

# CHAPTER I

## INTRODUCTION

### 1.1 Background

Misunderstandings and misconceptions can indeed hinder the learning process in biology and prevent students from gaining a deep understanding of the subject. Biology is a complex and interconnected field, and having a solid grasp of fundamental concepts is crucial for building a strong foundation for further learning. Misconceptions can arise due to various reasons, such as prior knowledge gaps, misconstrued information, or the misinterpretation of scientific concepts (Posner et al., 1982).

These misconceptions can be particularly problematic because they can hinder the integration of new knowledge into a student's existing understanding. They may also lead to incorrect explanations or interpretations of biological phenomena. To address these issues, it is important for educators to actively identify and address common misconceptions in biology. By understanding the misconceptions students may have, teachers can design instructional strategies and learning activities that specifically target those areas. Encouraging student engagement through hands-on experiments, discussions, and concept mapping can lead to a deeper understanding of biological concepts and their interrelationships (Ajaja, 2013). This approach fosters active learning and promotes critical thinking, allowing students to make meaningful connections between different aspects of biology.

Identifying and addressing misconceptions is crucial for effective teaching and learning. It helps determine which materials commonly harbor misconceptions. Once these misconceptions are identified, understanding why they occur becomes vital. Factors contributing to misconceptions can be analyzed, and strategies to overcome these misconceptions can be formulated.

Moreover, providing real-life examples and connecting biological concepts to everyday experiences can enhance students' ability to relate and apply their knowledge (Salendab & Laguda, 2023). This approach can help students see the relevance of biology in their lives and promote a more

comprehensive understanding of the subject. Overall, fostering a deep understanding of biology requires educators to be aware of potential misconceptions, create opportunities for active learning, and emphasize the interconnected nature of biological concepts. By being aware of common misconceptions, teachers can address them directly and provide accurate information to students. Engaging students in active learning experiences, such as hands-on experiments, discussions, and problem-solving tasks, allows them to actively construct their understanding of biology. Additionally, highlighting the interconnectedness of biological concepts helps students see the bigger picture and make meaningful connections between different topics. By adopting these approaches, educators can promote a deeper and more robust understanding of biology among their students. By addressing misconceptions and promoting a conceptual understanding, students can develop a solid foundation in biology and be better equipped to explore more advanced topics in the future (Lintang et al., 2021). so that if misconception of a concept is not immediately resolved, it can cause misconceptions on other concepts. a number of studies, Natural Science Material in general and the reproduction of living things in particular have the potential to cause misconceptions for students (Fardiansyah, 2015; Samiha et al., 2017; Uriyaha & Nuriman, 2018). In the context of natural science, including the topic of reproduction in living things, students may encounter various misconceptions due to the complexity of the concepts and the potential for misunderstandings. The intricate nature of biological processes and the interconnections between different concepts can contribute to the development of misconceptions.

The problem faced in learning science is the low understanding of students concepts about plant reproduction. plant reproduction which is one of the concepts in biology which requires a level of conceptual understanding and very close to everyday life This material has interrelated subconcepts that allows students to understand the necessary initial understanding of the material if students' initial understanding is not strong then to understand the next sub-concept prone to misconceptions (Roy & Mohapatra, 2022). Certain misconceptions like 'pollens are like seeds' and 'asexual reproduction in plants is equivalent to cell

multiplication' were reported in a study on conceptual difficulties of high school students in biology. students' notion of plant reproduction is driven by their knowledge of animal reproduction- misconceptions discovered in this study were 'plants can not move to have sexual reproduction with another plant' and 'plants can not produce sperm and ovum'. Misconceptions about pollination and seed dispersal mechanisms in plants were detected in the majority of grade 5 to 12 students (Vosniadou, 2019). difficulties in differentiating between pollination and seed dispersal which was also addressed in other studies (Boyer 2000; Nyberg, Andersson, and Leach 2005).

The four-tier diagnostic test instrument is a method used to identify students' misconceptions and assess their level of understanding of a concept. It consists of a series of questions or statements organized into four tiers, each representing a different level of understanding (Tumanggor, et al., 2020). Instruments with a four-tier format are effective in analyzing students who have misconceptions and assessing their understanding of concepts. The four-tier format allows for a comprehensive assessment of students' knowledge and confidence levels in their answers. It helps identify not only correct and incorrect responses but also the level of certainty students have in their answers and the scientific reasoning behind their choices. This format provides a more nuanced understanding of students' misconceptions and allows for targeted intervention to address these misconceptions. By using four-tier instruments, educators can gain valuable insights into students' conceptual understanding and design instructional strategies to promote accurate and meaningful learning.

This study aims to analyze students' misconceptions regarding the topic of plant reproduction and describe the factors that contribute to these misconceptions. The collected data are crucial for assessing the students' comprehension levels of the concepts presented in the material. The findings from this research can serve as a valuable guide for teachers in addressing and remedying students' misconceptions, ensuring that their understanding of interconnected concepts remains unimpeded in future learning.

## 1.2 Research Problem

Based on the background, the research problem of this study is “What are the student misconceptions about plant reproduction as assessed using a four tier diagnostic test instrument? The research problem is expanded into two research questions.

1. What is the distribution of students’ conceptions about reproduction in plants?
2. How are misconceptions about reproduction in plants found among junior high school students?

## 1.3 Operational Definition

### 1. Students’ Conception

Student conception refers to the ideas, beliefs, and understanding that students have about a particular topic or concept. These conceptions can be accurate or inaccurate, and they may differ from the scientifically accepted or widely understood explanations. students' conceptions will be categorized into five categories: Scientific knowledge (SK) Occurs when the correct answer and the correct reasoning are present, but the person still holds a belief that contradicts their accurate understanding. False positive (FP) Occurs when the answered question is correct, but the didn't know the reason behind the answer. False negative (FN) occurs when Occurs when the answered question is incorrect, but the reasoning behind the answer is correct. Misconceptions (M) Incorrect or flawed understandings of a concept, but their belief in their understanding. and Lack of knowledge (LK) refers to a state where a student lacks the necessary information or understanding of a particular concept.

### 2. Students’ Misconceptions

Misconceptions were identified when students answered incorrectly in both the first tier (multiple-choice question) and the third tier (reasoning behind their answer). By utilizing the four-tier test, the research aimed to identify and understand specific misconceptions held by students

regarding plant reproduction. This approach allowed researchers to delve deeper into the thought processes behind students' incorrect responses and uncover any misconceptions they held. By pinpointing these misconceptions, educators and researchers can design targeted interventions and instructional strategies to address and rectify them, promoting accurate understanding of plant reproduction concepts among students.

### 3. Four-tier Diagnostic test

Four tier test is an diagnostic instrument to identify students' misconceptions on plant reproduction topic the first tier is multiple choice question with 4 answer choices student find one answer is correct , second tier is level student confidence based on students' answer in tier one , third tier is multiple choice regarding the reason students answer in tier one, fourth tier is level student confidence in choosing the reason for the answer. (Çelikkanlı & Kızılcık, 2022). By utilizing the four-tier test, educators can gain insights into students' misconceptions, their confidence levels, and the reasoning behind their answers. This diagnostic instrument provides a comprehensive assessment of students' understanding and helps identify areas where misconceptions may arise.

## 1.4 Limitation of Problem

This study's limits and area of attention are as follows:

### 1. Reproduction in Plants

The focus of this research is limited to detecting student misconceptions in ninth-grade lower secondary school students. The specific science concept addressed is plant reproduction, which is included in the curriculum of 2013. The research is specifically aligned with Core Competence 3 and Basic Competences 3.2 and 4.2, which provide a framework for understanding the topic. It is important to note that this research does not encompass all aspects of plant reproduction or cover students from different grade levels or educational contexts.

### 2. Four–Tier Test

using a four-tier approach to identify misconceptions among students based on their answers and confidence levels. The four-tier approach likely involves categorizing students' responses into different tiers based on the correctness of their answers and their level of confidence in those answers. The approach seems to be effective in pinpointing when students hold misconceptions, particularly when they answer incorrectly at Tier I (basic understanding) and Tier III (intermediate understanding), yet still exhibit confidence in their incorrect answers. However the four-tier approach can solely identify misconceptions; it does not uncover the underlying causes of these misconceptions.

### **1.5 Research Objective**

This research aims to analyze student misconceptions on plant reproduction topic using four tier diagnostic test instrument in lower secondary school. In detail based on research question there are some objective of the reasearch which are :

1. To analyzed student categories of the Students' Conception on reproduction in plants topic
2. To analyzed misconceptions on reproduction in plants topic among junior high school student

### **1.6 Research Benefit**

This research is expected to provide some benefit for teachers, students, schools, and researcher as follow :

1. Teachers

This research is indeed valuable for junior high school teachers as it provides insights and a diagnostic method for identifying student misconceptions in science, specifically in the topic of plant reproduction. By utilizing the four-tier diagnostic test instrument, teachers can effectively identify and understand the misconceptions held by their students. teachers can design and implement targeted instructional strategies to address and correct these misconceptions. By tailoring their teaching methods and learning activities to specifically target the

identified misconceptions, teachers can enhance student understanding and facilitate conceptual change. This research can contribute to the professional development of teachers by increasing their knowledge and awareness of common misconceptions in plant reproduction. It empowers teachers to be more effective in their instructional practices and better equipped to support their students' learning.

## 2. Students

This research indeed holds value for junior high school students as it provides insights into their understanding of the concept of plant reproduction. By diagnosing and analyzing student misconceptions, the research helps to identify areas where students may have gaps or misunderstandings in their understanding of plant reproduction. By addressing misconceptions and providing accurate information, students can actively participate in the learning process and refine their understanding of plant reproduction. This research empowers junior high school students to take an active role in their own learning and supports them in developing a more comprehensive and accurate understanding of the concept of plant reproduction.

## 3. Researcher

This research holds significance for researchers in the field as it provides valuable information and data on student misconceptions related to plant reproduction. The findings and methodology employed in this research can serve as a reference and foundation for future studies aiming to diagnose student conceptions and misconceptions in science education. Researchers can build upon the insights gained from this research by exploring different aspects of student misconceptions, investigating the underlying factors influencing these misconceptions, and developing interventions or instructional strategies to address and correct them. Researchers can contribute to the body of knowledge in science education and further advance the field of diagnosing student conceptions. This research provides a stepping stone for future investigations, encouraging researchers to explore innovative approaches and interventions to

improve science education and promote conceptual understanding among students.

### **1.7 Organization of Research Paper**

The organization of this research paper is divided into five chapters. The chapters are as follows:

#### **Chapter I**

This chapter consists of the research background, research problem, research question, limitations of research, research objectives, research benefits, and the organizational structure of the research paper.

#### **Chapter II: Literature Review**

This chapter consists of students' understanding of science, students' misconceptions in science, four-tier tests as diagnostic instruments, content analysis of plant reproduction in national middle schools.

#### **Chapter III: Research Methodology**

This chapter consists of the research design, research methods, population and sample, research instruments, data analysis, and research procedures.

#### **Chapter IV: Results and Discussion**

This chapter consists of the results of the data analysis. It also contains a discussion that is constructed based on the results.

#### **Chapter V: Conclusion, Implications, and Recommendations**

This chapter contains the conclusions drawn from the results and discussion. It also contains implications and recommendations for future research.