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Optimizing Student Activities and Learning Outcomes through Problem Solving Models in Stoichiometry Material

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ABSTRACT

Purpose of the study: This study aims to improve student activity and learning outcomes by applying the Problem Solving learning model.

Methodology: This research is a Classroom Action Research conducted in two cycles, with each cycle consisting of planning, implementation, observation and reflection. The subjects of the research were 33 students of class XC of State Senior High School 1 Wawonii. Data sources came from teachers and students. Data collection techniques were tests and non-tests (observation, document review). Data analysis used qualitative descriptive analysis techniques..

Main Findings: The results of the study showed that: Problem Solving model learning can improve student activity and learning outcomes, namely 71.00% in cycle I increasing to 85.33% in cycle II. Problem Solving model learning can improve student learning outcomes. The percentage of student learning outcome completion reached 64.63% in cycle I increasing to 81.82% in cycle II. From this study it can be concluded that the application of problem solving models can improve student activity and learning outcomes on the subject of stoichiometry.

Novelty/Originality of this study: This study offers novelty by applying the Problem Solving Model to improve student learning activities and learning outcomes in Stoichiometry material, which has been considered difficult by many students.

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1. INTRODUCTION

Efforts to improve the quality of education are generally directed at mastering science and technology which need to be improved and perfected in the field of teaching [1], [2]. One of the efforts made to improve the quality of education in schools is to improve the teaching and learning process [3], [4]. The learning model is directed at increasing student activity in the teaching and learning process so that the teaching and learning process takes place optimally between teachers and students [5], [6]. In general, the teaching and learning process at both elementary and secondary school levels is dominated by the teacher, while students can only listen, see and take notes on the teacher's explanation [7], [8]. The learning above is known as a conventional learning model, namely lectures that result in passive students, feeling bored and less interested in following the subject matter taught, especially in chemistry subjects, and there are few opportunities for students to ask questions. Thus, the chemistry learning atmosphere becomes unconducive, causing students to become passive. This will certainly affect learning achievement. So that there will be a negative student response to chemistry material.

Efforts to improve student learning achievement cannot be separated from various factors that influence it. One of them is the teacher, in this case the role of creative teachers is needed who can make chemistry learning better, more interesting and liked by students [9]-[11]. The classroom atmosphere needs to be planned and built in such a way by using the right learning model so that students can get the opportunity to interact with each other so that students can achieve optimal learning achievements [12]-[14]. In line with the development of research in the field of education, new learning models have been found that can improve student interaction in the teaching and learning process, known as the cooperative learning model. The cooperative learning model is an activity of implementing learning in groups, which interact with each other, where learning depends on the interaction between experts in the group, each student is responsible for the learning process in class and also in their group. [15]-[17].

Based on initial observations at State Senior High School 1 Wawonii, it was found that chemistry learning did not improve students' creativity, many teachers still use conventional learning models, namely monotonous lectures in chemistry learning in class, so that the learning atmosphere seems stiff and is still dominated by the teacher and makes students passive which results in the teaching and learning process not running optimally. Based on the results of interviews with chemistry subject teachers for class XC of State Senior High School 1 Wawonii, in that class students still find it difficult to apply formulas in answering questions, especially on the topic of stoichiometry. Generally, students can only memorize formulas, but cannot describe the meaning of the formula, students tend to only do calculations, and do not like statements and have difficulty in understanding chemical rules.

According to the analysis of chemistry teachers, this weakness is caused by students not playing an active role in chemistry learning and in addition, chemistry teachers are also not creative enough in developing learning models. Teachers are only fixated on conventional learning models. This weakness has an impact on chemistry learning outcomes at Wawonii 1 State Senior High School. As an illustration of the chemistry learning outcomes of students in semester 2, the average student score according to the minimum completeness criteria of the school concerned is at least 70.0. While the score obtained by students at Wawonii 1 State Senior High School on the subject of stoichiometry is only 60.0, lower than the average score on other subjects, namely the subject of chemical bonds 65.0, the periodic system of elements 62.5.

Based on the learning outcome data, the topic of stoichiometry needs special attention. Several efforts have been made by teachers to improve student learning outcomes, especially in the topic of basic chemical laws and chemical calculations (stoichiometry), namely by giving assignments to be done both at home and at school but have not shown significant changes. Therefore, efforts are needed to improve learning problems to improve student learning outcomes. Based on the results of reflection with chemistry teachers, the researcher proposed a problem-solving learning model as an alternative learning model to overcome these weaknesses.

Problem solving learning is a learning model that consists of several members in one group who are responsible for mastering part of the learning material and are able to teach the material in the form of (practicing questions and working on questions) to other members in their group [18]-[20]. This learning model is very suitable for stoichiometry material because in this material there are many sub-topics that are required so that students can understand abstract concepts including: Chemical laws, and chemical calculations. In this material, students are required to understand the relationship between the basic laws of chemistry or processes related to chemical calculations (stoichiometry) [21]-[23], in addition there are also many calculations in it so that by using this problem solving learning model, students can work together in a group and interact with each other in the classroom and have many opportunities to process information and improve communication skills [24]-[26].

This model is believed to be able to solve problems experienced by students, because the problem solving learning model is designed to increase students' sense of responsibility for their own learning (practicing questions, working on questions) and also the learning of others [27]-[29]. Students not only learn the material given, but they must also be ready to provide and teach the material to their group members [30], [31]. The problems experienced by students are quite disturbing and it is felt that action is needed to overcome them. Because a number of these problems involve mastery of basic concepts that play a very important role in the learning stages and when facing exams. Several efforts made by chemistry subject teachers to improve the teaching and learning process have been carried out previously, such as providing understanding to students, guiding students to be more active in expressing opinions, but in reality they have not shown significant changes [32][33]. Therefore, classroom action research is needed for improvement in the implementation of the learning process [34], [35]. Improvements are directed at the way the material is presented and the interaction between groups in the class. This was chosen because it is believed to be able to answer existing problems and is possible in its implementation.

Previous studies conducted by Sari et al., [36] highlighted the influence of problem-based learning models in improving students' problem-solving skills and scientific writing abilities. However, these studies tend to focus more on conceptual aspects and writing abilities without delving into the direct relationship with learning outcomes on specific materials. The current study attempts to fill this gap by focusing on the application of problem-solving models to optimize learning activities and student learning outcomes specifically on stoichiometry materials. Thus,

this study offers a more targeted approach in the context of chemistry learning and explores the impact of learning models on student engagement and learning outcomes on complex topics.

The novelty of this research lies in the application of the problem solving model to optimize student activity and learning outcomes in stoichiometry material. This approach provides a different learning alternative from conventional methods by integrating problem-solving strategies designed to increase student active involvement and understanding. In the context of stoichiometry learning, this model offers a more applicable and relevant approach to real situations, which has not been widely used in previous studies. The urgency of this research is based on the fact that stoichiometry is one of the materials that is often considered difficult by students because of its abstract nature and requires high analytical skills. This difficulty contributes to low student learning outcomes in chemistry. Therefore, this research is important to provide innovative solutions in learning, so as to improve the quality of the process and student learning outcomes in the material that is the main challenge in the chemistry education curriculum. This study aims to improve student activity and learning outcomes by applying the Problem Solving learning model.

2. RESEARCH METHOD

The subjects of this study were students of class X C of State Senior High School 1 Wawonii. The determination of class X C as the subject of the study was based on the results of discussions with chemistry teachers stating that in that class the absorption rate was lacking/the level of mastery of chemistry material was still slow compared to other classes so that a learning model was needed that could improve student learning outcomes. This classroom action research was carried out in 2 (two) cycles and each cycle consisted of 2 meetings which were adjusted to the changes to be achieved as designed in the factors being investigated and the scope of the material according to the available time allocation. Each cycle was carried out with the following stages: planning, action, observation and evaluation, reflection.

In this study, two types of data collection instruments were used, namely activity tests and learning outcomes. The learning outcome test was constructed in the form of descriptive questions with a total of 5 questions in cycle I and 4 questions in cycle II. The test was developed based on learning objectives. The test used was compiled by the researcher in collaboration with the chemistry subject teacher of class X C of State Senior High School 1 Wawonii. Observation sheets as a guideline for observing teacher and student activities in the problem-solving learning process. Observations of teacher activities are focused on the implementation of the problem-solving learning model and the learning process. Observations of students are focused on student activity in learning.

In this study, qualitative data were obtained through observation sheets and quantitative data were obtained through tests. Data collection techniques related to the process in problem-solving learning were obtained through observation sheets and data related to student learning outcomes were obtained through tests. As an indicator of success in this classroom action research, if the completion value of each class of at least 80% of students has achieved a minimum value of 70.37 and individual learning completion if the student has obtained a value of ≥ 70.37 (school provisions).

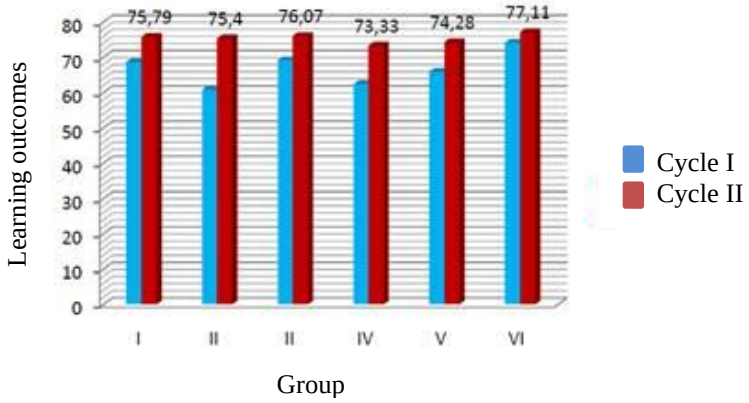
3. RESULTS AND DISCUSSION

Student Activities

Things observed in students during the learning process through the application of the learning model (Problem Solving) include: students' attention to the demonstration of learning materials given by the teacher, students' activities in working on Student Worksheets, how students present their work results and students' courage in asking questions/responding to questions and expressing opinions. The results of observations of student activities during the learning process show that there is an increase in student activity during the teaching and learning process, namely student activity in listening/paying attention to teacher explanations from cycle I to cycle II increased by 13%. The activity of working on learning Student worksheet from cycle I to cycle II increased by 10.90%. The activity of asking questions/responding to questions from cycle I to cycle II increased by 29.20%. And the activity of paying attention to the presentation of individual work results from cycle I to cycle II increased by 23.90%.

Student Learning Outcomes

The results of individual/group student learning in cycle I and cycle II actions on the topic of stoichiometry can be seen in the graph below:



There was an increase in the percentage of student learning outcomes completion from cycle 1 to cycle II, where in cycle I the student learning completion was 63.64% to 81.82% in cycle II with an increase of 18.18%, which can be seen in the graph below:

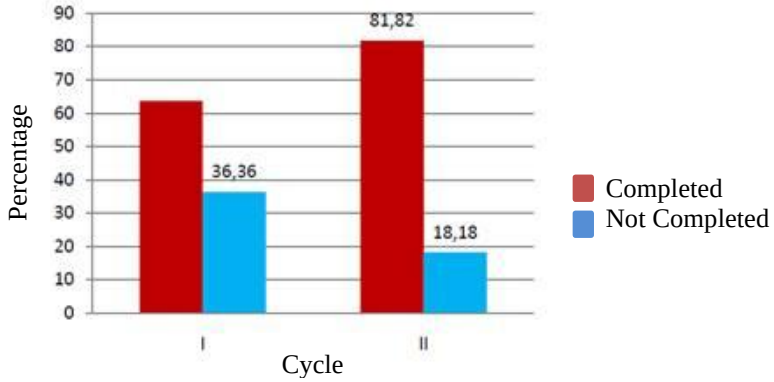


Figure 2. Graph of student learning outcomes completion

Observation of Teacher Learning

The results of observations of teacher activities during the teaching and learning process took place in cycle I and II actions on the subject of stoichiometry which were implemented through the application of problem-solving learning models. This classroom action research consists of two cycles. Each cycle consists of two meetings carried out in accordance with research procedures. Before implementing cycle I, students were first given an initial evaluation/test to determine the extent of basic knowledge (before implementing problem-solving learning models) possessed by students regarding the subject of Stoichiometry. From the results of student learning and the percentage of learning completion in class X C of State Senior High School 1 Wawonii, namely data from the last three years, it shows that student learning outcomes are still relatively low and have not reached the minimum percentage of completion compared to after this learning media was implemented. Before this learning media was implemented, the average student learning outcomes were 63.25, 65.30 and 66.00 with a percentage of completion of 61.08%, 71.45% and 69.84, respectively.

This is very different compared to student learning outcomes and the percentage of student learning completion through the application of the Problem Solving model as a learning model, namely the average student learning outcome is 77.11 with a completion percentage of 81.82%. Based on the above, it can be said that through the use of the State Senior High School 1 Wawonii Problem Solving model, it has a very good influence on student learning outcomes. Students are more motivated to follow the learning. This can be seen from the students' attention which is focused on the material being taught. Through the use of this problem solving model, it helps students develop understanding and comprehension of a concept that is not easily obtained in other ways. Students are able to work together in groups well, students are brave enough to express their opinions and answer questions given during the discussion.

Psychologically, the application of learning through the use of this problem solving model provides enormous benefits to students, including: 1). Motivating students to study harder because of encouragement from their group members and ongoing assessments, 2). Eliminating students' fear of expressing their opinions and answering questions, and 3). Cultivate student cooperation, critical thinking and the ability to help friends. Because the indicators of success in this study have been achieved, in this case at least 75% of students have achieved a

score of ≥ 66.70, then this study was stopped in cycle II. This means that the action hypothesis has been answered, namely through the use of problem solving Problem solving class X C State Senior High School 1 Wawonii on the subject of stoichiometry can be improved.

This study has a significant positive impact, especially in increasing students' active involvement and their learning outcomes in stoichiometry material through problem solving models. The impact is seen in students' ability to think critically, understand concepts deeply, and apply materials to real situations, which in turn can improve the quality of chemistry education. However, this study also has several limitations, such as the dependence on teacher facilitation skills in implementing problem solving models effectively and the difficulties of students who are less accustomed to problem-based learning approaches. In addition, the implementation of this model may take longer than conventional methods, which can be a challenge in a limited learning schedule.

4. CONCLUSION

Based on the research data, it can be concluded that: The application of the learning model through Problem Solving Learning can improve the chemistry learning outcomes of class X C students of State Senior High School 1 Wawonii on the subject of Stoichiometry with a completeness of 64.63% in cycle I action to 81.82% in cycle II action. Learning through the application of the Problem Solving model can increase the percentage of students who carry out activities, namely 71.00% in cycle I action to 85.33% in cycle II action. Further research is recommended to explore the application of technology-based problem solving models or collaborative approaches to other chemistry materials to broaden their impact.

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