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A JIGSAW TYPE COOPERATIVE LEARNING MODEL ASSISTED BY STUDENT WORKSHEET INFLUENCE ON LEARNING OUTCOMES IN THE CHEMISTRY OF SALT HYDROLYSIS MATERIALS

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ABSTRACT

Despite its popularity, the discovery learning model is not always successful in improving learning outcomes, especially in populations of students with large ability disparities. The group of high achieving students is too dominant and the low achieving group tends to participate less, so they don't get optimal results. Therefore, alternative learning models are needed to encourage class participation. The purpose of this study was to identify the effect of the jigsaw type cooperative learning model using student worksheet on the results of learning chemistry on salt hydrolysis in class XI MIPA students. This research uses a non-equivalent control group design. The application of the jigsaw type cooperative model and discovery learning are used as independent variable and learning outcomes are designated as dependent variable. Samples were taken through the non-probability sampling technique with saturated sampling. Classes XI MIPA 1 and XI MIPA 2 are the experimental class and the control class in this study, respectively. Data collection using pre-test and post-test on the sample class with multiple choice test instruments. Hypothesis testing with the t-test to produce t_{count} 3.48 and with a value of t_{table} 2.01. This data shows that the jigsaw type cooperative model using student worksheet has a significant impact on student learning outcomes as indicated by t_{count} which is greater than t_{table}.

ABSTRAK

Meskipun cukup populer, model *discovery learning* tidak selalu berhasil meningkatkan hasil belajar, terutama dalam populasi peserta didik dengan disparitas kemampuan yang besar. Kelompok peserta didik berprestasi tinggi terlalu dominan dan kelompok berprestasi rendah cenderung kurang berpartisipasi, sehingga tidak mendapatkan hasil optimal. Oleh karena itu, model belajar alternatif diperlukan untuk mendorong partisipasi kelas. Tujuan penelitian ini adalah untuk mengidentifikasi pengaruh model pembelajaran kooperatif tipe jigsaw berbantuan STUDENT WORKSHEET terhadap hasil belajar kimia materi hidrolisis garam pada peserta didik kelas XI MIPA. Penelitian ini menerapkan rancangan *non-equivalent control group design*. Pengaplikasian model kooperatif tipe jigsaw dan *discovery learning* dijadikan variabel independen dan hasil belajar ditetapkan sebagai variabel dependen. Sampel diambil melalui teknik *non probability sampling* dengan sampling jenuh. Kelas XI MIPA 1 dan XI MIPA 2 adalah kelas eksperimen dan kelas kontrol dalam penelitian ini. Pengumpulan data menggunakan *pre-test* dan *post-test* terhadap kelas sampel dengan instrumen tes pilihan ganda. Uji hipotesis dengan uji-t menghasilkan t_{hitung} sebesar 3,48 dan t_{tabel} dengan nilai 2,01. Data ini memperlihatkan bahwa model kooperatif tipe jigsaw berbantuan STUDENT WORKSHEET memberikan dampak yang signifikan terhadap hasil belajar peserta didik yang ditunjukkan oleh t_{hitung} yang lebih besar dari t_{tabel}.

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INTRODUCTION

Internal and external factors can have an impact on student learning achievement. External factors include influences from the school environment, surrounding environment and family environment, while internal factors include biological and psychological components (Suwardi, 2012). One aspect of the school environment that influences students' learning achievement is the choice of model used in classroom learning (Sukarmini *et al*, 2016). Cahyono & Joko (2014), added that one of the external impacts on students' learning skills is the learning model that teachers apply in the classroom.

The results of interviews and direct monitoring of the learning mechanisms carried out by chemistry teachers, it turns out that chemistry teachers have implemented the discovery learning model in the implementation of learning. In fact, from the results of classroom observations, it is known that the application of the discovery learning model has not succeeded in maximizing the level of student involvement in the implementation of learning, the group of high achieving students is too dominant and on the other hand the group of students with low achievement or low ability tends to participate less. Apart from that, using the same learning model repeatedly can make students bored. According to Sihombing & Magdalena (2020), the learning process turns into a process that makes students passive when the same learning model is used consistently. From the Midterm Test results, it is known that the average Midterm Test score for class The majority of students obtained a score below 75 as KKM. Therefore, student learning outcomes are categorized as low.

The topic of salt hydrolysis is covered in the material studied in class XI MIPA. According to Yotiani *et al* (2016), one of the abstract chemistry topics is the topic of salt hydrolysis. Most students consider this material difficult because it must be understood in a short time. Based on interviews with chemistry teachers, students at the research school experienced the same problems.

Based on these problems, the author offers to apply the jigsaw type cooperative learning model as a solution. According to Budiawan (2013), jigsaw type cooperatives are a teaching and learning model that can encourage the emergence of potential in students so that they can be actively involved when learning. Masluchah and Abdullah (2013), the jigsaw type has stages including: (1) explaining the learning objectives and giving students motivation; (2) convey the topic to be studied to students; (3) form home groups with 4-6 people in each group and each group member is given a different sub-topic to study and discuss; (4) students who are given the same sub-topic are instructed to gather to form an expert group to discuss; (5) the sub-topics that have been studied are explained when students return to their home group; (6) students are given an evaluation to determine how much they understand the topics they have studied; and (7) students are given appreciation.

Based on research conducted by Hutabarat and Napitupulu (2015), it is known that the jigsaw type model assisted by student worksheet can maximize student learning outcomes. This view is reinforced by Hariadi *et al* (2019), who state that the jigsaw type has a good impact on learning outcomes because it changes the students' learning system, each student is

given the responsibility to master different sub-topics so that they are encouraged to be involved in the learning mechanism. For this reason, the author intends to carry out research with the title "The Influence of the Jigsaw Type Cooperative Learning Model Assisted by STUDENT WORKSHEET on Chemistry Learning Outcomes on Salt Hydrolysis Material".

METHODS

The planning stage begins in September 2022, while research activities are carried out in February-March 2023. This research was carried out at SMA Negeri 1 Sukamulia which is located on Jl. AMD Sukamulia, District. Sukamulia, Kab. East Lombok, Prov. West Nusa Tenggara.

Experimental research is carried out by providing treatment and observing how students behave to see how the treatment influences their behavior (Indra *et al*, 2015). This research uses a quasi-experimental design. Research that uses a quasi-experimental design does not fully control all external and internal variables or influences that influence research activities (Harefa *et al*, 2022).

The design applied in this investigation was a non-equivalent control group design. The research was carried out in two different classes which functioned as the experimental class and the control class. The population in this study were all students in class XI MIPA in 2 classes. The non-probability sampling method with saturated sampling was used to take samples. Saturated sampling is applied because the entire population is used as a sample. Class XI MIPA 1 was designated as the experimental class and class XI MIPA 2 was designated as the control class. Determination of the sample class is based on the average UTS score. The class with the lowest overall score is designated as the experimental class, namely the class given the treatment and vice versa as the control class.

The learning model applied in the experimental class was a cooperative jigsaw type assisted by student worksheet, while the other sample classes were treated using discovery learning. The following is a description of the research design:

Table 1. Research design

Group	*Pre-test*	Treatment	*Post- test*
Experiment	$T_{1(E)}$	$X_{(E)}$	$T_{2(E)}$
Control	$T_{1(K)}$	$X_{(K)}$	$T_{2(K)}$

All things chosen by researchers to be researched in order to collect data to develop conclusions are included in the research variables (Sugiyono, 2021). Student learning outcomes are the independent variable and the dependent variable is the jigsaw type cooperative model assisted by student worksheet in the experimental class and discovery learning in the control class.

The planning stage, implementation stage, and assessment stage are the three steps that make up this research. Students' cognitive abilities are evaluated using test instruments. The questions on the test instrument are in the form of multiple choices. The instrument created was then tested for validity using Aiken's V, while empirical validity testing using point biserial correlation, and instrument reliability testing using the KR_{20} formula and t_{test} were used to test the research hypothesis, with the condition that the data tested must be normally distributed and

sourced from homogeneous population variance.

RESULT AND DISCUSSION

Six meetings were used to carry out the teaching and learning process in both classes, which also included pre-test and post-test activities. The jigsaw type emphasizes teamwork, each group member is responsible for understanding and being able to explain back to the group (Elida, 2022). Student worksheet is a resource or instruction that contains summaries and instructions to support teaching and learning activities. According to Muslimah (2020), student worksheet is a tool to assist teaching and learning tasks so that productive interactions can be formed between students and teachers. Apart from that, student worksheet can trigger the emergence of students' potential in implementing learning, teach students to identify and improve abilities, and help students in developing concepts.

Students' cognitive abilities are evaluated using the questions that have been given. Multiple choice questions are questions on the test. The expert validity test value using the Aiken's V formula varies from 0.72 to 0.83 based on data analysis findings which show that the instrument is considered very good. The valid instrument was then tested on students other than the sample class, namely class XII MIPA 1.

In accordance with the results of validity calculations, 12 of the 20 pre-test questions were declared valid at a significance level of 0.05 with r_{counts} ranging from 0.46 - 0.69, while 14 of the 20 post-test questions were valid at the same significance level, with r_{counts} ranging from 0.44 to 0.56, and r_{table} 0.43. The valid questions were tested for reliability using the K-R_{20} formula. Furthermore, the 12 pre-test questions that were valid in the reliability test had a reliability value of 0.81 and the reliability value of the post-test questions calculated from the 14 item numbers was also 0.81. The test results provide evidence that the research instrument has very high reliability.

Table 2. Pre-test and post-test results

	Pre-test		*Post-test*	
	Experiment	Control	Experiment	Control
Classical completeness	0%	0%	75%	37,5%
Highest score	50	58	100	93
Lowest score	8	8	57	50
Average score	32,96	34,04	80,50	69,04

Table 2 shows that the post-test classical completeness of the experimental class was higher than the control class and obtained different scores, respectively 75% and 37.5%, even though not a single student in either class achieved classical completeness during the pre-test. . The experimental class outperformed the control class in terms of completeness level, lowest score and highest score.

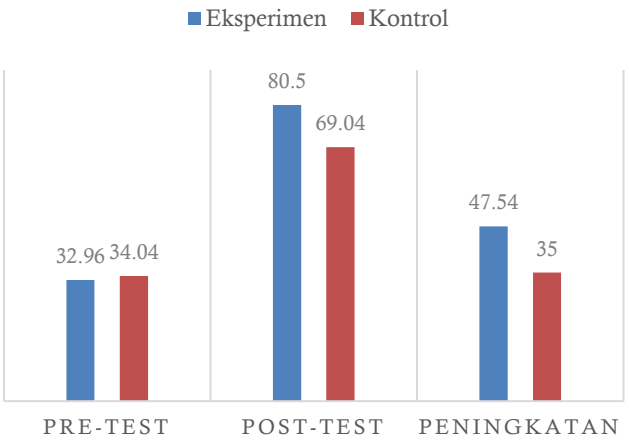

Figure 1. Average value

The graph above shows the control class's average pre-test score which is superior to the experimental class. Even though students are given the opportunity to study independently before taking the pre-test, the pre-test scores of students in both classes are below the minimum completeness criteria because students have not yet mastered salt hydrolysis. The average increase in the two classes was 47.54 (experiment) and 35 (control), respectively.

Students are encouraged to understand and master the topics studied better with the help of their group friends. Nurfitriyanti (2017), found that the jigsaw type could improve students' understanding. Students coordinate with each other and must be united to obtain the assigned material.

The learning scores obtained by students in the class treated with the jigsaw type cooperative learning model were superior to those in the class treated with the discovery learning model as shown in the N-Gain score. From the results of the analysis, the N-Gain scores for the experimental and control classes were 0.71 and 0.52.

Table 3. n-gain score

Class	N-gain score	Criteria
Experiment	0,71	High
Control	0,52	Medium

The discussion phase of the expert team and the return of the expert team to the original group as well as discussions in the original group are stages that can provide good results for optimizing student learning outcomes. Students have the opportunity to share information about sub-topics obtained when discussing in expert groups. In other words, each expert group student is involved in the group discussion process to deepen their understanding of the given sub-topic. Hariadi *et al* (2019), the aim of students returning to their home group is to convey the sub-topics discussed in the expert group. Students must explain what they understand to their home group, this can encourage the emergence of students' potential so that they can understand their sub-topic.

Learning with a jigsaw type model provides a fun learning experience, which can be seen when students are involved and enthusiastic about learning. According to research by Rusyaid & Salim (2021), increasing student involvement is proof that they really enjoy learning with jigsaw type

cooperatives. Apart from that, the learning mechanism becomes simpler with the student worksheet. Muslimah (2020), claims that student worksheet can be used as a guide for carrying out the learning process and can facilitate interaction between students and teachers.

Based on the results of observations, learning implementation in the experimental class tends to be active, while in the control class it tends to be passive. Each student in the experimental class was given a different sub-topic to study and students shared information with each other during discussions in expert groups, the discussion activities became lively. In addition, students are tasked with explaining to other members of their group. According to Hariadi *et al* (2019), it was found that all students participated actively in discussions when the jigsaw type was applied to thermochemical topics because each student was given the responsibility to master different sub-topics. This is done so that students in the experimental class are motivated to participate actively in their learning.

In addition, rewarding students with prizes can inspire them to work harder and cause learning outcomes to improve. Aljena *et al* (2020), who found that rewarding students for good deeds can increase their drive to learn.

The test criteria state that H_0 is rejected while H_a is accepted if $t_{count} > t_{table}$ at a significance level of 0.05, and vice versa. The results of data analysis obtained t_{count} 3.48 and t_{table} 2.01 (with d_k= 46 at a significance level of 0.05). This figure shows that H_0 is rejected while H_a is approved. These findings show that the jigsaw type cooperative model assisted by student worksheet has a significant impact on student learning outcomes. This is in accordance with the findings of Hutabarat & Napitupulu (2015), which show that the use of a jigsaw type model assisted by student worksheet on the subject of hydrocarbons can have a good effect on student learning outcomes. Apart from that, the research findings of Hariadi *et al* (2019) showed that student learning outcomes on thermochemical topics had improved after implementing the jigsaw type cooperative learning model.

Researchers in the experimental class encountered three problems: (1) students and teachers needed time to organize the classroom because there were discussions in the expert team and the home team; (2) students are not yet familiar with the stages of jigsaw type cooperative learning; and (3) there are some class members who have less skills or achievements than their group friends. In response to the problems that occurred, the following things were implemented: (1) the teacher and all class members agreed to fix the classroom first before learning was held; (2) students are given more specific information by the teacher about the stages of the learning model; and (3) teachers provide students who have lower skills with intensive guidance.

Apart from that, researchers also encountered problems in the control class, namely: (1) students tended to be silent or did not respond when asked to identify problems; and (2) during group discussions, the majority of students are passive in discussion activities, those who have high proficiency or skills tend to be too dominant, while those with low proficiency or skills tend to participate less so that only students with high ability are relied on in discussions. In response to these problems the teacher: (1) explains examples to encourage students to more easily identify problems; and (2) the teacher plays a role by being involved in each group to monitor and

ensure that all students are able to be involved and have a role in group discussions.

CONCLUSION

Based on research findings, the application of the jigsaw cooperative learning model assisted by student worksheet has a significant impact on student learning outcomes in the salt hydrolysis material. In contrast to the control class which got an average post-test score of 69.04 and a completion percentage of 37.5%, experimental class students got an average post-test score of 80.5 and a completion percentage of 75%. The increase in score obtained by the experimental class was 47.54 and the control class was 35. The difference in the increase in scores in the two sample classes was 12.54.

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