



## The Identification of Student Misconceptions on the Concept of Electricity Using the CRI Decision Matrix Three Level Test

Muhammad Azzarkasyi<sup>1\*</sup>, Syamsul Rizal<sup>2</sup>, Kasmawati<sup>3</sup>

<sup>1,2</sup> Department of Physics Education, Universitas Serambi Mekkah, Banda Aceh - Indonesia

<sup>3</sup> Madrasah Aliyah Negeri 1, Aceh Tamiang, Aceh – Indonesia

\*Corresponding email: [azzarkasyi@gmail.com](mailto:azzarkasyi@gmail.com)

### ABSTRACT

The purpose of this study is to determine the percentage of students who experience misconceptions (MIS), know the concept (KCC), do not know the concept (LK), Guess (LG), and not confidence (NC) in learning electricity concepts; in what subconcepts students experience misconceptions and what causes misconceptions. The object of the research was the first-level D-III students of Radiology Engineering in the first semester of the 2016/2017 school year who contracted the Basic Physics course. The method used is descriptive method. In this study the CRI Three-Tier Test decision matrix is used to identify student misconceptions. To find out the cause of the misconception conducted interviews. The results of CRI diagnostic data analysis showed that of the 37 students who were the object of research it was found that as many as 26.35% did not know the concept (LK), 20.95% knew the concept (KCC) where the students were in accordance with scientific conceptions, 0.51% students guessed LG), 40.88% of students experienced misconceptions (Mis), and 11.32% of answers to students who were not confident (NC). The highest percentage of misconception was found in the sub-principle of ohm's legal concept (41.08%), kirchhoff's legal sub-concept (41.89%) and sub-basic concepts of electric and parallel circuits (40.54%). The results of the interviews showed that the causes of the misconceptions included the character of abstract electrical concepts, lack of understanding of the concept, difficulty analyzing the sequence, and the unpreparedness of students to accept material delivered by the lecturer.

**Keywords:** misconception, Certainty of Response Index (CRI), electricity

### INTRODUCTION

Alternative misconceptions or concepts that occur in students can not be separated by the causes or sources of concept mismatches. The causes of misconceptions can be caused by several sources, namely from students, instructors, textbooks used, context, and ways of teaching (Suparno, 2005).

Misconceptions experienced by students can also occur due to misinterpretation of natural phenomena or events encountered in their lives. Misconceptions that have been obtained by students when school is still settled on him until he was in college (Dewi, 2013).

## **Problem of Research**

The learning process of Basic Physics in D-III Radiology Engineering, students are always directed to be able to understand the learning material as well as possible. However, during the learning process students do not always absorb information fully from the Physics material being taught, this is because physics lessons contain many scientific concepts. So what students understand about a scientific concept is often different from the concept adopted by physicists in general (Suparno, 2005). Mismatch in understanding the concepts understood by students with the understanding of the concepts put forward by experts is called misconceptions or alternative concepts.

## **Research Focus**

Some research results show that many misconceptions occur in learning a number of topics (concepts) Physics. Among them are the concepts of mechanics, electricity, thermodynamics, waves and optics, modern physics, astronomy and earth space (Suparno, 2005). Misconceptions about the concept of electricity often occur that some students misunderstand the electrical voltage, the light on a series of electrical circuits and others. Some research also shows the existence of misconceptions and difficulties in learning electricity at the high school and college level.

Electricity is material that on average there are misconceptions by students. The material also experienced many difficulties during learning, requiring understanding of the concept before understanding the formula. Electrical material is also difficult to observe, especially without the help of special equipment. As a result, this concept has become one of the concepts that are considered difficult by students and many students who experience misconceptions.

Therefore, in understanding key concepts in electricity, it is necessary to have a pattern to be able to distinguish between students who understand the concept from students who experience misconceptions. From the description above, this study aims to identify misconceptions and the causes of misconceptions in D-III Radiology Engineering students in the electrical concept by using the CRI Three-Tier Test decision matrix.

## **METHODOLOGY OF RESEARCH**

### **General Background of Research**

Based on the purpose of the study used, this research is a descriptive study using quantitative descriptive methods in explaining the research results obtained.

### **Sample of Research**

The research subjects used were first-level students of D-III Radiology Engineering, totaling 32 students. The diagnostic outcome data is expressed in the form of a percentage of total misconceptions of the total number of students (32 students).

### Instrument and Procedures

Instrument in collecting data in the form of multiplechoice questions (tests) with 5 answer choices. The number of questions used are 20.

### Data Analysis

The diagnostic results are expressed as a percentage of the total misconceptions of the total number of students (32 students) based on the respondent's answer pattern. After that the percentage of each criterion is calculated using the formula used by Cahyaningsih (2006: 40) as below:

$$\text{Persentase } LK = \frac{LK}{N} \times 100\%$$

$$\text{Persentase } KCC = \frac{KCC}{N} \times 100\%$$

$$\text{Persentase } LG = \frac{LG}{N} \times 100\%$$

$$\text{Persentase } MIS = \frac{MIS}{N} \times 100\%$$

$$\text{Persentase } NC = \frac{NC}{N} \times 100\%$$

information:

LK = Number of students who do not know the concept

KCC = Number of students who know the concept

LG = Number of Guessing Students

MIS = Number of students who are misconceptions

NC = Number of non-resident students

N = Total number of students

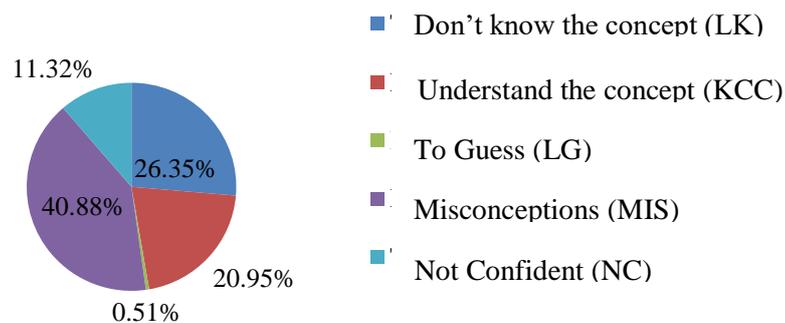
Furthermore, an analysis of student understanding was carried out in each sub-concept by adding up the percentage of students who did not know the concept (LK), already knew the concept (KCC), guessed (LG), misconceptions (Mis), and the answers of students who were not confident (NC) in each sub-concept is based on the confidence of the students' answers on each test question. To find out the causes of misconceptions experienced by students, it is identified from students' mistakes in giving incorrect reasons. In other words, the deception in the test questions provided at the level of confidence from the CRI matrix and the reasons given from the students' answers can illustrate the causes of misconceptions from preconception to intuition.

## RESULTS AND DISCUSSION

The results of data analysis using threetier diagnostic test showed that of the 37 students who were the object of research, it was known that as many as 26.35% did not know the concept (LK), 20.95% already knew the concept (KCC) where students were in accordance with scientific conceptions, 0.51% students who guessed (LG), 40.88% of students experienced misconceptions (Eg), and 11.32% answers of students who were not confident (NC) (Figure 1). These results indicate that the level of understanding of students'

[Type text]

concepts towards the concept of electricity is relatively low. Among the causes of the low acquisition of average scores of these students is because the initial conception of students about the concept of electricity is still limited by the knowledge they gained from previous levels of education and is also influenced by language factors or influenced by their environment. The high percentage of students experiencing misconceptions is due to the fact that students do not interpret the concept correctly. Another factor is the level of difficulty / the nature of the concept learned, the language is difficult and the number of foreign terms in this concept.



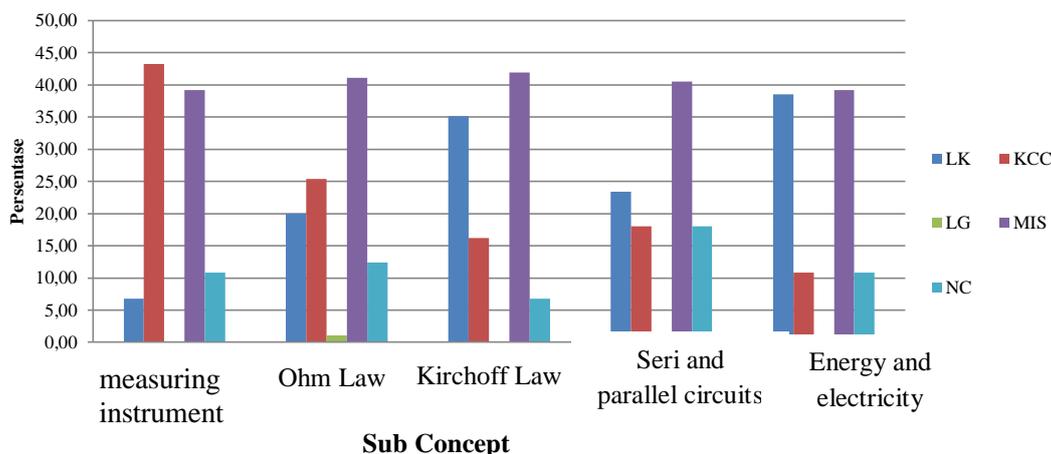
**Figure 1.** Understanding of Student Concepts

Student misconceptions can come from students themselves, which is the result of misinterpreting the concept of what they feel is based on the intuition of each of them, in addition there are also students connecting their conceptions with events in everyday life.

Students determine for themselves what concepts enter their brain, interpret and store them. Students who are passive cause the rearrangement of knowledge in their brains will not occur, conversely the more active students are involved in the learning process, the better the understanding of the concept. Misconceptions experienced by students can also be obtained from learning obtained from previous teachers or lecturers. Learning by the teacher or lecturer may be less directed so that students make a wrong interpretation of a concept, or maybe the teacher or lecturer experiences a misconception of a concept so that what he conveys is also a misconception.

### **Understanding of student concepts in each sub concept**

To find out the understanding of the concepts (conceptions) of students in each sub-concept of the electricity concept, further analysis was carried out. The results of the analysis in each sub-concept to see the average student who does not know the concept (LK), understand the concept (KCC), guess (LG), misconceptions (Mis) and non-confidence (NC) as in Figure 2.



**Figure 2.** Understanding of Student Concepts in Each Sub-Concept

Based on Figure 2 above, it is found that the two electricity sub concepts are experiencing a high misconception. Sub concepts that experienced a high misconception, namely the sub-principle ohm's legal concept (41.08%), kirchhoff's legal sub-concept (41.89%) and sub-concepts of electric and parallel circuit concepts (40.54%). Based on the analysis of the level of difficulty, the concept is in the medium category. So it can be said that misconceptions that occur due to errors of knowledge previously obtained, such as the concept of series and parallel circuits, students assume that lamps closer to the voltage source will be brighter than other lamps. Another example is students consider the factors that influence the resistance value of a conductor is the strong current flowing on the conductor.

Based on the interview results it is known that students are not ready to accept the concepts given. Some students only read high school books as literature because they were considered the easiest to understand. Whereas high school books only discuss superficial electricity concepts so that it is not enough to equip students to study electricity concepts at a deeper and more complex university level. As a result there is a discontinuity of student concepts. The concept of electricity taught at different levels is usually not well connected, causing difficulties for students to develop an understanding of electricity concepts holistically. Student cognitive development that is not in accordance with the concepts being studied can also cause misconceptions on students. Other causes of misconceptions that also come from students are limited and wrong student reasoning, students' ability to grasp and understand the concepts being learned, and students' interest in learning the concepts given.

## CONCLUSIONS

The results of data analysis using threeter diagnostic test showed that of the 37 students who were the object of research, it was known that as many as 26.35% did not know the concept (LK), 20.95% already knew the concept (KCC) where students were in [Type text]

accordance with scientific conceptions, 0.51% students who guessed (LG), 40.88% of students experienced misconceptions (Eg), and 11.32% answers of students who were not confident (NC). The highest percentage of misconceptions was found in the kirchoff law sub concept (41.89%), the Ohm Law sub concept (41.08%), and followed by the series and parallel series sub concepts (40.54%). The results of the interviews showed that the causes of the misconceptions included the character of abstract electrical concepts, lack of understanding of the concept, difficulty analyzing the sequence, and the unpreparedness of students to accept material delivered by the lecturer.

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