

IDENTIFICATION OF MISCONCEPTION IN NERVOUS SYSTEM SUBMATERIAL USING THREE-TIER MULTIPLE CHOICE DIAGNOSTIC TEST

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Abstract

The nervous system is a part of biology lesson contain various physiological mechanisms that allow students misconceptions. The purpose of this research was describing student's misconception profile and the cause of misconception using three-tier multiple choice diagnostic test. The type of the research was descriptive research with quantitative analysis. The research subjects were 60 students of XI IPA 1, IPA 2, and IPA 3 of SMA Negeri 16, biology teacher, and the learning material. Three-tier test was used for analysing student misconceptions of nervous system materials. The results of the research showed that the students' misconception profile was 41.14% on the eight topics of the nervous system submaterial with the highest misconception on the topic of neuron types and the function was 47.50%. Misconceptions were caused by the students, teacher, learning book, context, and learning method.

Keywords : misconception, three-tier test, nervous system.

INTRODUCTION

Concepts are the foundation to develop knowledge and solve problems. Each concept has different interpretation in each individual who understands it. The interpretation of a concept is called conception. Student self-conception will influence awareness of concepts. It concept is not in accordance with the definition or concept agreed by the experts, then it is called as misconception (Ibrahim, 2012). Misconceptions presented by a student can come from variety of sources, including students, teachers, textbooks, and teaching methods. Misconceptions can be experienced by all students in elementary, junior high school, senior high school, until college students in all lessons.

One of the topics of biology lesson that contains complex material, many physiological processes and relatively huge number concepts is Nervous System. The Matter of Nervous System in Curriculum 2013 is in Basic Competence 3.10 : Analyzing the relationship between the structure of the tissue constructings organs in the coordination system and link it to the coordination process to explain the role of nerves, hormones, and sensory organs devices in coordination and regulatory mechanisms and functional disturbances that may occur in the humans coordination system through literature studies, observations, experiments, and

simulations. The material of the nervous system is only discussed shortly because the nervous system is included in the submaterial of the coordination system. This will result on the limitation of student's understanding and make them prone to misconception (Saputri, 2015).

Misconceptions have to be identify, so the teacher can determine the steps to overcome these misconceptions. Tools that can be used to identify misconceptions are concept maps, interviews, and multiple-choice tests (Kirbulut and Omer, 2014). Test of three-tier types are more effectively used to detect students with misconceptions and lack of knowledge. Three-tier tests can be used to determine the profiles of student misconceptions and misconceptions that identified. This test consists of three levels in one question. The first level is a matter of multiple choice and the answer option. The second level is the reason the student chose the answer option at the first level, and the third level is an affirmation question about students' confidence on answering level one and level two (Schaffer, 2013, Astari, 2012).

Based on the description, it is necessary to know the profile of misconception and the cause of student misconception on Nervous System submaterial. The purposes of this study are to

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describe the profile of student misconceptions and the cause of student misconceptions.

METHODS

This research used descriptive method with quantitative approach. This research consisted of three stages, namely preparation phase by interviewing teachers and clarification on the students, the implementation stage was the preparation of questions and test questions on the students, and the final stage of the analysis of student answers. The research was conducted in November 2017 - March 2018. The subject of this research are students of class XI IPA 1, IPA 2, and IPA 3 Senior High School 16 Surabaya, biology lesson teachers, and textbooks. Three-tier tests are used to describe the misconception profiles and the causes of student misconceptions in the submaterial nervous system.

Technique of data analysis category of student concept understanding, can be seen in Table 1 as follows.

Table 1. The Category of Student Concept Understanding

No	Student's Answer Pattern	Level of Understanding
	One Tier – Two Tier – Three Tier	
1	True – True - Sure	Understand
2	True – True - Not Sure	LessUnderstand
3	True - False -Sure	Misconception
4	True – False - Not Sure	Guessing
5	False –True - Sure	Misconception
6	False – True - Not Sure	Guessing
7	False – False - Sure	Misconception
8	False – False - Not Sure	Not Understand

Source : Adapted from Suhendi (2014)

The student answer percentage known by using this formula.

$$PJ = \frac{n_x}{N_s} \cdot 100\%$$

Information:

PJ = percentage of student answers on each item
nx =the number of students categorized as Understand , less understand, not understand concept, guessing, and misconception
Ns = total number of students

The categories of student misconception rates are categorized according to Table 2.

Table 2. Misconceptions Level Category

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Percentage (%)	Category
0-30	Low
31-60	Medium
61-100	High

Source: Adapted from Arikunto (2013)

RESULTS AND DISCUSSION

The results of the research were the percentage of student misconception in nervous system submaterial, and factors of misconception. The percentage of students' understanding categories nervous system submaterial can be seen in Figure 1.

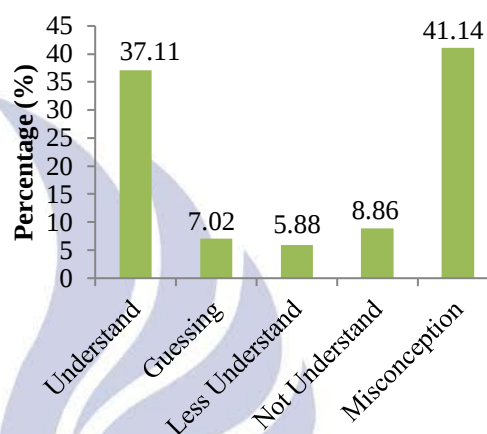


Figure 1. The Percentage of Student's Concept Understanding Category

Based on Figure 1, it can be seen that the percentage of students that understand the concept was 37.11%, then 7.02% of students guessed, 8.86% did not understand the concept, 5.88% less understood concept, and 41.14% of students experiencing misconceptions. Students experiencing misconceptions can be analyzed for their misconceptions rate. This can be seen in Figure 2.

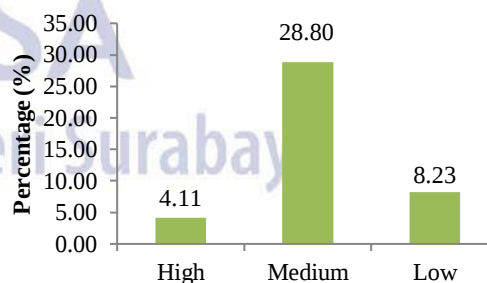


Figure 2. Misconceptions Level Category

The students' misconception level based on the figure was 4.11% including high misconception, 28.30% of students was medium, and 8.23% of student misconception was low.

Misconceptions also occur on eight topics in nervous system submaterial. The percentage of misconception from the higher to the lower were on the topic of types of neurons and their function were 47.5%, the mechanism of conscious movement and reflex motion were 45.8%, the mechanism of impulse delivery were 44.44 %, nervous system disorders equal to 41.67, peripheral nervous system equal to 40.83%, structure of nerve system compiler network equal to 38.33%, central nervous system 37.22%, then sympathetic and parasympathetic nervous system topic equal to 36.67% . It can be seen in Figure 3 below.

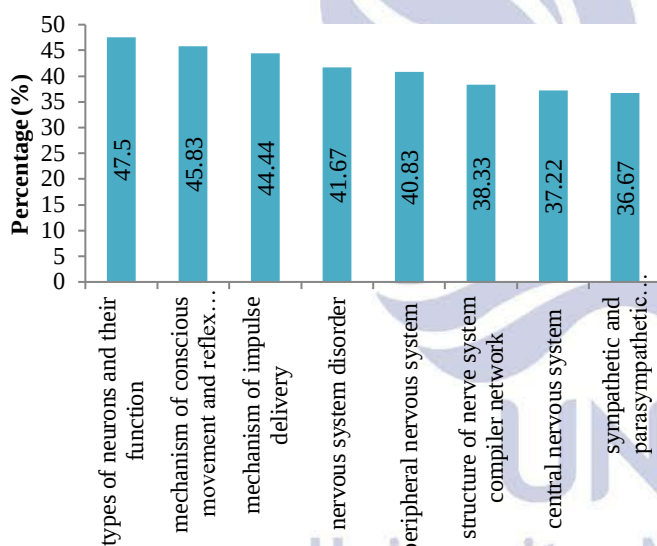


Figure 3. Misconception in Each Topics.

Misconceptions factors in students can be known by conducting direct interviews with biology teachers and students, analyzing textbooks used, and giving the same problem to biology teachers. The result of the interview showed that misconception was caused by the limitations of information held by the students, the students have not mastered the concept, the learning source of the students, and the teaching method of the teacher. The result of identification can be seen in Table 3 .

Table 3. Misconceptions Factor

No.	Causative Factor	Respons
1	Preconception	Information obtained by students without limitation, so that students have not been able to inferred the information comes from

No.	Causative Factor	Respons
		reliable sources or not.
2	Student not mastering the concept	Students have not mastered the concept on the nervous system submaterial, especially distinguish the structure and explain the physiological mechanism.
3	Learning resources	Learning resources are book of Class XI Biology Erlangga publisher, LKS Viva Pakarindo, and internet. No misconceptions, but the explanation was incomplete
4	Teacher methods	There were some materials explained incomplete by the teacher, because students asked to read themselves like a nervous system disorder. Another topics described briefly

Students misconception category were 41.14% because students could not comprehend the concepts in nervous system submaterial. It can be known because there were misconceptions on any material topic with the highest misconception percentage on the topic of neuron types and their function is 47.50%. Students answer correctly on the first tier, the student known that the neuron was unipolar form, but in the second tier, the student misquotes the function so it responds that the function of unipolar form neurons was motoric. Sherwood (2010) mentioned that the shape of sensory neurons is unipolar and serves in delivering impulses from receptors to the central nervous system. Unipolar neurons do not have dendrites and have only one axon. In the third tier, students reply sure, so students are categorized as misconceptions.

Misconceptions can caused by student itself, the source of learning used, and teaching methods used by teacher. Misconceptions in the student itself usually influenced by the preconceptions carried over until the student receives the material, so when explaining a concept, the student still uses his own version of reprehension that sometimes does not fit with the correct concept and arises misconceptions (Millencovic, et al., 2016). Students also lack understand of the nervous system submaterial, thus disrupting the acceptance of the next concept. Students are often unaware that they are

misconceiving, so when they were told that the students' concepts were wrong, students will face difficulties to improve their initial concept, especially if it has been going on for quite a long time (Tekkaya, 2002).

Misconceptions also can be caused by teachers. Based on the results of tests, showed that teachers have misconceptions on the topic of nerve system compiler structure, types of neurons and their functions, and mechanisms of impulse delivery. Based on interviews, teachers are more likely to use lecture-assisted methods with powerpoint presentations (PPT), only explaining important material, and there are some materials that students learn by reading. The teacher sometimes understands the concept, but when gave the explanation in very simple way and expected students understood easily, but some important points finally missed and the students mistakenly took the material core resulting in misconception (Suparno, 2013). Ibrahim (2012) stated teachers can experience mistakes, not mastering the concept or using the method of teaching that is not appropriate so that misconception occurs in students.

Another cause of misconception was the use of incomplete books. Although textbooks used by students and teachers have no misconceptions, but incomplete book descriptions caused the student lack of knowledge, then the use of difficult language or terms can also make it difficult for students to understand a material (Nusantari, 2014).

Misconceptions have to be reduced immediately so it would not affect the process of assimilating knowledge and the results of student's learning. How to deal with misconceptions can be done by changing the teaching method of the teacher. How to overcome misconceptions if students have trouble knowing the structure and function of the nervous system, Bridging Analogy can be done (connecting analogy). Bridging Analogy is teaching a concept through simple analogy with events that exist in the environment and easily understood by students (Suparno, 2005). In addition to these methods, misconceptions can be addressed by explaining the material by optimizing the existing learning media, using images or animations that more interesting so that students can easily understand the material (Utami, 2011). Currently there has been a lot of animation about the physiology of the nervous system, so even though the physiological processes in the nervous system are hard to observe directly, it can be learned using the animation.

CONCLUSION

Student misconceptions in nervous system submaterial amounted to 41.14% and occurred on eight topics with the highest percentage on the topic of types of neurons and their function of 47.50%. Misconception is caused by the influence of teachers, students, teaching methods, and learning resources.

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