The Effect of The Guided Inquiry Learning Model with Multiple Representations (Interpelasi) on Student Learning Outcomes and Retention on Salt Hydrolysis Material

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Abstract. The research's objective is to determine the impact of using the Interpellation learning model on the students' learning outcomes and retention in the salt hydrolysis topic for class XII IPA of SMAT Wira Bhakti. This research is classified as quantitative research, with a sample of 44 students from class XI IPA 1 and IPA 2 of SMAT Wira Bhakti. The data used in this research are in the form of test data on students' learning outcomes and retention. The research findings indicate that the average score of the experimental class is 73.86, while the control class is 62.27. Additionally, the students' retention test for the experimental class obtained an average score of 68.18, and for the control class, it is 48.86. The hypothesis is tested using a t-test. The results of the analysis signify that: 1) the following values are obtained, where $t_{count} > t_{table}$ (3.428 > 1.682), meaning that there is an impact of the Interpellation learning model on the students' learning outcomes; 2) the following values are obtained, where $t_{count} > t_{table}$ (5.872 > 1.682), meaning that there is an impact of the learning model on the students' retention.

Keywords: guided inquiry learning, student learning outcomes, retention in salt hydrolysis

1 Introduction

In general, teaching and learning can be interpreted as a situation where there is a change in behavior in students, both in terms of knowledge, attitudes and psychomotor skills, resulting from the provision of positioning in learning situations and guidance to direct students to comply with the goals that have been set [1]. Learning can be carried out well if it starts with good learning planning, therefore an appropriate learning model is needed to support increasing students' conceptual understanding [2].

In studying chemistry, the aim is to understand chemical concepts, where there are connections and applications to solve problems in life and technology. Chemistry remains a challenging subject, leading to students' inability to apply scientific concepts to real-life problems due to their lack of experience in relating these concepts to observable phenomena [3]. Chemical concepts are tiered concepts and develop from simple to

H. S. Panigoro et al. (eds.), *Proceedings of the 2nd International Conference on Sciences, Mathematics, and Education 2023 (ICOSMED 2023)*, Advances in Social Science, Education and Humanities Research 927,
https://doi.org/10.2991/978-2-38476-410-5_55

complex, this causes conceptual errors to occur so they need to be prevented. A complex concept can be mastered if the underlying concepts have been mastered properly and correctly. One approach involves the utilization of suitable learning methodologies that align with the inherent characteristics of chemistry [2, 4, 5].

An indicator of the effectiveness of the teaching and learning process may be observed through the learning successes attained by students. By conducting learning outcome assessments, we can assess the progress made in students' learning outcomes. Learning outcomes refer to observable and measurable changes in an individual's behavior, encompassing knowledge, attitudes, and abilities. This shift might be perceived as an enhancement and advancement that surpasses the previous state [6, 7].

Learning outcomes may be defined as a method of evaluating student learning by assessing their achievements in relation to certain learning objectives. Learning outcomes can seek to assess the level of success attained by students after engaging in learning activities, where the level of achievement is then recorded with a scale of letters or words or symbols. Learning outcomes are defined as the talents earned by each student after going through the learning process. Learning is not a goal but just a process to accomplish a goal [8, 9].

Student learning outcomes are impacted by two elements, namely internal factors and external ones. Internal student issues include health difficulties, physical impairments, psychological factors (intelligence, interest in learning, attention, talent, motivation, maturity and preparation of students), and tiredness factors. Meanwhile, extrinsic variables that impact student learning processes and results include family, school and community issues [3].

Learning outcomes cannot be isolated from the three parts, namely cognitive, emotional and psychomotor, these three things are criteria that may be used by educators to measure the amount of success of the learning process. In the emotional component, students are tested to what degree they are able to apply learning values to themselves, where this area is directly tied to values and self-concept. In the psychomotor element, pupils are able to apply their information in everyday life by acts or activities. These two items are of course distinct from the cognitive aspect, the purpose of the cognitive component is focused towards thinking abilities which include simpler intellectual talents, especially remembering, to the capacity to solve problems, where this element may be tested via a written exam. So in this research the learning results mainly focus on cognitive elements, the emotional and cognitive aspects are simply supporting [10, 11].

Retention is a condition related to the process of storing information or refers to the level at which material that has been studied is still attached to memory, which is obtained as a stimulus which is then responded to in short-term memory leading to long-term memory [12].

Retention is a crucial aspect in the learning process. The learning process will leave an imprint on a person and will be momentarily kept in his memory. The crucial function of memory in the learning process is not only represented in the dimensions of memory, but more in the dimensions of critical thinking, learning, linking, remembering and employing all the knowledge and talents that have been obtained [13]. Strong memory or retention means that what students know will be stored in long-term mem-

ory. Students who have weak retention can have a negative impact on their learning outcomes [14].

One of the main materials in chemistry subjects is salt hydrolysis. The concept of salt hydrolysis is a difficult concept for upper secondary students. This is caused by the many concepts that are abstract and interconnected using previous concepts. The characteristic of salt hydrolysis material is that it requires basic knowledge of ionization reaction equations and solution stoichiometry, so it requires students to have a good understanding of the concept. Based on the findings of observations, it suggests that kids who comprehend simple concepts well would quickly learn more complicated topics. However, the bulk of students have trouble learning chemistry ideas owing to the basic lack of thorough grasp of early chemical concepts. This is what occurs throughout the learning process.

The Interpellation learning model is a learning paradigm that was developed and is an abbreviation for the Guided Inquiry learning model with Multiple Representations [15–17]. The interpellation learning model consists of 4 stages, namely the orientation and identification stage, exploration stage, reconceptualization stage and application stage, developed with the following objectives 1). Facilitates conceptual change (facilitates shifting conceptions and reducing student misconceptions). 2). Strengthen student retention of the concepts they have learned. 3). Students can communicate well. 4). Students can work together in groups and respect each other's opinions. 5). Growing students' interest in learning and changing their misconceptions.

The Guided Inquiry-oriented Learning Model with Multiple Representations has consistency in tasks related to managing the learning environment. During learning, the teacher restructures the learning environment quite strictly, pays attention to the academic focus and hopes that students become diligent observers and participants. By implementing the Guided Inquiry learning model with multiple representations, it is hoped that students will try to form and restructure their concepts. This process requires students' ability to connect chemical concepts through macroscopic, submicroscopic and symbolic representations [17, 18].

The existence of this learning model can provide an opportunity for each student to be able to convey learning concepts using various representations without being monotonous in one representation. The Interpellation learning model is considered appropriate, because it suits the characteristics of salt hydrolysis material.Apart from that, Guided Inquiry learning with Multiple Representations is based proven effective in reducing misunderstanding of learning concepts, Learning by interconnecting multiple representations can reduce misconceptions. The adoption of suitable learning models can support the growth of students' pleasure of classes, boost students' learning motivation and make it simpler for students to grasp lessons, therefore helping students to attain greater learning outcomes [19, 20].

2 Method

Experimental study studies how specific therapies influence people in controlled conditions. This study comes under this sort of research [21]. Pretest-posttest control group design was the design of this investigation. Data on students' learning outcomes and

retention on salt hydrolysis material (after test and retention test) were acquired from experimental and control classes. This study was done on 44 students from class XI IPA 1 and XI IPA 2 of SMA Terpadu Wira Bhakti.

To collect data, a test sheet consisting of twenty multiple choice questions for pretest and posttest (cognitive component) as well as a retention test was employed. These questions were delivered to the experimental and control classes similarly. Affective and psychomotor learning outcomes were also measured by observation sheets.

In this research, data collection was carried out using the test method, which aims to measure basic abilities and achievements. The test is carried out three times, namely: 1. The pre-test is carried out before being given treatment, in this case the pre-test is carried out before the learning process begins, which aims to determine the students' initial abilities regarding the material to be studied, 2. The post-test is carried out after being given treatment in terms of This Posttest is carried out after the learning process, which aims to determine students' abilities regarding the material that has been studied. 3. Retention test to determine students' retention of learning material, a retest is carried out two weeks after giving the Posttest, with the aim of determining students' memory abilities. regarding the material that has been given.

Before the instrument is used, a validity and reliability test is carried out. The validity of the test is carried out in two stages, namely through the lecturer (construct validation) and also by validating the test items from the test results to students. Hypothesis testing in this study uses the t test, where the conditions for the t test are that both groups must come from a population that is normally distributed and also has a homogeneous variance, therefore before carrying out the t test it is necessary to carry out a data normality analysis test and also a homogeneity of variance test.

3 Results and Discussion

The research was conducted to determine the effect of the learning model on student learning outcomes and retention. The treated class was class XI IPA 1, which used the Interpellation learning model as the experimental class, while class XI IPA 2 served as the control class, using direct learning. After learning, a post-test was carried out to measure students' cognitive abilities in order to assess their learning outcomes. The post-test results showed an average value of 73.86 for the experimental class and 62.27 for the control class. Additionally, the retention results showed an average value of 68.18 for the experimental class and 48.86 for the control class.

For greater clarity, the average learning outcomes and retention of experimental and control class students are presented in the following Figure 1.

Students' learning results (cognitive component) are determined by their average score in the retention exam. Students' preparation for the retention exam influences this result, as this study did not treat the experimental or control class following the test. This is because one technique to strengthen the ability to recall is to keep or repeat the content delivered. Another influencing factor is that there is no information that a retention test will be held with the aim that the retention test results obtained in this research are based on students' knowledge of the material stored in students' long-term memory. Where the experimental class which used the Interpellation learning model experienced a slight

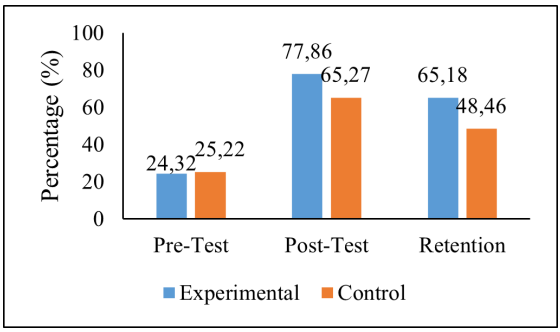

Fig. 1. Graph of the average value of learning outcomes (cognitive aspects) and retention of experimental and control class students

change with a slight difference between the average score resulting from the post-test and also the retention test, in contrast to the control class which used the direct learning model where the average score resulted from post-test and retention test there is quite a big difference or it could be said to have experienced a significant change. This shows that classes using the Interpellation learning model will make students more active, so that the learning material provided is well embedded and helps in using students' memories in learning process situations. This is different from the control class which uses a direct learning model where the average score resulting from the post-test and also the retention test has quite a large difference or can be said to have experienced a significant change. This shows that classes using the Interpellation learning model will make students more active, so that the learning material provided is well embedded and helps in using students' memories in learning process situations. This is different from the control class which uses a direct learning model where the average score resulting from the post-test and also the retention test has quite a large difference or can be said to have experienced a significant change. This shows that classes using the Interpellation learning model will make students more active, so that the learning material provided is well embedded and helps in using students' memories in learning process situations.

As support for learning outcomes in this research, not only cognitive aspects are measured, but affective and psychomotor aspects are also assessed. In the affective and psychological aspects, there were different scores obtained between the two classes. In the affective aspect of presentation, the average value of the overall attitude indicator for students in the experimental class was higher than in the control class, where the experimental class had an average value of 90.62 and for the control class it was 86.9. In the psychomotor aspect (presentation activities) for the experimental class, the average score was 88.64, while for the control class it was 81.8. The two scores for the affective and psychomotor aspects are not much different because the learning model used is the Interpellation model for the experimental class and conventional learning in the control class can be said to be almost the same but the stages are much different, because the Interpellation learning model supports an environment where students are trying to shape and reconstruct material concept. In addition, this process requires students' ability to connect chemical concepts through macroscopic, submicroscopic and symbolic

representations. Therefore, in this case the role of the teacher is to encourage interaction between students and provide opportunities for students to explore their own thought processes, restructure their concepts, explain concepts that have been discovered, and apply these concepts.

Data from the post-test results and the retention test were analyzed using the data normality test, homogeneity of variance test, and the t-test. Based on the results of the data normality test and variance homogeneity, hypothesis testing in this study was calculated statistically using the t-test. For the learning outcomes (post-test), the calculation of hypothesis testing gave a t_{count} value of 3.428 and a t_{table} value at the level $\alpha = 0.05$ with $dk = 42$, which is 1.682. Thus, t_{count} is seen to be greater than t_{table} ($t_{\text{count}} = 3.428 > t_{\text{table}} = 1.682$), so that H_{01} is rejected, meaning that H_{a1} is accepted. The same is true for the data from the retention test, where the t_{table} value at the $\alpha = 0.05$ level with $dk = 42$ is 1.682, while t_{count} is 5.872, thus rejecting H_{02} and accepting H_{a2}.

The use of the Interpellation learning model can create a conducive learning environment, where the learning environment is characterized by democratic processes and active participation of students in learning to achieve mastery of concepts. A conducive learning environment and democratic interpellation learning model is characterized by interactions between students and students and also interactions between students and teachers, where this interaction is created in an atmosphere of group discussions and class discussions. Apart from supporting the growth of cognitive learning, discussions can also create a positive social environment [19]. This learning model was developed with the aim of; Facilitating conceptual change (facilitating shifts in students' conceptions and reduction of misconceptions), strengthen students' retention of the concepts they have learned, students can communicate well, students can work together in groups and respect each other's opinions, and foster students' interest in learning and changing their misconceptions. So that the learning concepts taught will be well ingrained and stored in students' minds for a long period of time.

4 Conclusion

The average value for the experimental class learning outcomes is higher, namely 73.86 and the control class, namely 62.27. Then the data is analyzed using the t test so that the value of $t_{\text{count}} = 3.428$ and $t_{\text{table}} = 1.682$ is obtained, where tcount is greater than ttable, thus rejecting H01 or in other words accept Ha1. The value for retention resulted in an average value for the experimental class of 68.18 and the control class of 48.86, so that when the t test analysis was carried out, the value of $t_{\text{count}} = 5.87$ and $t_{\text{table}} = 1.682$ where tcount was greater than ttable, thus rejecting H_{02} or in other words receiving H_{a2}. So it can be concluded that there is an influence of the Interpellation learning model on learning outcomes and student retention in the material on salt hydrolysis class XI Science at Wira Bhakti Integrated High School.

5 Acknowledgements

Multiple entities have made significant contributions to the successful completion of this research, and we express our gratitude for their valuable support. We extend our

appreciation to the educators and learners of SMAT Wira Bhakti Gorontalo, whose contributions have been crucial to the success of this study.

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