# CHAPTER I
# INTRODUCTION

## 1.1 Research Background

Misconceptions in science can arise from various sources, such as misunderstandings of daily life or misunderstandings of informally acquired knowledge through media or cultural habits. These alternate conceptions are firmly rooted in students' minds and are resistant to change. Even with explicit teaching, students will not always simply "let go" of prior conceptions of phenomena. This resistance not only hinders the acquisition of new knowledge but can also negatively impact students' attitudes toward science learning, reducing their interest and motivation (Guerra-Reyes et al., 2024). When students repeatedly experience confusion or conflict between their prior beliefs and scientific explanations, they may begin to feel frustrated, incompetent, or disinterested. This can lead to a decrease in self-confidence, increased anxiety toward science subjects, and eventually a lack of engagement in classroom activities. Over time, such negative experiences can form lasting impressions, causing students to perceive science as difficult or irrelevant, thereby limiting their willingness to participate actively or pursue further learning in the subject.

Understanding students' conceptions and misconceptions is an essential part of effective science education. The earth and solar system is one of the most fascinating yet demanding topics that students are exposed to in astronomy. The Solar System is a constant unit of science education due to the fact that it represents the basic information that the students need to grasp prior to learning more advanced topics in astronomy (Supriatna et al., 2019). Research conducted in recent years has shown that misconceptions related to astronomical concepts, including the nature and behavior of celestial bodies and their interactions, are prevalent among learners at various educational levels. These misconceptions may impede the formation of accurate scientific information and interfere with the establishment

of broader understanding by students regarding more advanced astronomical concepts (Lelliott & Rollnick, 2010).

Most of the research studies has indicated students many wrong misconceptions about astronomical ideas which is generally not covered by them. For example, (Korur, 2015) researched some of the misconceptions of seventh-grade students and pre-service science teachers about planets in the context of a solar system, and they found that most of these misconceptions can be rescaled as misinterpreted problem related to a celestial body and planetary motion. The research highlighted major misconceptions, such as students lack of understanding of moon phases and changes in the seasons. The research revealed significant misunderstandings, such as students not knowing about phases of the moon or how the seasons changed. The results would be used to guide a targeted intervention content based educational activity in which through addressing misconceptions we aim for building a better understanding of astronomy by students. Teachers can also make use of resources such as concept cartoons and diagnostic quizzes in order to pinpoint specific misconceptions that may be standing between students and a clear understanding of this crucial area of science.

Assessing students' understanding and identifying their misconceptions are just as crucial as teaching the concepts themselves (Bayrak, 2013). Multiple-choice tests are convenient and widely used in science classrooms to assess students' understanding. However, it also poses some challenges, such as determining whether or not a correct answer demonstrates the student's understanding or is a result of a guess (Negoro & Karina, 2019). The diagnostic tests would go a long way in establishing some specific misconceptions the students have about Earth and the solar system. Diagnostic tests could be prepared in several forms, but one of them is a tiered assessment that explores students' final answers and the reasoning processes that lead to those answers (Gurel et al., 2015).

Therefore, it is necessary to develop a diagnostic test that is able to measure student misconceptions. Student misconceptions in science concept subjects. This development can provide suggestions for correcting and overcoming students'

misconceptions or incorrect conceptions. By developing a four-tier diagnostic test, students' concept understanding in science subjects will be facilitated and can be measured (Fakhriyah & Masfuah, 2021). This study aims to develop and describe the validity of diagnostic test instruments to diagnose misconceptions on the topic of earth and solar system among junior high school students in East Bandung region.

Bandung was chosen as the research location because the city is one of the main educational centers in Indonesia with the existence of various school levels and representative educational institutions, including in the East Bandung area. Bandung has a diverse student population in terms of social and academic backgrounds such that the results of the study can provide broad description of students' misconceptions. The social context influences learning achievement (Kurniawan & Wustqa, 2014), so the diversity of students' social backgrounds in Bandung is an important factor that can affect learning outcomes, including in understanding science concepts. This is also in line with the background of students in Bandung who are proficient in elementary science materials such as the earth and solar system, so that this research can effectively identify and eliminate common misconceptions. Thus, Bandung is a strategic and relevant location to develop and test the validity of the Four-Tier Diagnostic Test as a misconception diagnosis tool on solar system materials at the junior high school level.

## 1.2 Research Problem

Based on the above background context, the research problem of this study is "How can the Four Tier Diagnostic Test be used to assess misconceptions about Earth and Solar System among students in East Bandung?". Based on the research problem, the research leads to describe the following questions :

a. What is the type of conception about Earth and Solar System among students?
b. What is the common misconception in each subtopic of Earth and Solar System among the students?

## 1.3 Operational Definition

1. Students' Conceptions

   Students' conceptions frequently refer to their perceptions and interpretations of particular subjects, which can be influenced by prior knowledge, experiences, and the context of learning in which they are studying. This is further developed into five categories for emerging categories in the student conceptions: scientific knowledge, false positive, false negative, misconception, and lack of knowledge.

2. Students Misconception

   Misconceptions are incorrect understandings or beliefs that students hold about a particular concept, often due to incomplete knowledge, prior experiences, or misleading explanations. Misconceptions can hinder learning by creating false assumptions that students may carry forward.

3. Four Tier Diagnostic Test

   The four-tier diagnostic test is an assessment instrument designed to identify students' conceptual understanding and misconceptions in a more detailed and accurate manner. It consists of four components for each item: a multiple-choice question testing content knowledge, a confidence rating for the answer to the first question, a multiple-choice question probing the reason behind the selected answer, and a confidence rating for the reasoning.

## 1.4 Research Objective

The objectives of this research are described as follows :

a. To analyze junior high school students in East Bandung conceptions level on earth and solar system use a Four-Tier Diagnostic Test.
b. To analyze the most common misconceptions of junior high school students in East Bandung about earth and solar system topics.

## 1.5 Research Benefit

1. For Teachers

   Teachers can use the research findings to identify and address students' misconceptions about the Earth and the solar system. By understanding common errors, they can develop targeted teaching strategies to clarify misunderstandings.

2. For Students

   It allows students to reflect on what they know about the Earth and the solar system while also recognizing any mistakes that may be made. The identification of such misunderstandings can aid in building a more precise comprehension of the concepts.

3. For other researchers

   This study contributes to the scientific researcher as it provides us with interesting information on how students learn the skill of recognizing and considering their misconceptions. Future research can draw from these findings in planning more effective means of rectifying students' misconceptions.

## 1.6 Scope of Research

The scope of this research is limited to several aspects to focus on the topic being studied. This research is intended for 8th-grade junior high school students who have studied the *Earth and Solar System* topic as outlined in the Kurikulum Merdeka. The instrument used in this research is a Four-Tier diagnostic test, chosen to identify students' misconceptions more deeply. This test was developed based on a preliminary study using open-ended questions, which were analyzed and generalized into carefully constructed four-tier multiple-choice questions for each concept. The sample of this study consists of junior high school students in the East Bandung Regency who have learned the topic.