

CHAPTER I

INTRODUCTION

1.1 Research Background

Students have information, attitudes, abilities, and experiences since they are always engaging with their surroundings. They build new knowledge in their thoughts as they acquire ideas (Kose, 2004). Learning can be affected by inaccurate knowledge due to students' wrong assumptions based on experience, misinformation from teachers, misunderstandings by students, and inaccurate information in textbooks (Develi & Namdar, 2019).

According to Suprpto (2020), a misconception occurs when, a student fails to make the necessary links between new and existing concepts, resulting in incorrect conceptions. Understanding the different kinds of misunderstandings and the reasons behind them will assist science instructors who teach in Indonesia to come up with a suitable strategy to correct misconceptions and raise student learning outcomes.

Misconceptions are caused by several factors that can be categorized into four categories: students, teachers, textbooks or literature, and teaching methods. (Suparno, 2013). There will be confusion and incoherence among students if they are unaware that misunderstandings arise. The misperception will prevent students from gaining a deeper knowledge of the learning process if it is not corrected right away. When students are aware of the misunderstandings that have occurred, it is easier to change and improve their understanding. Students are also able to make conceptual connections on their own (Duda, 2020). According to Duda et al. (2019) in a study about common misconceptions in scientific issues related to cells, many students have misconceptions and are not aware of the concept.

Cells are essential to biology. Every living thing is made up of cells. This cell is the most basic living material collection in the sequence of biological organization. Prokaryotes or microbes, are single-celled creatures, whereas eukaryotic cells or animal/human and plant cells, are multicellular (Campbell, 2002). In this study, the material used is the topic of cells in 8th grade of junior high school which consists of several sub-topics including cells and microscopes, animal cells and plant cells, and cell specialization. The selection of the cell biology

concept was based on the fact that it is abstract and hard for many students to grasp. This study is expected to reveal the misconceptions that arise among students. Therefore, this study can make an important contribution to students and teachers (Duda, 2020).

According to Luthfyanti et al. (2024), junior high school students' comprehension of cell content remains inadequate. Students frequently have misunderstandings, and fail to comprehend the subject matter. High levels of student misconceptions are caused by a combination of factors such as motivation and intellect. The inability of students to connect their newly acquired material with material that already exists in their minds, can be one of the contributing factors to a poor concept understanding of cell material. This makes it challenging for them to understand what the teacher is attempting to teach them. Students can find it difficult to understand the material on cells since it comprises abstract concepts that need to be seen using instruments like microscopes or photos (Syarif et al, 2023).

According to Situmorang and Sihotang (2021) found that the structure of cell organelles is the most common misconception among high school students about cell material. Students forget the function of these organelles and lack a thorough understanding of the structure of each part of the cell. Then, another research indicates that first-year senior high school students have misconceptions, particularly about the types of cells and the traits of bacteria cells. These findings suggest that pupils are still having difficulty understanding the characteristics of bacterial cells (Suhel & Rusyati, 2021).

Diagnostic testing is one of the methods to measure misconceptions held by students, they are standardized (Bakti et al, 2022). Diagnostic tests can provide an accurate description of students' misconceptions on certain materials. The instrument on the diagnostic test has undergone developments promoted by other researchers. It consists of two-, three-, and four-level multiple choices. Moreover, each level has different strengths and weaknesses (Yusrizal & Halim, 2017). To overcome the weakness of earlier methods, a diagnostic exam can be administered to a larger sample size and offer comprehensive data on students' knowledge levels (Ojose, 2015).

The two-tier diagnostic test consists of reasoned multiple-choice questions. It seeks to motivate students to provide or select justifications for their answer (Barniol & Zavala, 2016). Then, by including an additional tier that asks students to indicate whether or not they are certain of their responses to the previous two tiers, three-tier test allow researchers to overcome a few constraints (Kirbulut & Geban, 2014). However, the two-three tier diagnostic test still has limitations, one of which is that it cannot identify the reason why students actually encounter misunderstanding (Gurel et al., 2015). To find students' misunderstandings, a variety of assessment instruments are created and employed. In recent years, the most often utilized tests are the four-tier multi-tier tests (Kaltakci, 2012).

The four-tier model is the diagnostic test model that can provide the most complete information in making a diagnosis. In this model, an item has answer choices (tier 1), reason for choosing an answers (tier 3), and the degree of confidence for both answer (tier 2) and reason (tier 4) (Caleon & Subramaniam, 2010). The implementation of diagnostic tests not only aims to improve the learning process, but is expected to illustrate students' skills as well (Dewi et al, 2022).

There is still a dearth of research that focuses on misconceptions about cells. A bibliometric analysis was carried out utilizing visualization software like VOSviewer and tools like Publish or Perish (PoP) (Al Husaeni & Nandiyanto, 2022). This analysis is used for mapping the scientific field of a journal and grouping scientific articles in accordance with the research conducted. In order to obtain an overview of a field of study, bibliometric analysis is a systematic review technique that looks for research trends and current concerns based on publication history. It generates findings by doing more thorough content analysis (Nursaniah & Nandiyanto, 2023).

Scientific research was conducted tens or even hundreds of years ago. However, this study's bibliometric analysis was limited to the last ten years. The research's issue of student misconceptions is supported by 130 keywords. They are separated into 7 clusters based on study keyword similarity. Misconceptions are the most common keyword in research during the past ten years, according to network visualization. This term has to do with high school students, which implies that they

are frequently the subject of the study. However, there is no pathway related to the cells. This shows that the research carried out is still on a small scale.

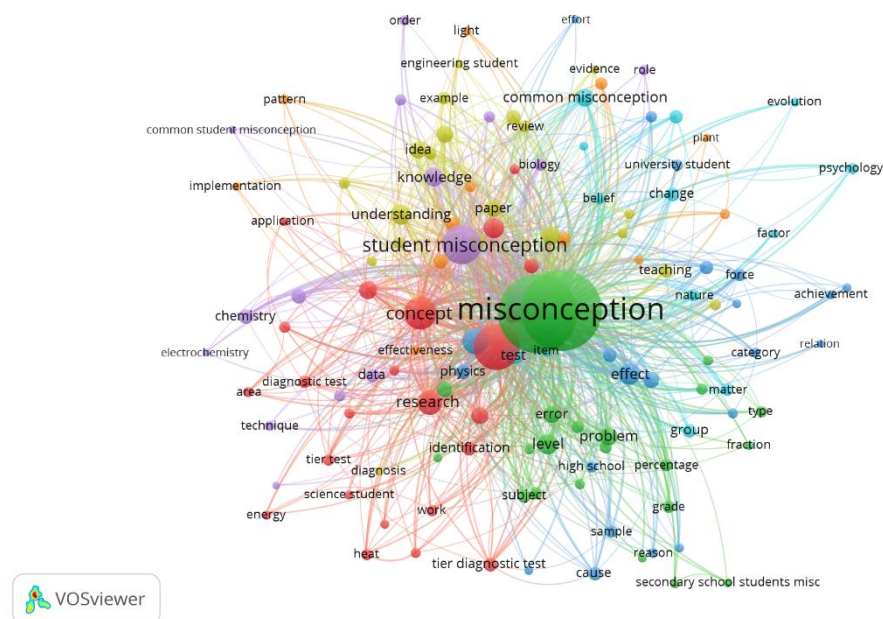


Figure 1.1 Network Visualization of Students' Misconception

1.2 Research Problem

The research problem of this study can be defined as “How a four-tier diagnostic test can be used to assess student conceptions about cells?” Based on research problem given, the research leads to describe the following questions:

- What conceptions do students have about cells?
- What are the most common misconceptions middle school students hold about cells?

1.3 Operational Definition

The following operational definitions for student misconceptions, four-tier diagnostic tests and cells, will be used in this research.

1. A misconception occurs when students fail to make the necessary connections between new information and old concepts that they already have, resulting in incorrect notions being produced (Suprpto, 2020).
2. A four-tier diagnostic test is developed from a three-tier multiple choice diagnostic test. The development is an addition to the level of student confidence in choosing answers and reasons (Rahayu, 2021). The four-tier multiple choice diagnostic test is designed to determine how strongly learners

master concepts through the level of confidence in answering questions (Dendodi & Hamdani, 2020).

3. The cell is the structural and functional unit of living things, which implies that it is the building block of living things and carries out all the functions of life (Nendissa et al, 2023).

1.4 Limitation of Research

To focus the research, there are some limitations as follows:

1. Cells Topic

The topic covered in this study refers to the cell topic that is limited by the depth of the 8th grade in Indonesia's Curriculum of Merdeka (Maryana, 2021).

2. Four-Tier Diagnostic Test

A four-tier test is an instrument used to measure students' conceptions. It consists of four tiers, which are the main question, the confidence level for the main question, the reason, and the confidence level for the reason. The confidence level questions of four-tier tests used in this study only consist of two options which are sure and not sure (Kiray & Simsek, 2021).

1.5 Research Objective

The objectives of this research are described as follows:

- a. To analyze the level of students' conceptions about cells
- b. To analyze the most common students' misconceptions about cells

1.6 Research Benefit

- a. Teachers

Junior high school teachers can benefit from this research by learning more about their students' conceptual understanding of cell subjects, particularly in situations where they lack the time to complete the diagnostic test at the start of the class. In addition, if teachers have the time, they can utilize the diagnostic test to diagnose students' conceptions of cell themes prior to or following a lesson to observe how much students' conceptions have improved. In addition, educators should plan more effective teaching techniques and approaches to lessen students' misconceptions about cell themes.

b. Students

Students in junior high school can benefit from this research by learning more about the ideas they have regarding themes related to cell. It will assist students in clearing up any misconceptions they may have. Therefore, they might attempt to steer clear of the common misconception identified in this study and work to fortify their understanding in the process.

c. Researchers

Researchers can benefit from this study by using the resources it provides to assess students' misconceptions about cell subjects. These materials can also serve as a reference for future research on related topics.

1.7 Organizational Structure of Research Paper

This research paper is organized according to the following structure:

a. Chapter I: Introduction

This chapter includes the following topics: background information and context, the research problem, problem limitations, research aims, and research benefits.

b. Chapter II: Literature Review

This chapter provides important variables, including students' misconceptions, the four-tier diagnostic test, and the cells, (plant and animal cells, cell specialization, and parts of the microscope).

c. Chapter III: Research Methodology

This chapter provides an explanation of the research methodology, study design, research subjects, including sample and population, research tools, data analysis, and research methods.

d. Chapter IV: Results and Discussion

This chapter explains the findings of the study in light of the stated research questions and places the results in the context of other research on student misconceptions.

e. Chapter V: Conclusions, Implications and Recommendations

The conclusion derived from the result and discussion is presented in this chapter. It also includes suggestions and implications for follow-up studies.