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Improving Learning Outcomes of Chemistry Subjects through the Application of the Guided Inquiry Learning Model

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Abstract: This study aims to improve students' chemistry learning outcomes through guided inquiry learning models in class XI IPA 1 SMA Negeri 1 Tanjung Batu. This research is classroom action research carried out in three cycles. Data collection was carried out using a test at the end of the cycle. From the research, it was found that the completeness of students' learning outcomes before the action (T0) was 26.67% with an average grade of 59.83. After being given action by using the guided inquiry learning model (T1) the mastery of learning outcomes and the average value of learning outcomes increased to 53.33% and 64.33. Then in cycle 2 (T2) learning completeness increased to 66.67% with an average grade of 75.58. Whereas in cycle 3 (T3) there was an increase to 86.67% with a class average value of 82.16. The results showed that there was an increase in students' chemistry learning outcomes by using the guided inquiry learning model, with this model students could find their own knowledge, learning was more meaningful so that learning outcomes could increase. It can be concluded that the use of guided inquiry learning models can improve students' chemistry learning outcomes, where T3>T2>T1>T0. In connection with the research that has been done, the researcher suggests that teachers should apply the guided inquiry learning model if students' chemistry learning outcomes are low.

Keywords: Classroom Action Research, Guided Inquiry Learning Model, Student Chemistry Learning Outcomes

A. Introduction

In learning activities, learning models can be used that involve students to be active. Through the learning model the teacher can help students get information, ideas, skills, ways of thinking, and expressing ideas. Students are required to learn actively in developing their potential. Learning is a process of making changes within oneself by interacting with the environment to obtain changes in aspects of knowledge, attitudes and skills. So that teaching and learning activities are not dominated by the teacher, but students are more active during the learning process (Anwariningsih & Ernawati, 2023).

Based on observational data conducted in class, it is known that the results of studying chemistry in class XI IPA 1 are very low. The learning outcomes of students in class XI IPA 1 are not good compared to other class XI IPA. This can be seen from the classical learning completeness of daily tests 1 16.21%, midterm tests 50%, and final semester tests 27.02%. The class is said to have completed learning if there are ≥ 85% of students who have reached the proportion of correct answers ≥ 70.

Kosasi (2015) argues that the desired learning process is that students participate actively in the learning process while the teacher only acts as a motivator, facilitator and learning manager. This learning process is often referred to as a student center with the aim of helping students develop their own concepts. Suciati (2020) suggests that students should learn through active participation with concepts and experiments that allow them to discover the concepts themselves.

SMA Negeri 1 Tanjung Batu implements the 2013 curriculum. The selection of the application of the inquiry learning model is very appropriate to use in the 2013 curriculum because it emphasizes the courage to ask students and at the same time can assess students' attitudes, knowledge and skills. Inquiry comes from the word to Inquire means to participate or be involved, in asking questions, seeking information, and carrying out investigations (Devi, 2022).

In the application of the inquiry learning model, students are trained to think critically by finding answers to existing problems. Students get the opportunity to practice developing thinking skills so that the knowledge construction process can occur properly and students can improve their understanding of the material being studied. Students understand chemistry learning better if they solve the problems, they have by finding answers to these problems themselves and learning outcomes can increase with indicators of success, namely ≥85% of students getting grades ≥70.

Because students have not been able to carry out the learning process independently, in this study a guided inquiry learning model (Nisa et al, 2018; Mulyana et al, 2018; Seranica et al, 2018) was attempted where at the initial stage more guidance was given, little by little the guidance was reduced.

B. Methods

This study aims to improve the learning process by applying the guided inquiry learning model and can improve the learning outcomes of class XI IPA 1 students of SMAN 1 Tanjung Batu. This type of research is classroom action research. The research was conducted in three cycles, the first cycle discussed buffer solutions, the second cycle discussed salt hydrolysis and the third cycle discussed buffer solutions and salt hydrolysis experiments. The research subjects were class XI IPA 1 at SMAN

1 Tanjung Batu totaling 30 students consisting of 6 male students and 24 female students. The technique of collecting data for this research is by using observation sheets, learning achievement tests and documentation. Data analysis techniques based on student learning outcomes, percentages and indicators of success.

C. Results and Discussion

This research was conducted in three cycles where each cycle was held in 2 meetings. The first cycle studied the components of the buffer solution, calculating the pH, the effect of adding a little acid, a little base, and dilution to the buffer solution, as well as the function of the buffer solution in the body and life. The second cycle studied the properties of hydrolyzed salts, the equations for reactions that could be hydrolyzed in water, the equilibrium formula for salt hydrolysis, the pH of salt hydrolysis, and the uses of salt hydrolysis. The third cycle carried out experiments to analyze buffer and non-buffer solutions, determine the nature of the buffer solution, the hydrolysis of salts from weak acids with strong bases and strong acids with weak bases.

Data on Learning Outcomes Before being given Action (T_o)

Data on student learning outcomes before the action (T_o) is taken from learning outcomes on the subject of chemical equilibrium in the even semester of the 2021/2022 school year with an average learning outcome of 59.83 and 26.67% mastery learning consisting of 8 students who pass and 22 students who did not complete. Recapitulation of learning outcomes before being given action (T_o) can be seen in table 1.

Table 1. Recapitulation of Learning Outcomes before being given Action (T_o)

Score	Number of Students	Learning Completeness of Learners	Average student learning outcomes
≥ 90	2	26,67 %	59,83
80 – 89	2	(Complete)	
70 – 79	4		
≤ 69	22	73,33 % (Not Completed)	
Total	30		

Recapitulation of Completeness of Student Learning Outcomes in Cycle I, Cycle II, Cycle III

Recapitulation of the percentage of completeness of student learning outcomes in class XI IPA 1 SMAN 1 Tanjung Batu cycle I, cycle II, and cycle III can be seen in Table 2 as follows:

Table 2. Recapitulation of Student Learning Outcomes

Score	First Cycle (T1)		Second Cycle (T2)		Third Cycle (T3)	
	Number of students	Mastery learning (%)	Number of students	Mastery learning (%)	Number of students	Mastery learning (%)
≥ 90	1	53,33 %	10	66,67 %	3	86,67 %
80 – 89	10	(Complete)	4	(Complete)	20	(Complete)
70 – 79	5		6		3	
≤ 69	14	46,67 % (Not complete)	10	33,33 % (Not complete)	4	13,33 % (Not complete)
Amount	30	100 %	30	100 %	30	100 %
Average	64,33		75,83		82,16	

Observation Data of Student Activities

Recapitulation of the percentage of student activities in class XI IPA 1 SMAN 1 Tanjung Batu cycle I, cycle II, and cycle III can be seen in Table 3 as follows:

Table 3. Recapitulation of Student Activity Results

Group	Cycle 1	Cycle 2	Cycle 3	Average	Category
Group 1	37,50 %	62,49 %	87,06 %	62,35 %	Fair
Group 2	65,62 %	85,93 %	92,18 %	81,24 %	Excellent
Group 3	46,87 %	70,31 %	95,31 %	70,83 %	Good
Group 4	48,43 %	68,75 %	93,74 %	70,30 %	Good
Group 5	37,49 %	64,06 %	95,31 %	65,62 %	Cukup
Group 6	56,24 %	84,37 %	96,87 %	79,16 %	Good
Average	48,69 %	72,65 %	93,41 %	71,58 %	Good
Category	Worst	Good	Excellent	Good	

Recapitulation of the overall percentage of complete learning outcomes and student activities in class XI IPA 1 SMAN 1 Tanjung Batu cycle I, cycle II, and cycle III, can be seen in table 4 as follows:

Table 4. Recapitulation of the Percentage of Mastery of Learning Outcomes and Student Activities

Cycle	Mastery learning	% Average Activity
Cycle I	53,33 %	44,92 %
Cycle II	66,67 %	69,03 %
Cycle III	86,67 %	92,85 %

This research was conducted in three cycles, where each cycle was conducted in 2 meetings. In the first cycle studied the components of the buffer solution, calculating the pH, the effect of adding a little acid, a little base, and dilution to the buffer solution, as well as the function of the buffer solution in the body and life. The

second cycle studied the properties of hydrolyzed salts, the equations for reactions that could be hydrolyzed in water, the equilibrium formula for salt hydrolysis, the pH of salt hydrolysis, and the uses of salt hydrolysis. The third cycle carried out experiments to analyze buffer and non-buffer solutions, determine the nature of the buffer solution, the hydrolysis of salts from weak acids with strong bases and strong acids with weak bases. Data on student learning outcomes before being given action was taken from learning outcomes on the subject of chemical equilibrium with an average learning outcome of 59.83 and 26.67% completeness, consisting of 8 students who completed and 22 students who did not complete. Prior to conducting research, teachers often used the lecture method, debriefing and working on questions. The dominant teacher in the learning process. The teacher once tried the inquiry approach but experienced difficulties because students were still not used to making problem formulations, discussions and conclusions. The researcher chose to apply the guided inquiry model because the school implemented the 2013 curriculum. The selection of the application of the inquiry learning model was very appropriate for the 2013 curriculum because it emphasized the courage to ask students and at the same time was able to assess students' attitudes, knowledge and skills. Inquiry comes from the word to Inquire means to participate or be involved, in asking questions, seeking information, and conducting investigations (Devi, 2022).

Because students have not been able to carry out the learning process independently, in this study a guided inquiry learning model was attempted where at the initial stage more guidance was given, little by little the guidance was reduced. In the first cycle, it was seen that learning with the guided inquiry learning model could improve students' chemistry learning outcomes. In guided inquiry learning, students are directly involved in the learning process and actively discover their own concepts while the teacher only guides students, the teacher's role in the learning process is only a facilitator and motivator. The teacher acts as a guide in helping students to use the ideas, concepts, and skills they have learned to find concepts, so that students can retain these concepts longer (Karim, 2017). The average student learning outcomes rose from 59.83 in the less category to 64.33 in the sufficient category. And learning completeness from 26.67% in the very poor category rose to 53.33% in the less category. This is because in the first cycle, the guided inquiry learning model has been implemented, although the results have not yet reached an indicator of success, namely 85% of students getting a score of ≥ 70, this is the KKM that has been set at the school. From these data it can be seen that there was an increase in learning outcomes in cycle I after the guided inquiry learning model was applied, compared to learning before the guided inquiry learning model was applied.

When the learning process takes place, there are many weaknesses in cycle I. These weaknesses can be obtained from observational data observed by researchers during the learning process using the guided inquiry learning model, the average activity in

cycle I is in the very poor category, this is because students are still confused learning by using the stages of the guided inquiry model, at the stage of formulating the problem most of the students could not make the problem formulation visible during the learning process the whole group was still asking questions because they did not understand how to formulate the problem that had been given. After being given a new explanation they understood, at the stage of making a hypothesis the whole group did not understand, students still experienced difficulties because they did not have an understanding of the material being studied, they did not study the material beforehand. They look for relevant data first, then students can fill in the hypothesis-making stage. This step is certainly wrong because they must have an understanding of the existing problem so they can make the hypothesis.

The next stage, namely collecting data categorized as sufficient for the average of the two aspects observed. At this stage there are two aspects observed by the observer, the first is collecting data by finding relevant and appropriate data related to the problem to be solved and the second observed aspect is the involvement of all group members in collecting the data. In the first aspect it is in the good category, many students still have difficulty finding relevant and appropriate sources to use in solving problems, while in the second aspect it is in the poor category, only one or two people in the group play an active role in collecting data, the rest are just chatting and fussing. This is really ineffective, only active and smart students complete the worksheet while other students are just lazy. After all the data has been collected, students manage it by writing it on the student worksheets (LKPD) that the teacher has distributed, each group is given approximately 20 minutes to discuss the results they got in collecting data. The next stage is testing the hypothesis which is in the very poor category, the same as in the stage of formulating the problem and making a hypothesis, at this stage all students experience difficulty in doing so, and the whole group is in the very lacking category. In the conclusion stage, more than half of the group still could not make the right conclusion. And at this stage it is in the less category.

After that, the stage of presenting the results of group discussions was in the very poor category, after all the groups wrote down the results of their respective discussions, and were given time to discuss. All groups choose two representatives to read the results of their group discussions. At this stage it is still in the very poor category because the whole group presented the results of the discussion, they only read without understanding the meaning of the results, while the other groups who did not make presentations made the learning atmosphere noisy, they were busy with their respective groups regardless of the group presenting in front of them. The last stage observed was the collection of worksheets on the results of discussions on time. just. The percentage of activities using the guided inquiry learning model in cycle I was 44.92%, very low category. The average learning outcomes and classical mastery of students has increased compared to before implementing this guided

inquiry learning model. Because in cycle I there were many weaknesses, the researcher made improvements by increasing supervision of noisy groups, giving directions to groups who still did not understand the stages in the LKPD, so that all students played an active role in the learning process, one group presented only one stage and the other group others provide feedback or add, the group that gives the response must be a different person from the previous meeting, sanctions are given to groups that are late in submitting their LKPD, namely tidying up the class.

In the second cycle the average learning outcomes were 75.58 in the good category, 66.67% completeness learning consisting of 20 students who completed and 10 students who did not complete. From these data there is an increase from the previous cycle. In this cycle, students are accustomed to learning using the inquiry learning model, it can be seen from the percentage of activities in the second cycle that are in the good category, during the learning process there are still some weaknesses in this cycle, namely at the stage of making hypotheses students still have difficulty this is because they did not have an initial understanding of learning salt hydrolysis, they did not learn about the material in advance, but in this cycle only a few students had not studied the material themselves. Therefore, the teacher asks students to study the material in their respective homes in advance, so that when learning takes place, they already have an understanding of the material, and the teacher acts as a facilitator if there is a discussion on the material that is still not understood. After that, at the stage of testing the hypothesis, there were still several groups that answered incorrectly. This is because they are still confused, therefore the teacher asks students to ask other groups if at some stages they are still confused. In the second cycle, learning completeness still did not meet the indicators of achievement, namely 85% of students scored ≥ 70. The researcher decided to continue the research in the third cycle. With some improvements, namely students must first study the material to be discussed so that it is no longer difficult when making hypotheses and asking other groups if they still have difficulty at several stages.

In the third cycle, the learning process is carried out in the laboratory and at the stage of collecting data, it is carried out by conducting experiments and from sources such as books. In this cycle experiments on buffer solutions and salt hydrolysis. At the time of conducting the experiment the students had no difficulty because they had already conducted experiments in the laboratory on previous material. For each stage the students experienced no difficulties, it was seen that during the learning process they were accustomed to being independent in conducting experiments and filling in the worksheets provided, it was different during the initial conditions, the whole group asked about the stages and had difficulty filling in the stages correctly. In this cycle the average learning outcomes increased to 82.16 in the good category, and the classical learning mastery had reached an indicator of achievement in this study, namely 85% of students scored ≥ 70. In the third cycle the classical learning

completeness was 86.67 % consisted of 26 students who completed and 4 students who did not complete, which means that this research stopped at the third cycle. From the learning outcomes data, there were ten students who experienced a decrease in learning outcomes from the previous cycle to the third cycle, namely AAM, EY, HTA, MAA, MDG, MSA, OP, SR, Yld., and ZR but they still completed it, on the answer sheet for the final test they still did not quite correctly answer question number 5, namely how to conduct an experiment on salt hydrolysis, they answered with litmus paper. The answers that were answered were still lacking, they should have answered in more detail the steps of the experiment they had done.

With the stages that have been carried out, students can play an active role in building knowledge for themselves, not only receiving knowledge from the teacher and then just memorizing it but looking for this knowledge themselves by finding solutions to existing problems, thinking critically at the stage of formulating problems and making hypotheses, reconstructing knowledge by collecting data collecting data and solving these problems by testing hypotheses and conclusions. Students will play an active role in reconstructing their knowledge by searching for this knowledge themselves (Yolantia et al., 2021). Inquiry learning is a series of learning activities that emphasize the process of thinking critically and analytically to seek and find answers to existing problems. Students tend to be better able to find something new in order to solve the problems they face, that way they understand chemistry learning better if they solve the existing problems by finding answers to these problems themselves and learning outcomes can increase with indicators of success, namely ≥85% students get grades ≥70 (Muliani and Wibawa, 2019). The results of the study can prove that using the guided inquiry learning model can improve students' chemistry learning outcomes. This has also been proven by other researchers, namely (Ika et al., 2017; Muliani and Wibawa, 2019) which states that the guided inquiry learning model has an influence on scientific attitudes and science learning outcomes. This is in line with the results of research conducted (Gea, 2017; Marzela et al., 2018; Sunetri, 2021) that application the guided inquiry learning model can improve students' chemistry learning outcomes

D. Conclusion

Based on the results of the study it was concluded that the application of the guided inquiry learning model can improve students' chemistry learning outcomes. This can be proven by increasing the average value of students' cognitive learning outcomes. Before being given action the average value of students' chemistry learning outcomes was 59.83 with learning completeness of 26.67%. The average learning result in cycle 1 (T1) was 64.33 with completeness of 53.33% in cycle I had not yet reached an indicator of success because students were still confused about learning using the stages in the model, so the research was continued, the average learning in cycle 2 (T2), namely 75.58 with learning completeness of 66.67% has increased from

the previous cycle but has not yet reached an indicator of success because students still lack an initial understanding of the material to be studied so that it is difficult at the stage of testing hypotheses and research continued, the average learning outcome in cycle 3 (T3) was 82.16 with a mastery of 86.67% in cycle III had achieved an indicator of success, namely 85% of students achieved a score of ≥70 so that the research was stopped. The data shows that T3>T2>T1>T0.

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