

CHAPTER I

INTRODUCTION

1.1 Research Background

The progress of a nation is greatly influenced by education (Darmaji et al., 2019). The quality of learning in the classroom is evidence of the quality of education. The logical education capacities abilities of students in Indonesia are still relatively low, according to the results of the PISA (International Student Assessment Program) survey, the scientific literacy rankings in Indonesia in 2003, 2006, 2009, 2012, 2015 put Indonesia at the 61st rank out of 70 nations (El Islami et al., 2019). PISA survey in 2018 set Indonesia at the 72nd rank out of 77 nations (OECD, 2019c). The results of PISA 2018, show that Indonesia has decreased 2018 scores compared to 2015 in all assessed areas were in the low category because the scores achieved were below PISA average (Yusmar & Fadilah, 2023). PISA or Program for International Student Assessment is carried out every three years under the auspices of the Organization for financial Co-operation and Advancement (OECD), to compare the abilities of students in the 15 years age range. PISA aims to measure and compare the abilities and achievements of school children in OECD countries, one of which is Indonesia. Apart from that, PISA aims to observe and reflect the quality of school children's education in OECD countries, one of which is Indonesia. Apart from that, PISA also aims to observe and see the reflection of the quality of children's education with the aim of surveying and photographing the quality of education of children aged 15 years in OECD countries for success in the scope of work (Bidasari, 2017). According to PISA 2022 survey data, the average scientific skills score of Indonesian students is still lower than the average for all OECD countries. To overcome these issues, the government is attempting to move forward the quality of Indonesian instruction. One of them is making strides the quality of progressing learning.

When learning takes place, of course, students have a basic knowledge to build their concepts, and students with their abilities are able to accept and understand the material presented by the instructor. The different abilities that

students have in receiving and processing the material presented can result in the emergence of different knowledge. It is not uncommon for students to relate their knowledge to other concepts that they happen to have. As a result, knowledge arises that is not in accordance with the actual concept. Conditions like this often give students misconceptions (Hidayat et al., 2020).

Misconceptions or conceptual errors in learning are errors in understanding a meaning. Misconceptions are caused by many factors, some of which are the students themselves, teachers/instructors, learning modules, context, and teaching methods. Misconceptions are students' understanding of scientific concepts that are distinctive from scientifically accepted concepts (Kirbulut & Geban, 2014).

Chemistry is one of the natural science subjects at high school level. Chemistry is one of department science that studies the properties and structure of materials, the changes and energy that accompany material changes. Chemistry ranges from simple concepts to more complex and abstract concepts (Irawati, 2019). These concepts are interrelated. Connecting one concept to another, requires a correct understanding of the concept. The capacity to capture meaning is like being able to more effortlessly express material presented in a simpler and easier to understand form, being able to interpret it and being able to apply it. Understanding concepts is very necessary for students experiencing the learning process. When students understand the concept, it makes it simpler for students to illuminate existing issues.

One of the most subjects of chemistry in the high school educational modules is reaction rate. In the content standards, reaction rate is among the topics given in class XI even semester. This shows that reaction rate is one of the basic chemical concepts that is important for students to understand before understanding other chemical concepts. If students experience obstacles or misconceptions about the concept of reaction rates, this will create obstacles in understanding other chemical concepts. Reaction rate material is a material that has many abstract concepts, for example factors that influence reaction rates and

collision rates. The existence of this abstract concept makes it troublesome for students to get the concept of reaction rate and as a result gives rise to misconceptions (Nurpratami et al., 2017).

Many researchers have conducted research related to misconceptions about reaction rates, according to research by Rumapea & Silaban (2022) regarding misconceptions at SMA Negeri 9 Medan, based on the comes about of the research, it is known that students experience misconceptions regarding reaction rate material, it was 40%. Further research was carried out by Fahmi et al., (2017) regarding misconceptions at SMA Negeri 7 Banjarmasin, based on the results of the research, it is known that students experience misconceptions regarding reaction rate material. Then in research conducted by Lestari et al., (2021) related to student misconceptions at science class XI in a high school situated in Batu, it was 23,75%. The higher misconceptions occur on reaction order sub-topic that students accept that deciding the reaction order is based on the reaction coefficient.

Mistakes made by students in the reaction rate material, if not addressed, will continue and repeat the same mistakes, therefore it is necessary to know the students' mistakes in detail. Many researchers recommend alternative research to measure thinking abilities and determine students' level of understanding because most tests given to students only measure low-level thinking abilities and rarely know the degree of students' understanding of the concepts being considered. This assessment procedure needs to be considered because it does not give a substantial estimation of what students know and do not know. One way to diagnose misconceptions that occur in students is to use diagnostic instruments given to students during learning. Diagnostic tests are tests that aim to identify learning difficulties experienced by students in understanding concepts on a lesson topic (Lestari et al., 2021). The purpose of using this diagnostic test is so that learning can be designed effectively.

Therefore, to overcome students' misconceptions, one technique that can be used is to use a three-tier multiple-choice diagnostic test (Lestari et al., 2021).

The three-tier multiple choice diagnostic test is a diagnostic test that consists of three levels of questions. The first tier consists of questions containing various answer choices, the second tier contains answer reasons that refer to the first tier, the third tier contains the level of student confidence in answering the first tier and the second tier consists of response choices between sure and not sure. Student answers are considered correct in multiple-choice tests and the reasons are correct along with a high level of self-confidence. On the other hand, when students choose the wrong answer on a multiple-choice test followed by wrong reasons along with a high level of self-confidence, it is concluded that the student has a misconception. From the description over, this research points to identify misconceptions. By using three-tier multiple-choice diagnostic test is anticipated to be utilized to identify the understanding of the concept of high school students on chemical reaction rates.

Several previous studies regarding the utilize of three-tier multiple-choice diagnostic tests in recognizing misconceptions that occur in students. Inquire about conducted by Khairaty et al., (2018) appears that there are 56.21% of students experiencing misconceptions, 10.99% of students understand the concept and around 32.79% have a lack knowledge. Inquire about conducted by Rizki et al., (2022) appears that students experience misconceptions as much as 50%. Inquire about conducted by Aswita et al., (2017) shows that 63.37% of students experience misconceptions, 9.79% of students understand the concept, 24.50% of students have a lack knowledge.

Based on the results of interviews with chemistry teachers at SMA Negeri 2 Percut Sei Tuan, students experienced difficulties in learning reaction rate especially in determining reaction orders, collision theory, and chemical calculation. Teachers usually carry out exercises/evaluations in the form of multiple-choice and essays. Teachers have never carried out an evaluation to find out the level of students' conceptual understanding by giving a three-tier multiple-choice diagnostic test. Therefore, diagnostic tests for understanding concepts such as three-tier need to be developed to clearly understand the extent of students' understanding of the concept of reaction rate material, so that teachers can get a

picture of students' conceptual understanding and be able to determine appropriate follow-up activities.

Based on the explanation above, researcher realize the importance of knowing the level of student misconceptions with diagnostic tests. So researcher are interested in researching the SMA Negeri 2 Percut Sei Tuan school with the title "Analysis of Student Misconceptions Using the Three-Tier Multiple-Choice Diagnostic Test on Reaction Rate Material at SMA Negeri 2 Percut Sei Tuan."

1.2 Problem Identification

Based on the background above, several problems can be identified:

1. Students' interest in learning is low, thus triggering misconceptions in students especially on reaction rate material.
2. The use of three-tier multiple-choice diagnostic tests has never been applied by teachers in assessing reaction rate material at SMA Negeri 2 Percut Sei Tuan.
3. Students actually construct their concepts based on background, abilities, attitudes, and experiences, the construct is different from the construct that has been held and presented by the instructor.

1.3 Scope of Study

To make this study obtain specific results, the researcher focused the research on the material reaction rate to analyze the misconceptions of class XI students employing a three-tier multiple choice diagnostic test at SMA Negeri 2 Percut Sei Tuan.

1.4 Scope of Problem

In order for the research to be more directed and focused, the limitations of the problems in the research are as follows:

1. Analyze the categories of student misconceptions on reaction rate material.
2. The diagnostic test instrument used in this research is a three-tier multiple choice diagnostic test, in the form of multiple-choice questions in the first tier, reasons for answers in the second tier, and level of confidence in the third tier.
3. This research was carried out in class XI students at SMA Negeri 2 Percut Sei Tuan.

4. The instrument test in this study only measures students' cognitive aspects consisting of C1 (knowledge), C2 (understanding), C3 (application) and C4 (analysis) in the reaction rate material.
5. The target of this research is the use of a three-tier multiple-choice diagnostic test to measure the level of student misconceptions on reaction rate material.

1.5 Research Questions

The research questions in this research are:

1. What are the categories of student misconceptions of class XI students at SMA Negeri 2 Percut Sei Tuan on reaction rate material?
2. What is the feasibility of the three-tier multiple-choice test instrument in analyzing the misconceptions of class XI students at SMA Negeri 2 Percut Sei Tuan on reaction rate material?
3. What concepts from the reaction rate material of class XI students at SMA Negeri 2 Percut Sei Tuan who experience misconceptions?
4. What is the percentage level of misconceptions of class XI students at SMA Negeri 2 Percut Sei Tuan on each concept of reaction rate material based on the three-tier multiple-choice diagnostic test?

1.6 Study Objectives

The study objectives in this research are:

1. To analyze the categories of misconceptions in class XI students at SMA Negeri 2 Percut Sei Tuan on reaction rate material.
2. To determine the feasibility of the three-tier multiple-choice test instrument in analyzing the misconceptions of XI students at SMA Negeri 2 Percut Sei Tuan on reaction rate material.
3. To describe the concepts of class XI students at SMA Negeri 2 Percut Sei Tuan who experience misconceptions on reaction rate material.
4. To find out the percentage level of misconceptions of class XI students at SMA Negeri 2 Percut Sei Tuan on each concept of reaction rate material based on the three-tier multiple-choice diagnostic test.

1.7 Research Purposes

The benefits that can be obtained from this research are:

1. Theoretical benefits: Analyzing student misconceptions using a three-tier multiple-choice diagnostic test instrument. It is hoped that the misconception detection test instrument used will be useful as an evaluation tool.

2. Practical benefits:

a. For student

Students can identify conceptual weaknesses experienced in reaction rate material, foster rational and scientific thinking in students and increase student motivation in understanding reaction rate concepts that they have not yet mastered.

b. For teachers

Teachers can find out the level of students' understanding of the reaction rate material, making it easier for teachers to carry out follow-up activities according to the students' level of understanding.

c. For researcher

This research is useful for researchers because researcher gain experience applying instruments in special learning for students to reduce students' misconceptions in learning the concept of reaction rate, and improve researchers' skills in creating test instruments in the learning process at school.