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Comparison of Learning Outcomes for Acid-Base Materials Using Guided Discovery Models and Guided Inquiry Learning With Buzz Group Discussion Techniques

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ABSTRACT

The learning process using a scientific approach was not carried out effectively during Covid-19, due to time constraints that affected learning outcomes. Therefore, the learning process was carried out using guided discovery and guided inquiry models with buzz group discussion techniques. This study aims to compare student learning outcomes using guided discovery and guided inquiry models with buzz group discussion techniques for acid-base material. This type of research is an experimental study with a randomized posttest-only comparison group design. Samples were taken by random sampling technique, selected class XI IPA 3 as experimental class 1 (guided inquiry) and XI IPA 4 as experimental class 2 (guided discovery). Learning outcomes were obtained from posttest results and data analysis techniques using a t-test. The results of data processing obtained that the learning outcomes in the experimental class 1 (78.38) were higher than the experimental class 2 (74.82) and the t-test analysis was 0.039. Based on the results of data analysis, it was concluded that learning outcomes using guided inquiry and guided discovery models with buzz group discussion techniques for acid-base class XI IPA MAN 1 Bukittinggi were significantly different.

1. Introduction

The Covid-19 pandemic, which has spread to almost all countries in the world, including Indonesia, has had an impact on education. The government provides policies to limit activities outside the home, including in the learning process (Nafrin & Hudaidah, 2021). The Ministry of Education and Culture, research and technology states that areas that fall into the category of Enforcement of Community Activity Restrictions (PPKM) level 4 continue to carry out distance learning (PJJ) while education units in PPKM areas level 1-3 are allowed to hold

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face-to-face learning in accordance with the Joint Decree (SKB).) 4 ministers, namely: (1) the existence of permits from the local government, school principals and parents of students; (2) comply with health protocols; (3) student attendance is limited to 50% of each class; (4) shorter learning time and less material taught. One of the provisions of the 4 ministerial decree is that the learning time is shorter so that the time in the learning process is limited. Time constraints cause the concepts that must be mastered by students are not achieved completely (Pratama & Mulyati, 2020).

The subject matter of SMA/MA Chemistry studied in class XI even semesters is acid-base material. This material consists of the concept of acid-base, acid-base indicators, pH of strong acids, strong bases, weak acids and weak bases (Kemendikbud, 2017). Acid-base material competence requires students' understanding of previous concepts such as chemical equilibrium, chemical reactions, stoichiometry and chemical bonds (Zainuddin Muchtar, 2012). Mastery of acid-base materials is very necessary, if there is a misunderstanding on acid-base materials it will have an impact on further chemical materials such as salt hydrolysis materials, buffer solutions (Orgill & Sutherland, 2008) and acid-base titrations (Sheppard, 2006). The learning process based on the 2013 curriculum which emphasizes learning using a scientific approach needs to be implemented to achieve basic competencies in acid-base material. Two of several learning models that are in accordance with the scientific approach are Guided Discovery Learning and Guided Inquiry Learning.

The Guided Discovery Learning model is a learning process that can improve student learning outcomes by activating students during the learning process. In the learning process, students are given a problem or fact in everyday life related to the related material at the beginning of learning, not only given the concept directly, so that students are able to conclude their own knowledge (Kosasih, 2014). The teacher helps students in the process of discussion and question and answer and familiarizes students with systematic thinking in concluding their knowledge. This learning model provides direct guidance to students in finding knowledge, with teacher guidance it is expected that students are able to understand the learning material well (Sumarniti NN, Arcana IN, 2014).

The Guided Inquiry Learning model is a learning process designed to foster a desire to learn by activating students in discovering their own knowledge. The teacher opens learning by providing problems or facts related to the related material. The teacher guides students with questions that guide students to solve the problem. Students are directed to discuss or ask questions in finding solutions to the problems given so that they are able to conclude the knowledge gained. To strengthen the concepts that have been obtained, one way is applied in this model so that students are able to conclude the knowledge obtained independently by working on practice questions that are relevant to the related concepts (Sofiani, 2011). This learning model requires students to be more active in the learning process (Hanson, 2005). However, these two models take quite a lot of time in the learning process (Erman Suherman, 2003); (Prathama et al., 2017). Therefore,

learning using a scientific approach is not carried out effectively during the Covid-19 pandemic (Sari et al., 2021).

The learning process using a scientific approach is also not implemented in several areas in West Sumatra. Based on the results of the questionnaire analysis distributed via Google Form to 13 educators at 8 schools in Padang, Bukittinggi, and Solok stated that 66.7% of the scientific approach in the learning process was not implemented during the Covid-19 pandemic due to time constraints in the learning process. which is only 35 minutes in one hour lesson, so 80% of teachers have difficulty using a scientific approach in the learning process. The learning outcomes of students showed that during the pandemic, especially in acid-base materials, there was a decrease of 61.5% when compared to before the Covid-19 pandemic.

Time constraints in the learning process must be overcome in various ways, one of which is using discussion techniques. The discussion technique that is suitable for both models is the buzz group discussion technique. According to (Sudjana, 2005) the Buzz Group discussion technique is a technique used in learning activities carried out through discussion in small groups consisting of 3-6 people. (Suarjana & Garminah, 2014). This buzz group technique is an alternative to be used in the learning process, because this discussion technique is centered on student activities, the teacher acts as a facilitator whose job is to guide students, direct and condition the group discussion situation. running as expected so that discussion activities do not take long and activities after the discussion are carried out (Arif & Muchlash, 2021).

The advantages of the buzz group discussion technique in the learning process are that students become active, fun, respect the opinions of friends, make it easier for students to express opinions and foster confidence in conveying information and asking questions (Azis et al., 2016). In buzz group discussions, small groups carry out short discussion activities about parts of the problems faced by large groups. Through these discussions, students will help each other so that the learning carried out will be more enjoyable. This discussion technique will activate students, explore the activities of students cognitively, affectively and psychomotor (Sudjana, 2005).

This study aims to compare the learning outcomes of students who study using the guided discovery learning model with the buzz group discussion technique and the guided inquiry learning model with the buzz group discussion technique.

2. Methodology

This type of research is an experimental research conducted on students of class XI IPA MAN 1 Bukittinggi City in the 2021/2022 academic year. Sampling was done by simple random sampling technique after the population was known to be normally distributed and homogeneously varied. The design of this study was a

randomized posttest-only comparison group design, with a research design as shown in Table 1.

Table 1. Research Design

Subject	Treatment	Measurement
Experiment Class 1	X ₁	O ₁
Experiment Class 2	X ₂	O ₂

(Sukmadinata, 2009).

Information :

X₁ = Guided Inquiry model with buzz group discussion technique

X₂ = Guided Discovery model with buzz group discussion technique

O₁ = *posttest* Experiment Class 1

O₂ = *posttest* Experiment Class 2

At the implementation stage, the two classes used as the experimental class were given different learning models, namely the experimental class 1 learned to use the Guided Inquiry model with the buzz group discussion technique and the experimental class 2 learned to use the Guided Discovery model with the buzz group discussion technique. At the end of the lesson, a test of learning outcomes was given with the same questions for both experimental classes.

The research instrument used was a chemical structured essay diagnostic test (SEDToC) which was developed by Nurmaya (2021) consisting of 59 questions. The implementation of the final test (posttest) was attended by 78 students, 39 students from experimental class 1 and 39 students from experimental class 2. The learning outcomes of the two experimental classes were tested for normality, homogeneity of data variance and independent t-test (t-test) with a significance level of = 0.05. The conditions for testing the hypothesis are accepted if the significant value is < 0.05 or $t_{\text{count}} > t_{\text{table}}$. The test was carried out using the help of SPSS Statistics 25.

3. Results and Discussion

The learning activities in this study were carried out for five meetings. The learning model used in the experimental class 1 uses a guided inquiry learning model with buzz group discussions and experimental class 2 uses a guided discovery learning model with a buzz group discussion technique. At the first meeting, students discussed the concept of acid-base according to the Arrhenius, Bronsted-Lowry, and Lewis theories. The second meeting of students discussed the nature of acids and bases, the third and fourth meetings of students discussed the strength of acids and bases, the fifth meeting of students conducted experiments on the pH change trajectory of several indicators. At the sixth meeting, a final test was conducted to obtain student learning outcomes using a chemical structured essay diagnostic question (SEDToC) on acid-base material that had been developed by Fitriza & Nurmaya (2021).

The learning process for the experimental class 1 in this study used a guided inquiry learning model with a buzz group discussion technique, the first stage was orientation. In this activity, students were given motivation to create new knowledge of students by linking it with previous knowledge and conveyed learning objectives and indicators to be achieved. to see the success of the teaching and learning process.



Figure 1. Learning Process

The second stage is exploration, at this stage the opportunity is given to students to make observations and investigations. Students are guided in finding concepts by observing the models provided and answering key questions in the LKPD by discussing with group members. At this stage the buzz group discussion technique began to be implemented, structured discussion activities for each group consisted of 5-6 people, group discussion activities were coordinated so that group discussions could run well and on time. The third stage is concept formation, at this stage students explore models or information with key questions given, students are guided and encouraged to explore. The application stage, at this stage students are given in the form of exercises and questions, exercises are given to increase students' self-confidence from the concepts obtained during exploration and concept formation. The exercises given are in the form of questions contained in the LKPD, students can answer them by discussing among group members. The teacher participates in guiding each group in completing the given exercise, and warns each group two minutes in advance that the time for doing the exercises is almost over. The fifth stage is closing, in this stage small groups gather into large groups, allowing one small group representative to convey the results of their discussions with a limited time that has been determined for each acid-base topic, another group is tasked with responding and summarizing the results of the large group discussion. Furthermore, students are able to conclude their findings.

In the learning process of experimental class 2 in this study using a guided discovery learning model with a buzz group discussion technique, the first stage is motivation and problem presentation, in this activity the teacher acts as a facilitator for students to carry out observation activities by being given problems, then the teacher motivates participants learn to discover their own knowledge. The

second stage is data collection, at this stage students collect data from various sources to prove the formulated hypothesis. At this stage the buzz group discussion technique began to be implemented, structured discussion activities for each group consisted of 5-6 people, group discussion activities were coordinated so that group discussions could run well and on time.

The third stage is data processing, at this stage students discuss with group members to solve the questions in the LKPD. The teacher participates in guiding each group in completing the given exercises until new knowledge is obtained, and warns each group two minutes in advance that the time for doing the exercises is almost over. The fourth stage is proof, in this stage small groups gather into large groups, allowing one small group representative to present the results of their discussions with a limited time that has been determined for each acid-base topic, another group is tasked with responding and summarizing the results of the large group discussion. Furthermore, in the fifth stage students are able to conclude what is obtained.

In the learning process, discussion activities are carried out with a predetermined time limit depending on the topic of the material being studied. The time limit in the discussion process is carried out so that learning in a short time during the Covid-19 pandemic which is only 35 minutes in one hour of lessons can take place well.

Learning Outcomes

Collecting research data that has been carried out, obtained student learning outcomes at the end of learning. Data on learning outcomes for experimental classes 1 and 2 are shown in Table 2. The final test (posttest) was conducted to obtain the learning outcomes of students who learned to use the learning model that had been determined for each sample class. The posttest scores for the two sample classes can be seen in Table 2. The posttest scores for the experimental class 1 used the guided inquiry learning model with the buzz group discussion technique with an average of 78.38 and the average value for the experimental class 2 using the guided discovery learning model with discussion techniques. the buzz group is 74.82. There are differences in learning outcomes of the two sample classes, the average value of the experimental class 1 is higher than the average value of the experimental class 2.

Table 2. Final Test Values for Experiment Class 1 and Experiment Class

Class	Lowest Value	The Highest Score	Average
Experiment Class 1	66	93	78,38
Experiment Class 2	61	88	74,82

Data Analysis

The research data for the final test (posttest) was processed and analyzed to obtain conclusions. Prior to the analysis, the data was tested for normality and homogeneity based on the values obtained from student learning outcomes.

Furthermore, hypothesis testing was carried out with an independent t-test (t-test) to see a comparison of the learning outcomes of students in the experimental class 1 and the experimental class 2.

Normality Test

Normality test for both classes of samples was carried out using the Kolmogorov-Smirnov test. This test aims to see whether the sample comes from a population that is normally distributed or not. The test data is normally distributed if the significant value obtained is more than the real level ($\alpha = 0.05$). Based on the results of the normality test for the experimental class 1, a significant value was obtained, namely 0.090 while the significant value for the experimental class 2 was 0.069. From the results obtained, the significant value of the sample class > 0.05 so that it can be concluded that the test data of the two samples were normally distributed. The results of the sample normality test for student learning outcomes can be seen in Table 3.

Table 3. Normality Test Results

Group	Kolmogorov-Smirnov ^a			Shapiro-Wilk			
	Statistic	df	Sig.	Statistic	df	Sig.	
Posttest	Guided Inquiry	.131	39	.090	.949	39	.078
	Guided Discovery	.135	39	.069	.963	39	.226

a. Lilliefors Significance Correction

Test of Homogeneity of Variance

The homogeneity test of two variances was conducted to determine whether the two sample class test data had homogeneous variances or not. The test results show that the significant value obtained is greater than the predetermined ($\alpha = 0.05$) which is 0.357. It can be concluded that the sample data has a homogeneous variance. The results of data analysis can be seen in Table 4.

Table 4. Variance Homogeneity Test Results

Posttest		Levene	df1	df2	Sig.
		Statistic			
	Based on Mean	.858	1	76	.357
	Based on Median	.548	1	76	.461
	Based on Median and with adjusted df	.548	1	73.887	.461
	Based on trimmed mean	.850	1	76	.359

Hypothesis Test

From the results of the analysis of the normality test and homogeneity test, it is known that the two experimental classes are normally distributed and have homogeneous variance. Therefore, the hypothesis test is carried out using the similarity test of two averages (t-test) with the test criteria: If the significant value is $< 0.05 / t_{\text{count}} > t_{\text{table}}$ then H_a is accepted and H_o is rejected and if the significant value is $> 0.05 / t_{\text{count}} < t_{\text{table}}$ then H_a is rejected and H_o is accepted. Based on the

results of data analysis, it was obtained that hypothesis testing on learning outcomes (posttest) can be seen in Table 5.

Table 5. Hypothesis Test Results

		Levene's Test for Equality of Variances					t-test for Equality of Means		95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig.(2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Posttest	Equal variances assumed	.858	.357	2.097	76	.039	3.564	1.700	.178	6.950
	Equal variances not assumed			2.097	74.964	.039	3.564	1.700	.178	6.951

Table 5 shows the results of the t-test, obtained a significant value of 0.039, t_{count} (2.097) > t_{table} (1.991). Then H_a is accepted and H_o is rejected. This shows that the learning outcomes of students who use guided inquiry learning and guided discovery learning with the buzz group discussion technique for acid-base class XI IPA MAN 1 Bukittinggi City are significantly different.

4. Conclusion

Based on the results of the study, it can be concluded that there are significant differences in student learning outcomes using the guided discovery and guided inquiry models with the buzz group discussion technique. The learning outcomes obtained by the experimental class 1 (78.38) and the experimental class 2 (74.82). The learning outcomes of the two classes in this study revealed a significant difference. This is supported by the t-test analysis which obtained a significant value of 0.039 and t_{count} (2.097) > t_{table} (1.991).

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