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Differences in Learning Outcomes and Critical Thinking Skills of Students Taught with Discovery Learning Model and Probleam Based Learning Assisted with Powerpoint Media on Acid-Base Material

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Abstract: Difference in the learning objectives and critical thinking skills of students instructed utilizing the discovery learning model and the problem-based learning strategy, with support from PowerPoint presentations on acid-base content. The purpose of this study is to evaluate students' critical thinking abilities and learning results**.** instructed in problem-based learning with PowerPoint presentations on acid-base topic versus the discovery learning model. We refer to this type of research as a quasi-experiment. Every pupil in class XI IPA SMA S Markus Medan and samples from classes The study's population consisted of two individuals, XI IPA 1 and XI IPA 2, were chosen using total sampling. The study's conclusions showed that students' learning outcomes and ways of thinking differed depending on whether they were taught using DL or PBL approaches. In the first experimental class, students' average learning result was 80.00, while the average for individuals in experimental class II was 76.56. The students in the Experiment I class (79.88) and the Experiment II class (76.63) are then shown for their mean critical thinking scores. The correlation test between learning results and critical thinking abilities among students taught using the DL model is 0.667, whereas students taught using the PBL paradigm has a 0.365 correlation test.

Keywords: Discovery Learning, PowerPoint, learning outcomes, problem-based learning, and critical reasoning skills.

Abstrak: Tujuan penelitian adalah untuk membandingkan kemampuan berpikir kritis dan hasil belajar siswa yang diajar tentang asam basa dengan menggunakan media PowerPoint yang didukung model problem based learning dan Discovery Learning. *Penelitian ini melibatkan perbandingan kedua gaya mengajar dan menilai dampaknya terhadap keterampilan berpikir kritis siswa dan hasil belajar. Penelitian dilakukan dengan metode quasi eksperimen dan mengikutsertakan seluruh siswa XI IPA SMA S Markus Medan sebagai populasi, dengan sampel terdiri dari siswa XI IPA 1 dan XI IPA 2 yang dipilih dengan menggunakan teknik full sampling. Temuan penelitian menunjukkan bahwa siswa yang diajar menggunakan model DL dan PBL menunjukkan kapasitas kognitif dan hasil belajar yang berbeda. Rata-rata hasil belajar siswa pada kelas eksperimen I sebesar 80,00, sedangkan rata-rata hasil belajar siswa pada kelas eksperimen II sebesar 76,56. Selain itu disajikan pula rata-rata nilai berpikir kritis siswa pada Kelas Eksperimen I (79,88) dan Kelas Eksperimen II (76,63). Selanjutnya penelitian menemukan koefisien korelasi sebesar 0,667 antara hasil belajar dengan kemampuan berpikir kritis pada siswa yang diajar dengan model DL koefisien korelasi berbeda pada siswa yang diajarkan dengan paradigma PBL uji korelasi sebesar 0,365.*

Kata kunci: *Discovery Learning, PowerPoint, hasil pembelajaran, pembelajaran berbasis masalah, dan kemampuan berpikir kritis.*

▪ INTRODUCTION

A branch in the realm of Natural Sciences (IPA) that highlights conceptual, regulative, legal, principle, and theoretical aspects is the field of study of chemistry (Panggabean et al., 2022). Chemistry has abstract and complex concepts that are tough for some students to learn and comprehend (Andriani et al., 2019). Acid-base material is regarded as sophisticated since it involves mathematics, intricately linked material, and a profound comprehension of concepts (Utami et al., 2020).

Based on observations carried out at SMA Swasta Markus Medan, it is known that the chemistry learning process is still monotonous in the form of lectures. Teachers still do not utilize a variety of learning media, They continue to use printed books from the education office as their only source of instructional materials. Therefore, the learning process is often felt boring by students, causing difficulties in understanding the material which has little effect on the academic success of students. This can be seen from the available information which shows that students still have scores below the KKM, which is 70. In class X1 IPA 1, the percent of passing midterm tests is 25% while for class XI IPA 2 it is 19%, where these results are still far from the expected number of completeness. Critical thinking abilities of students are also still not optimally empowered in schools so that developing critical thinking abilities is necessary.

Learning models able to utilized to grow students' critical thinking skills and increase their gaining knowledge achievement to the maximum. The Discovery Learning model is one of the learning models that can be used. While learning, students who use the Discovery Learning approach acquire data in the form of materials and multimedia with learning objectives in mind (Egolum & Igboanugo, 2019). The discovery learning model requires students to actively produce ways of solving problems, the teacher is only a guide and is useful in strengthening students' self-confidence because of cooperation with others (Jayadiningrat et al., 2019).

It is also believed that by employing the problem-based learning approach, learning objectives and critical thinking abilities will be attained. The problem-based learning approach places a strong emphasis on students taking an active role in solving group problems and getting to a conclusion by identifying the necessary actions.(Permatasari et al., 2019). In PBL learning, The instructor just offers direction and aids pupils in their educational journey while students are active in finding ways to solve the problems given (Pinem et al., 2023).

In encouraging learning activities at school, learning media is very important. According to Fadilah et al. (2023), One tool that may be used to maximize and enhance the learning process is learning media. PowerPoint is one type of instructional tool that can be utilized in the classroom. Using PowerPoint materials can result in student learning objectives and is more effective in its application because it has an attractive presentation design, be it pictures, videos, animations and so on, making students not bored (Wulandari, 2022).

Numerous studies that touch on the area of study that can be conducted were found based on the explanation of earlier research. According to research by Nugrahaeni et al. (2017), using the discovery learning technique can help students learn more effectively and develop their critical thinking skills. Using problem-based learning and discovery learning models will improve students' critical thinking abilities, per research by Pasaribu et al. (2020) and learning objectives.

According to this explanation, the researcher plans to conduct research on " Disparities Between Problem-Based and Discovery Learning in Student Learning Outcomes and Critical Thinking Skills Models with Support from PowerPoint Media on Acid-Base Material".

▪ METHOD

Quantitative research with a quasi-experimental approach is being conducted here. Research with numbers is a research approach that is based on the philosophy of positivism and is considered a scientific or scientific method because it follows concrete or empirical, measurable, rational and systematic scientific principles (Sugiyono, 2019). Students from SMA Swasta Markus Medan comprised the study's population. Selected using complete sampling, the samples consisted of 32 students from each of the The two classes are XI IPA 1 and XI IPA 2.Problem-based learning and discovery learning were the experimental learning models that were employed to instruct the first and second experimental classes, respectively. The three actions involved in this research process are as follows: First step of preparation: observation, creating lesson ideas, setting up and verifying media and equipment. 2) selecting the sample, administering pretests, putting learning into practice, administering posttests, and 3) processing, analyzing, and deriving conclusions comprise the implementation step.

The test instrument utilized consists of up to 20 multiple-choice questions to gauge student learning objectives and up to 5 essay questions to gauge students' capacity for critical thought. Following that, the test instrument's Analysis is done on the degree of difficulty, validity, dependability, and discriminating power. The three components of the data analysis technique are homogeneity, normalcy, and hypothesis testing. For assessing hypotheses, two-party t tests and correlation tests are employed.

▪ RESULT AND DISCUSSION

1. Learning Outcome Data

Learning outcome data is obtained from pretest results obtained before learning and posttest data obtained after learning. Table 1 below provides statistical information on learning outcomes.

Table 1. Statistics on the Learning Outcomes of Students

Data	Statistical	Class	
		Experiment I	**Experiment II**
Pretest	Total	1200	1195
	Average	37,50	37,34
	Standard Deviation (S)	7,73	7,18
	variance(S^2)	69,68	51,59
Posttest	Total	2560	2450
	Average	80,00	76,56
	Standard Deviation (S)	6,35	7,23
	Variance (S^2)	40,32	52,32

It is determined from the preceding table that the experimental classes I and II pretest values are 37.50 and 37.34, respectively. In experimental class I, the posttest value

was 80.0, while in experimental class II, it was 76.56. The average learning outcomes increased for both classes.

2. Critical Thinking Ability Result Data

Information about critical thinking abilities derived from pretest and posttest findings. Table 2 below provides statistical information on the learning results of students.

Table 2. Statistical Data on Critical Thinking Ability Results

Data	Statistical	Class	
		Experiment I	**Experiment II**
Pretest	Total	1212	1200
	Average	37,88	37,50
	Standard Deviation (S)	4,98	5,05
	variance(S^2)	24,76	25,55
Posttest	Total	2556	2452
	Average	79,88	76,63
	Standard Deviation (S)	6,70	5,48
	Variance (S^2)	44,89	30,05

The pupils' capacity for critical thought was assessed by examining the data in the table above, specifically the pretest values of 37.88 and 37.50 in courses I and II for experimentation. Experimental classes I and II had posttest scores of 79.88 and 76.63, respectively.

3. Normality Test of Learning Outcome Data

The Chi Square test was used to determine normality at a At the α= 0.05 is the significance level. The test results are shown in the following Table 3:

Table 3. The Normalcy Test Results for the Student Learning Outcomes Data

Class	Data	X^2_{count}	X^2_{table}	a	Description
Experiment I	Pretest	7,471	11,07	0,05	Normal
	Posttest	10,751			
Experiment II	Pretest	5,526	11,07	0,05	Normal
	Posttest	7,601			

It may be inferred from the following table that there is a normal distribution of experimental classes I and II's pretest and posttest results.

4. Normality Test of Critical Thinking Ability Data

The critical thinking ability data's normalcy test results are displayed in Table 4 below:

Table 4. Results of the Critical Thinking Ability Normalcy Test: Result Data

Class	Data	X^2_{count}	X^2_{table}	a	Description
Experiment I	Pretest	6,682	11,07	0,05	Normal
	Posttest	10,776			
Experiment II	Pretest	4,272	11,07	0,05	Normal

	Posttest	7,651		

Considering the above table, it is obtained that Results of the pretest and posttest for experimental classes I and II are routinely disseminated.

5. Homogeneity Test of Learning Outcome Data

The testing of the learning outcomes data for The results of experimental classes I and II are displayed in Table 5:

Table 5: Student Learning Outcome Data Homogeneity Testing

Data	Variance	Fcount	Ftable	Description
Pretest	59,68	1,157	1,882	Homogeneous
	51,59			
Posttest	40,32	1,298	1,882	Homogeneous
	53,32			

6. Critical Thinking Ability Data Homogeneity Test

Table 6 below displays the results of the critical thinking proficiency homogeneity test for experimental classes I and II.

Table 6. Data from the Test of Critical Thinking Homogeneity Ability

Data	Variance	Fcount	Ftable	Description
Pretest	24,76	1,032	1,882	Homogeneous
	25,55			
Posttest	44,89	1,494	1,882	Homogeneous
	30,05			

7. Hypothesis Testing

For assessing hypotheses, two-party t tests and correlation tests are employed. The subsequent is an explanation of the test hypothesis.

Table 7. Test of Hypothesis I: Learning Outcomes

Class	$\underline{X}$	Variance	T_{count}	t_{table}	⟨	Description
Test I	80,00	40,32	2,020	1,999	0,05	Ho is rejected,
Experiment II	76,56	53,32				Ha is accepted

The previous table makes it clear that Ha is accepted and Ho is rejected when the value of tcount > ttable (2.020 >1.999). In other words, there's a big difference between

what kids learn when they're taught Acid-Base subject using the Discovery Learning approach and when they study it using Problem-Based Learning with the support of PowerPoint media.

Table 8. Hypothesis Test II (Critical Thinking Ability)

Class	$\underline{X}$	Variance	T_{count}	t_{table}	⟨	Description
Test I	79,88	44,89	2,124	1,999	0,05	Ha is accepted,
Testt II	76,63	30,05				Ho is refused.

The previous table clearly shows that Ha is approved and Ho is refused when t t table (2.124> 1.999)> count. That is to say, there are significant differences between the ways in which Acid-Base content is taught through PowerPoint presentations in the Discovery Learning technique and Problem-Based Learning in terms of the critical thinking skills that are taught.

Table 9. Hypothesis Test III

Class	R_{count}	R_{table}	a	Conclusion	Description
Experiment I	0,667	0,349	0,05	Ho is rejected, Ha is accepted	Powerful

The above table clearly shows that Ha is approved while Ho is refused when rcount > rTable (0.667 > 0.349). In other words, there's a substantial and favorable correlation between the learning outcomes that the Discovery Learning approach teaches and PowerPoint on acid-base content, with a 45% contribution from students' critical thinking skills.

Table 10. Hypothesis Test IV

Class	R_{count}	R_{table}	a	Conclusion	Description
Experiment II	0,365	0,349	0,05	Ho is rejected, Ha is accepted	Low

It is evident from the above table that when rcount> rTable (0.365> 0.349), Ha is approved while Ho is refused. That is to say, there is a strong and positive relationship between the learning objectives imparted through using problem-based learning model and PowerPoint on acid-base content, with a 13% contribution from students' critical thinking skills.

Two experimental classes with various treatments were used in this investigation. PowerPoint media helped teach a discovery learning model to experiment class I, while PowerPoint media helped teach a problem-based learning model on acid-base material to experiment class II.

Hypothesis Test I was carried out with independent hypothesis test using one sample t-test. Because t count (2.020) > t table (1.999), accepting Ha and rejecting Ho, the test results acquired the value. This implies that there is a significant difference in the learning outcomes between the discovery learning methods and pupils taught acid-base issues using PowerPoint presentations. The average posttest score in experimental class I

was 80.00. Conversely, experimental class II had an average posttest score of 76.56. This is consistent with research by Gani et al. (2021) showing that learning outcomes taught through problem-based learning had an average value of 74 and those taught through discovery learning had an average value of 83.

The price of The critical thinking abilities of students taught utilizing the discovery learning approach and those taught problem-based learning with PowerPoint media help on acid-base subject varied markedly. The results of testing hypothesis II (t count> t table (2.124> 1.999) lend credence to the rejection of Ho and the acceptance of Ha. In experimental class I, the average critical thinking score is 79.88. The average critical thinking score for experimental class II was 76.63. The results of the study show that students in experimental class I, where the problem-based learning paradigm is applied, have a stronger critical thinking ability than students in experimental class II used aid of PowerPoint presentations on acid-base learning.

Hypothesis III test is conducted to see if The critical thinking abilities of pupils and learning results are significantly and favorably correlated. When rcount> rTabel (0.667> 0.349) is the correlation test result, Ha is approved and Ho is refused. That is, academic outcomes taught using the Discovery Learning paradigm, which uses PowerPoint on acid-base material, have a strong and positive link with students' critical thinking abilities. The importance of r = 0.667 shows a strong category association of 45% with the role that critical thinking abilities play in learning outcomes. This result is in line with research conducted in the Discovery Learning paradigm by Dahlan et al., (2023), which discovered a link between student learning outcomes and critical thinking abilities where the value r = 0.853 was included in the high category.

According to the findings of the hypothesis IV test, rcount> rTabel (0.365> 0.349), which means that Ho is accepted and Ha is rejected. That is to say, there is no appreciable and positive correlation between the students' critical thinking abilities and the learning objectives taught utilizing the Problem Based Learning approach with the use of PowerPoint on acid-base material. The value of shows a low category correlation of 13% between critical thinking skills and learning outcomes r = 0.365.

▪ CONCLUSION

Considering the study that was done, it might be said that problem-based learning supported by PowerPoint media on acid-base materials and the discovery learning model affect students' capacity for critical thinking and learning results in different ways. Then, there is a connection between problem-based learning and the learning objectives taught using the discovery learning model with the use of PowerPoint media and students' critical thinking abilities.

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