JPPIPA 8(6) (2022)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

Analysis Understanding Participant Educate to Theory Rate Reaction

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Received: October 28, 2022
Revised: December 17, 2022
Accepted: December 24, 2022
Published: December 31, 2022

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DOI: 10.29303/jppipa.v8i6.2462

Abstract: Initial understanding is the ability to build early based on experience and knowledge possessed by using grammar that is still relevant to new knowledge. This study aims to explore the experience and knowledge of students to determine the initial understanding of the reaction rates topic. The method used is a questionnaire as a research instrument. In total, 100 students from SMA in Malang, East Java were selected using the purposive sampling method. From these questions, the types of questions are grouped based on alternative answers and sub-material questions and include 3 levels of representation, namely macroscopic, sub-microscopic, and symbolic. Then students' answers are presented and then the students' initial abilities are described following the answers given by students. In teaching and learning activities, students often encounter concepts of knowledge that are constructed independently by students so that when new knowledge is given, there are often differences in understanding or differences in concepts with actual information. The quantitative findings show that in general students' understanding of concepts is 'good', especially on the basic concepts of the reaction rate topic. However, in several sub-materials such as reaction orders, reaction order graphs, and chemical reaction equations in the reaction rate concept topic, there are still conceptual errors experienced by students so improvements and emphasis on concepts are needed in some of these sub-materials so the percentage of correct answers from students is greater from the previous.

Keywords: Social media; Chemistry; Analysis understanding

Introduction

Chemistry is a branch of science that has a fairly high level of difficulty, this is because the beginning of learning chemistry is not easy for students to understand. In addition, studying chemistry also requires good numeracy skills to solve problems in the scope of chemistry. Because of this, in studying chemistry, students and teachers are required to have a correct and good initial understanding of chemistry lessons. Initial understanding is the ability to build early based on experience and knowledge possessed by using grammar that is still relevant to new knowledge (Marthafera et al., 2018; Sofyan, 2019).

According to Mawaddah et al. (2016) understanding is a process consisting of the ability to explain and describe something, as well as being able to provide more creative descriptions. Meanwhile, according to Suhyanto et al. (2016) the beginning is an ideal (abstract) that can be used to classify an object. According to the Ministry of National Education quoted from Wardhani (2008) it is explained that the indicators of students understanding the beginning are seven points follows: (1) restating a beginning, (2) grouping objects according to certain criteria according to the beginning, (3) giving examples and not examples of an

How to Cite:
Widarti, H. R., Yamtinah, S., Mawardi, M., Rokhim, D. A., Siddiq, A. S., Syafruddin, A. B., Sriwahyuni, T., Rachmanita, Z. A., Amalia, E. R. F., Baharsyah, A., & Anggraini, T. (2022). Analysis Understanding Participant Educate to Theory Rate Reaction. *Jurnal Penelitian Pendidikan IPA*, *8*(6), 3027–3033. https://doi.org/10.29303/jppipa.v8i6.2462

initial one (4) explains the beginning in various forms (5) develops the beginning according to the achievement of requirements (6) uses and selects certain procedures or operations, (7) implements early in problem-solving.

The beginnings in chemistry are the initial type of stratified or experienced development from simple beginnings to complex, so studying chemistry must be done sequentially starting from the simplest to the complex beginnings. In addition, the material studied in chemistry is quite large so students are asked to be able to design their learning activities effectively and efficiently (Fahriyah et al., 2017). The main purpose of the learning method is to realize substantial learning (M. K. Nasution, 2017). So, to create this, students must be able to reconstruct experiences by absorbing information from outside independently. Because understanding the beginning of chemistry requires identification at the macroscopic and microscopic levels, students must understand the abstract beginning in chemistry first (Kurniawati, 2018; Marthafera et al., 2018; Sukmawati, 2019).

Along with the development of science and technology, changes are needed in the perspective of science education and the teaching methods used in the classroom (Aziz, 2019; Banggur, 2020). Therefore, several new teaching techniques have been developed in education. Conventional teaching methods that make teachers a source of information have now been replaced by constructivist learning methods that emphasize students as the center of the learning process (Hidayat et al., 2022). So, it is hoped that a non-passive learning atmosphere will be created by involving students directly so that students can gain knowledge by themselves in their minds and the teacher acts as a student mentor during learning (Üce et al., 2019). One of the chemical substances can be represented by three levels, namely, the rate of reaction Sub-materials in the reaction rate include the basic beginning of chemistry including activation energy, collision theory, enthalpy, factors that affect reaction rates, and reaction mechanisms. But in reality, there are still many students who depend on alternative beginnings in assessing reaction learning because most students find it difficult to describe chemical processes at the sub-microscopic and symbolic levels of each other. Both students and prospective teachers still often experience initial misunderstandings in understanding chemistry, so it is necessary to study the level of understanding of students and teachers towards chemistry students, especially on the reaction rate material. The purpose of the study is to describe the ability of students and teachers to understand the initial understanding of the reaction rate material

One of the preliminaries analyzes that need to be done in the development of learning media is the analysis of students (N. B. Nasution et al., 2018). At this stage, the character of the students who are the main subjects of the developed product users is analyzed. These characteristics include prior knowledge, attitudes and feelings of students, and student preferences regarding the product being developed. In this article, the variables to be studied are only initial knowledge. This is because the product to be developed is in the form of chemical learning media on the reaction rate material, so the initial knowledge that needs to be done is regarding the reaction rate. Therefore, a study was conducted to analyze students' prior knowledge about reaction rates.

Based on the research of Wijayadi (2017) shows that there are still many students at the high school and college level who experience conceptual errors in the reaction rate material. From this study, it was stated that students considered the role of catalysts in chemical reactions to increase their activation energy. This misconception is thought to occur because of the assumption that the activation energy is the energy possessed by the reactants. The root of the problem of this error is due to the incomplete understanding of students in the reaction rate material. Incomplete understanding of students can be caused by incomplete presentation of the reaction rate material in three representations, both macroscopic, microscopic, and symbolic (Wijayadi, 2017). From the background presented, it is necessary to have a strategy, model, and learning media that can present three representations in the complete reaction rate material.

Method

This study aims to determine the level of understanding in the students' point of view on the reaction rate topic. The research method used is descriptive qualitative and quantitative Descriptive method according to Nazir (2003), are: A method to examine the status of a group of people, an object, a condition, a system of thought or a class of events in the present. The purpose of this descriptive research is to make a systematic, factual, and accurate description, picture or painting of the facts, characteristics and relationships between the phenomena being investigated. The subjects of this study were students of class XI science who had received lessons on reaction rates in Malang City. The data collection technique in this study was a measurement technique in the form of multiple-choice tests. The research instrument was in the form of an initial understanding test.

The data analysis technique used in this study will be analyzed using descriptive statistics, namely the percentage for student response analysis. This study aims to determine the level of understanding in the student's point of view on the reaction rate material. The research method used is descriptive qualitative and quantitative (Nazir, 2011). A descriptive method according to Nazir (2003), are A method to examine the status of a group of people, an object, a condition, a system of thought, or a class of events in the present. The purpose of this descriptive research is to make a systematic, factual, and accurate description, picture, or painting of the facts, characteristics, and relationships between the phenomena being investigated.

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The data analysis technique used in this study will be analyzed using descriptive statistics, namely the percentage for student response analysis. The types of questions are grouped based on alternative answers and sub-material questions, then students' answers are presented and then the students' initial abilities are described according to the answers given to students. After several categories appear, the respondent's answers are calculated according to the question category, then the percentage is calculated. By using this percentage, it will be seen how far students know about reaction rates.

Result and Discussion

Prior knowledge greatly affects the process of receiving and forming new information for students (Hasanuddin, 2020). Initial knowledge of a material can be a provision for students to make it easier to understand the next material. Students who have good prior knowledge will understand the next material faster than students who have little prior knowledge. Initial knowledge is a collection of information that has been obtained from previous experience which has an influence on new knowledge. Initial knowledge is information that is still relevant to subsequent knowledge and has efficiency in understanding new concepts or information (M. K. Nasution, 2017).

In teaching and learning activities, it is often found that the concept of knowledge is constructed independently by students so that when given new knowledge, there are often differences in understanding or differences in concepts with actual information. Initial knowledge is a collection of individual knowledge and experiences gained throughout the life journey of learners that will help in learning new knowledge (Hikmah, 2018).

Concept understanding is a person's ability to build their knowledge obtained based on previous knowledge with their grammar and be able to build relevance with new knowledge (Mawaddah et al., 2016). Based on the analysis of a student's initial understanding of the concept of reaction rate, the percentage obtained for each question, the sub-materials consisting of 12 questions on the research instrument were categorized into four sub-materials which were unequal in number. The distribution of concepts, sub-materials, and each question in it can be seen in the following topic.

Respondent Demographic Data

Respondents who took part in the survey conducted in this study, prospective chemistry students who are in high school or early college level. The demographic data of the respondents are presented in Table 1.

Of the 12 questions given, there are 3 levels of material on the topic of reaction rates such as macroscopic, submicroscopic, and symbolic. macroscopic representation is something tangible and can be perceived by the senses, sub-microscopic includes molecular aspects that are used to explain phenomena at the macroscopic level, and symbolic is used to explain macroscopic phenomena quantitatively, including symbols, equations, stoichiometry, and calculations (Widarti et al., 2020).

In the answers given by students cross-level education listed in the table, in the first sub-material regarding reaction rate factors, it consists of three questions numbered 1-3 on the number one type of true or false question, this question is included in macroscopic representation because the concepts that are built can be represented through the senses. From this question, 82.3% of students who answered correctly that the surface area affects the rate of reaction means that as many as 82.3% of students have confidence in their initial knowledge of the factors that affect the rate of reaction. In question number 2 given two factors that affect the reaction rate, namely surface area and concentration of reagents, from 4 answer choices 42.9% of students answered correctly the relevance of surface area and solution concentration to the reaction rate, which is positively correlated. Then in question number 3, an illustration of an experiment with the same type of surface area reaction rate factor is given, namely powder and different concentrations of solutions, as many as 43.7% of students answered correctly the causal question regarding the concentration factor of the solution on the reaction rate.

Table 1. Distribution of Student Answers

Sub Material	Percentage	Answer Key	Percentage Correct the Answer
Factors that affect the rate of reaction; Surface area Correct	Correct: 82.3 % Wrong: 17.7 %	Correct	82.3 %

the topic of factors that affect the rate of reaction; surface area and concentration of solution	A: 11.4% B: 19.3% C: 16.9 % D: 9.4% E: 42.9%	E	42.9%
Factors that affect the rate of reaction; concentration	• If (1), (2), and (3) correct= 43.7% • If (1) and (3) correct= 21.7% • If (2) and (4) correct= 17.7% • If only (4) is correct = 9.8% • If all answers correct= 7.1%	If (1), (2), and (3) correct	43.7%
Collision theory Correct	Correct: 59.8% Wrong: 40.2 %	Correct	59.8 %
Activation energy	A: 13% B: 23.6% C: 20.1% D: 30.1% E: 12.2%	D	30.1%
Graph of activation energy	A: 18.9% B: 18.9% C: 20.5% D: 30.7% E: 11%	D	30.7%
Order of reaction	A: 20.5% B: 19.7% C: 22.8 % D: 14.6 % E: 22.4 %	E	22.4 %
Order of reaction	A: 11% B: 9.15% C: 21.3 % D: 37.8% E: 9.1 %	D	37.8%
Order of reaction	A: 13.8 % B: 26.4% C: 39 % D: 13.8% E: 7.1 %	C	39 %
The rate equation for the reaction	Correct: 59.8 % Wrong: 40.2 %	Correct	59.8 %
The rate equation for the reaction	A: 18.9 % B: 35.8 % C: 27.2% D: 12.6% E: 5.5%	C	27.2%
The rate equation for the reaction	A: 22.8 % B: 23.2 % C: 18.5% D: 15.7 % E: 19.7%	B	23.2%

Then the sub-material of the next reaction rate factor, namely collision theory, consists of 3 questions in numbers 4-6. This sub-material is included in the sub-microscopic and symbolic representation. The sub-microscopic representation is indicated by the number of reacting molecules, while the symbolic representation is shown in the writing of the reaction equation. Question number 4 regarding the probability of collisions between particles seen based on the concentration of carbon monoxide, from experiments 1-5 the concentration of carbon monoxide is getting bigger, meaning that there are more molecules in the carbon monoxide solution so that the greatest chance of collisions between molecules is at number 5, while the chance of collisions smallest in experiment number 1 because the concentration value is the lowest. 59.8% of students answered correctly, meaning that 58.9% of students believed that the concept of concentration affecting the rate of reaction was the correct concept.

Furthermore, in question number 5 regarding activation energy, of the 5 answer choices regarding the definition of activation energy is the energy that must be exceeded so that chemical reactions can take place and products are formed. As many as 30.1% of students answered correctly, that is, based on the graph presented, the reaction proceeds exothermically because the activation energy is greater than the energy required for the formation of the product. Although the percentage who answered correctly was only around 30.1%, this percentage was the largest compared to the other 4 answers.

So, the majority of students can be said to have good knowledge of activation energy. In question number 6 regarding activation energy, as many as 30.7% of students answered correctly the calculation of activation energy which is also related to the notion of activation energy. The number of presentations of students who answered correctly still dominates so students' understanding of activation energy is quite good but the emphasis needs to be given to the activation energy sub-material so that the percentage of correct answers is greater than 30%.

Then in the sub-material of the reaction order in questions number 7-9, there are two pieces of knowledge that you want to know in question number 7 regarding the calculation of the reaction order based on the experimental results and the graphic image of the reaction order obtained. This sub-matter is included in the symbolic representation shown in the reaction rate equation to determine a reaction order. As many as 22.4% of students answered correctly and precisely, namely in the order of reaction one, in question number 7 the percentage of wrong answers in answer choice A was quite large, namely 20.5% so this could be a reference to the concepts possessed by students regarding the order of reaction and the graph, straightening students' understanding of the reaction order sub material and the graph needs to be emphasized.

In question number 8 regarding the total reaction order, namely the number of reaction orders in each reactant in a chemical reaction equation. In question number 8, 37.8% answered the question correctly, meaning that 37.8% of students did calculations about the reaction rate correctly and according to the concept of the total reaction order. Furthermore, in question number 9 regarding the calculation of the reaction order of reagent A and the graph of the reaction rate, as many as 39% of students answered correctly. This means that the majority of students have knowledge of the reaction order and the graph is quite good, but still need to increase their understanding of the concept so that the percentage of correct answers is greater.

For the last sub-material, namely the reaction rate equation in questions number 10-12, in question number 10 the reaction rate equation is given and then a statement is added regarding the meaning of the reaction rate according to the reaction rate equation that accompanies the statement, this sub-matter is included in the symbolic representation shown in the reaction rate equation. As many as 59.8% of students answered with true, this shows that the majority of students already understand the meaning of the reaction rate which is defined according to the reaction equation. However, there are still around 40% of students who do not understand the notion of reaction rate, so that in the development of learning media later the sub-material of understanding the reaction rate needs to be added.

Then for question number 11 regarding the rate of reduction of the reactants in terms of the coefficients in the reaction equation. The basis for the calculation in question number 11 is a comparison between the concentration of the reactants and the concentration of the products. So that the correct answer is C from the data of students only about 27.2% answered correctly, while the percentage of students who answered B was as much as 35.8% which shows that there are differences in concepts regarding the calculation of reaction rates in terms of coefficients reaction equations, especially in calculating operations using the comparison method. Students who experience misunderstandings during the final process are due to limited reading resources or additional information about the subject matter in addition to being supported by the limitations of the teacher when providing information so that students who initially almost understand the concept of reaction rate but in determining the concept of reaction rate based on the coefficient of the reaction equation there are still mistaken.

While in question number 12 regarding the re-emphasis of the concept of reaction rate based on the reaction equation, it was found that 23.2% of students answered correctly. If we review the previous question, students should have understood the meaning of reaction rate, namely the decrease in reactants along with the increase in the number of products per unit time. However, in the answer to question number 12, there is still a small percentage of students who answer correctly, in the presentation of alternative answers, the other answers are evenly distributed, which is around 15-22%. This shows that the average is still confused in answering conceptual questions regarding the notion of reaction rate which has been integrated with the reaction rate equation. Understanding the concept of reaction rate should not only be limited to understanding but needs to be continued until the stage of implementing this understanding in a reaction equation.

It is normal for students to make mistakes in doing the questions. However, these errors must be anticipated immediately so that the same error does not occur again, especially the mistakes made by students in solving the problems of calculating the reaction order, graphing the reaction order, and understanding the reaction rate in a reaction equation. Therefore, the causes of errors made by students in solving chemistry problems need to be known. With the aim of finding the causes of errors made by students so that they can be corrected.

Conclusion

Based on the results and discussion, it can be concluded that in general students' understanding of cross-level education of the concept of reaction rate is as expected, especially on the basic concept of reaction rate. However, in some sub-materials such as reaction order, reaction order graphs, and chemical reaction equations on the concept of reaction rate, it is necessary that there are still conceptual errors experienced by students so that improvements and emphasis on concepts are needed in some of these sub-materials so that the percentage of correct answers from students is greater. In addition, from the results and discussions, further, development is needed to explore students' ways of thinking in representing the concept of reaction rate. The development of multiple representation-based media, will provide alternative views for students to overcome problems in learning the concept of reaction rate.

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