult to catch by students who do not excel in their intelligence in that field.

Learning by using the lecture method, the teacher is more dominant in telling stories and explain the subject matter or teacher-centered learning,

without any confirmation from the teacher regarding students' understanding of the concepts being studied. Thus, students' focus will be split between listening and writing (Khairaty et al., 2018). Students also tend not to review what they have written. Puspitasari & Yuliani (2020) explained that the lecture method if it is always used and for too long it will be boring. Given the lecture there are many aspects that are less favorable. The disadvantage of the lecture method is that the learning process is dominated by the teacher while students are passive and tend to memorize all the properties of the subject matter as facts and the subject matter can only be remembered temporarily so that it does not help students organize the material in their memory for a long period of time and in turn will reduce creativity (Adilah, 2017).

Another learning method is by way of discussion without supervision from the teacher, the teacher is passive and does not direct students so that it does not clarify students' understanding of the material being studied, and does not justify wrong concepts that students have which can cause misconceptions in students. Yuliati (2017) found that there were misconceptions in students because the learning method only used presentations. Students are asked to make presentations, without any explanation at the beginning of learning about the material. Students read and study material from the textbooks used and understand by themselves the concepts in the material.

The implementation of practicum is also very important in learning, especially biology because a lot of material is about a process so it needs to be practiced to understand the concept more clearly. the failure to carry out the practicum has a major influence on the students' conceptual knowledge which should be obtained in full through the practicum. This is in accordance with the opinion of Sundari, S., Yuliani, Bashri (2018) which explains the students' misconceptions about the material on the structure and function of plant tissues caused by not carrying out practicals in the classroom. This makes students not know the concept as a whole because they only know plant tissue through pictures, not directly.

5. Student Worksheet

Student Worksheets LKS and LKPD are one of the factors that cause misconceptions. Usually this worksheet is used by teachers as assignments for students. This worksheet contains a brief summary of a subject matter. However, there are also those who only use LKS or LKPD as a reference for student learning. This causes misconceptions in students because the information contained in the biology material in the worksheet is incomplete. Thus, students have difficulty in understanding, understanding and analyzing the explanations in the LKS. Students' misconceptions caused by LKS are explained by Fadillah, (2014) here students experience 21% misconceptions on biology material on the concept of the circulatory system.

The existence of misconceptions can also be caused by LKPD (Meydiasari & Soejoto, 2017). From the results of the interview, it was found that external

factors as the cause of misconceptions were caused by an understanding of the applicable curriculum, which was understood as learning that required students to be active in constructing their own knowledge, so that teachers seemed to teach in a simple way and provide opportunities for students to learn on their own through the Student Worksheet. Educate (LKPD).

CONCLUSION

Based on the results of a study on the causes of high school students' misconceptions on biology material for class XI semester I, it can be concluded that the cause of students' misconceptions is the students themselves, which specifically includes students' preconceptions or initial conceptions, lack of student abilities and reasoning or students' reasoning regarding the subject matter; Textbooks (language used and pictures); Teacher factors (teachers who experience misconceptions and teachers who do not deliver the material completely); Student worksheet ; Teaching method (only using lecture and discussion methods, no practicum).

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