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THE INFLUENCE OF PROBLEM BASED LEARNING AND DISCOVERY LEARNING ASSISTED WITH ANIMATED VIDEO MEDIA ON STUDENTS' SCIENTIFIC LITERACY CAPABILITY ON CHEMICAL EQUILIBRIUM MATERIALS

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ABSTRAK

Tujuan penelitian ini adalah apakah ada peningkatan dan perbedaan kemampuan literasi sains siswa yang dibelajarkan dengan model *Problem Based Learning* dengan model *Discovery Learning* berbantuan media video animasi pada materi kesetimbangan kimia. Populasi penelitian ini adalah seluruh siswa kelas XI IPA. Teknik pengambilan sampel dilakukan secara *purposive sampling,* diperoleh kelas XI IPA 5 berjumlah 34 siswa sebagai kelas eksperimen I dan XI IPA 6 berjumlah 36 siswa sebagai kelas eksperimen II. Hasil kemampuan literasi sains siswa yang dibelajarkan dengan model *Problem Based Learning* mengalami peningkatan dengan nilai rata-rata dari 47,05 menjadi 82,94, begitu juga dengan hasil kemampuan literasi sains siswa yang dibelajarkan dengan model *Discovery Learning* yaitu dengan nilai rata-rata 44,17 menjadi 79,94. Melalui uji hipotesis menggunakan *Independent Sample T-Test* dengan prasyarat normalitas dan homogenitas , diperoleh nilai *Sig.(2-Tailed)* sebesar 0,024. Maka nilai 0,024 < 0,05 sehingga Ha diterima. Hasil penelitian ini menunjukkan ada perbedaan kemampuan literasi sains siswa yang dibelajarkan dengan model *Problem Based Learning* dengan model *Discovery Learning* berbantuan media video animasi pada materi kesetimbangan kimia.

ABSTRACT

The aim of this research is to determine whether there is an increase and difference in the scientific literacy abilities of students who are taught using the Problem-Based Learning model and the Discovery Learning model assisted by animated video media on chemical equilibrium material. The population of this study was all students in class XI Science. The sampling technique was carried out using purposive sampling, resulting in class XI IPA 5, totaling 34 students, as experimental class I and XI IPA 6, totaling 36 students, as experimental class II. The results of students' scientific literacy abilities taught using the Problem-Based Learning model have increased with an average value from 47.05 to 82.94, as well as the results of students' scientific literacy abilities taught using the Discovery Learning model, namely with an average value of 44. 17 to 79.94. Through hypothesis testing using the Independent Sample T-Test with the prerequisites of normality and homogeneity, a Sig (2-tailed) value of 0.024 was obtained. So the value 0.024 < 0.05, so Ha is accepted. The results of this research show that there are differences in the scientific literacy abilities of students taught using the Problem-Based Learning model and the Discovery Learning model assisted by animated video media on chemical equilibrium material.

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INTRODUCTION

Education is an effort to improve the quality of each person, both directly and indirectly. This quality improvement can be known as personality change, increased knowledge, attitudes, habits, and skills (Hidayah & Pujiastuti, 2016). Learning activities are an important part of the educational process. Learning activities are defined as activities carried out by educational institutions in implementing the curriculum with the aim of encouraging students to achieve predetermined academic goals. Learning implementation plans (RPP), models, and learning media are learning tools that are needed in addition to the curriculum (Makhrus et al., 2019). One of the learning activities that students consider difficult is chemistry learning activities. Chemical material that is considered difficult is chemical equilibrium because this material has complex concepts consisting of defined concepts, abstract concepts, mathematical calculations, and graphs, so this material falls into the submicroscopic category. Apart from that, chemical equilibrium material is closely related to everyday life, so students often have difficulty understanding it. (Jusniar & Syamsidah, 2021). So that learning chemical equilibrium can be done easily, an ability is needed, namely scientific literacy skills.

Scientific literacy ability is the ability to connect scientific concepts and knowledge with contemporary problems (Khoiriza et al., 2021). PISA divides scientific literacy into four interconnected aspects: content, context, competence, and scientific attitudes. According to PISA (2018), the scientific literacy ability test includes three scientific competencies: interpreting data and evidence, designing and evaluating scientific research, and explaining scientific phenomena. Scientific literacy skills also include critical thinking skills, decision-making abilities, and basic knowledge (OECD, 2017). The science process skills aspect emphasizes that students utilize the learning process, activities, and creativity to acquire scientific knowledge, skills, values, and attitudes and to apply them in everyday life. Observing, grouping, interpreting, predicting, asking questions, hypothesizing, planning experiments, using tools and materials, applying ideas, communicating, and conducting experiments are skills expected from students (Lawi et al., 2020). One of the benefits of science process skills is as follows: (1) helping students solve problems they face every day; (2) providing students with resources to form their own concepts and learning approaches; (3) helping students who are still in the concrete thinking stage of development; and (4) increasing student creativity (Fitriana et al., 2019)

Based on the results of interviews with chemistry teachers at SMA Negeri 5 Medan class, the average exam score of many students who have not yet reached KKM = 75. Where the percentage in the completed category is only 34%, while the incomplete category is 66%. The results of the observations that the researchers obtained were that students lacked scientific literacy, especially in terms of science process skills. This is because educators still use conventional models and rely on textbook media, which leads to a learning process that is more teacher-centered, so the level of student activity in learning is very low.

One alternative to improve scientific literacy skills in aspects of students' science process skills is a learning model. Problem-based Learning (PBL) is an innovative learning model in which students are directly involved in solving problems. In chemistry, the PBL model can improve scientific literacy skills because students become better at self-regulation, better at learning, and better at self-evaluation (Meilasari et al., 2020). Characteristics of the PBL model according to (Rusman, 2018) states that the characteristics of the PBL model consist of (1) The problem is the starting point in learning; (2) The problems raised are problems that exist in the real world that are not structured; (3) Problems require multiple perspectives; (4) Problems that challenge

students' knowledge, attitudes and competencies; (5) Learning self-direction is the main thing; (6) Utilization of diverse knowledge sources, their use, and evaluation of information sources is an essential process in the PBL model; (7) Learning is collaborative, communicative, and cooperative; (8) Developing inquiry and problem-solving skills is as important as mastering content knowledge to find a solution to a problem; (9) Synthesis and integration of a learning process; and (10) PBL involves evaluating and reviewing student experiences and learning processes.

Apart from PBL, another learning model is Discovery Learning (DL). The DL model is a learning model that expects students to create and discover their own ideas with guidance from the teacher (Sarah et al., 2022). DL models usually require the ability to ask questions, observe, collect information, process information, and make conclusions based on data and information to find relationships between variables or test hypotheses. In a discovery learning system, the teacher does not deliver lesson material directly but gives students the opportunity to find answers to questions. The implementation of the learning model would not be effective without the help of the media. Animated videos are learning media that present images, sound, and text using language that is easy for students to understand. The important role of animated videos as a learning medium is the ability to visualize material that students cannot see or imagine (Mashuri & Budiyono, 2020). Some of the advantages of using animated video media in learning are as follows: (1) It can make it easier for teachers to explain information about complex material; (2) Using a combination of audio and visual media; (3) Can attract students' attention and focus, increase student motivation and learning outcomes; (4) Has an interactive nature, making it easier for students to respond; and (5) Independent, so that students can use animation media without teacher assistance. The disadvantages of animated video media are as follows: (1) Special software is required to create learning media with animation; (2) Creative design and skills are required to create effective animations for use as learning media; and (3) There are no real images such as photography and video (Dzakwan, 2020).

So, based on this problem, research was carried out with the aim of finding out improvements and differences in the scientific literacy abilities of students who were taught using the Problem Based Learning model and the Discovery Learning model assisted by animated video media on chemical equilibrium material.

METHODS

The research carried out was quantitative research using quasi-experimental methods. A quasi-experiment is research that approaches a real experiment (Sugiyono, 2015). This research aims to directly test the influence of a variable on other variables. This research was carried out from August 2023 to December 2023. The population of this research was all students of class XI Science at SMA Negeri 5 Medan, consisting of 9 classes. The sampling technique was carried out using a Purposive Sampling technique, namely directly selecting class XI IPA-5 with a total of 34 people as experimental class I with the PBL model assisted by animated video media and class assisted by animated video media. The design used by researchers is the Pretest and Post-Test Control Group Design. The research instrument is a scientific literacy ability test in the form of an essay, which has been prepared based on indicators of the scientific process skills aspect of 10 questions. Data collection was carried out through pretests and posttests, interviews, observation, and documentation. The pretest and posttest data obtained in the form of quantitative data on scientific literacy ability scores were then analyzed using SPSS 25 for Windows software. Apart from that, the results of the pretest and posttest scores are described using the categorization shown in Table 1.

Table 1. Criteria for science process skills

Interval	Criteria
81- 100	Very Good

Interval	Criteria
61 – 80	Good
41 – 60	Moderate
21 – 40	Poor
0 -20	Very Poor

(Hadiyati et al., 2022)

RESULT AND DISCUSSION

To measure students' science process skills (KPS), the essay test instrument consists of 10 questions that meet the criteria of 8 KPS indicators and represent each basic competency (KD) indicator regarding chemical equilibrium. The instrument used also meets test feasibility requirements in terms of validity, reliability, level of difficulty, and differentiability. So, this instrument is suitable for measuring scientific literacy abilities in aspects of students' chemical science process skills. The results of the analysis of students' scientific literacy ability scores in experimental class 1 and experimental 2 can be seen in Table 2.

Table 2. Results of analysis of students' scientific literacy abilities

No	Statistic	Eksperimental Class I		Eksperimental Class II	
		Pretest	*Posttest*	*Pretest*	*Posttest*
1.	Highest Score	68	97	67	94
2.	Lowest Score	30	76	25	71
3.	Mean Score	47,05	82,94	44,16	79,94

Table 2 shows that there is an increase in students' scientific literacy abilities after receiving treatment. The post-test mean score for experimental class I was 82.94, and for experimental class II was 79.94. The difference between the two scores was 3. In general, it shows that the ability to master science process skills for experimental class I students who used the PBL model assisted by animated video media was higher compared to experimental class II, which uses the Discovery Learning model. This is in accordance with the theory, which states that students' science process skills involve cognitive or intellectual, social, and manual skills. Intellectual skills are involved because students' science process skills will involve the student's own way of thinking (Hariandi et al., 2023). The PBL model is better in chemical equilibrium material compared to Discovery Learning because PBL emphasizes solving concrete problems that exist in the real world. Meanwhile, Discovery Learning focuses more on students and requires direct experience. In PBL syntax, the investigation stage can help students become more independent and responsible for problems. The teacher is responsible for ensuring the investigation process runs well. This has the potential to improve students' science process skills as well as their understanding of chemical equilibrium concepts. Apart from that, PBL is more suitable for helping students understand chemical equilibrium material and its applications in the real world. Students taught with the PBL model are more active in seeking information during learning activities, while students taught with the Discovery Learning model participate less in expressing opinions during discussion sessions.

The results of the pretest-posttest scores are then carried out as prerequisite tests. The first test is a normality test using Shapiro-Wilk with the help of SPSS 25 for Windows software. The results of the normality test can be seen in Table 3.

Table 3. Normality test results

Class	Data	data Sig.	Sig level.(α)	Details
Eksperimental I PBL	*Pretest*	0,087	0,05	Normally distributed
	Posttest	0,057	0,05	Normally distributed
Eksperimental II DL	*Pretest*	0,087	0,05	Normally distributed
	Posttest	0,170	0,05	Normally distributed

Based on Table 3, it can be seen that the results of the pretest significance value for experimental class I are 0.087, and the posttest significance value is 0.057. In experimental class II, the pretest significance value was 0.087, and the posttest significance value was 0.170. So, it can be concluded that the two classes produce normally distributed data because the significance value is > 0.05. Then the second prerequisite test is a homogeneity test using Levene's Test with the help of SPSS 25 for Windows software. The results of the homogeneity test can be seen in Table 4.

Table 4. Homogeneity test results

Data	data Sig.	Sig level.(α)	Details	Data
Pretest	Eksperimental I Eksperimental II	0,526	0,05	Homogeneous
Posttest	Eksperimental I Eksperimental II	0,847	0,05	Homogeneous

Based on Table 4, it can be seen that the pretest significance value = 0.526 and posttest significance = 0.847. So it can be concluded that the two experimental classes are homogeneous because the significance value of all data is > 0.05. The next statistical test is a hypothesis test using SPSS for Windows software, namely the Independent Sample T-Test. The results of the hypothesis test can be seen in Table 5.

Table 5. Hypothesis test results

Class	Data Sources	SPSS Data	Conclusion
Eksperimental I PBL	Posttest	0,024	Ha accepted
Eksperimental II DL	Posttest	0,024	Ha accepted

Based on Table 5, the Sig value (2-tailed) = 0.024 < 0.05. Because the significance value obtained is smaller than 0.05, Ha is accepted. Thus, there are differences in the scientific literacy abilities of students who are taught using the Problem-Based Learning model and the Discovery Learning model assisted by animated video media on chemical equilibrium material. The pretest-posttest results of students' science process skills were analyzed based on their respective indicators. This detail can be seen in Figure 1.

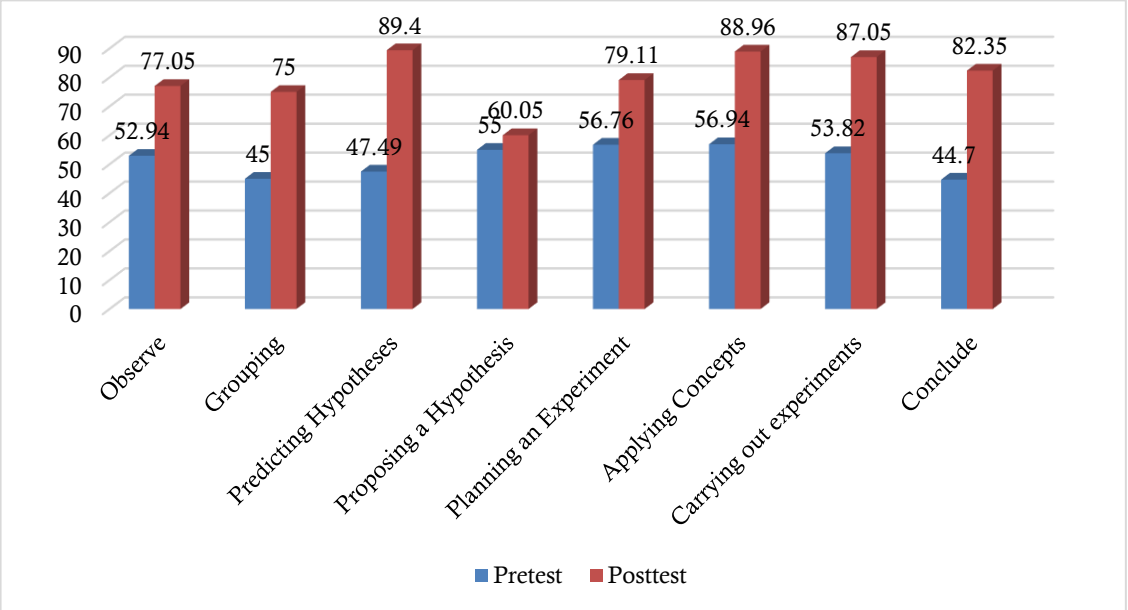

Figure 1. Percentage results of pretest and posttest achievement of science process skills for experimental class I students

Figure 1 shows that there is an increase in the achievement of students' science process skill indicators in experimental class 1. Before being given treatment in the experimental class,

the scores obtained were still low, with the average score for experimental class 1 being 51.58. After being given treatment in the form of applying the PBL model, there was an increase in students' science process skills to 79.87. In experimental class 1, the highest achievement indicator was predicting a hypothesis (89.40), and the lowest was proposing a hypothesis (60.05). If the results are categorized as the average score of the class, then it is included in the good category. The pretest-posttest results for experimental class 2 can be seen in Figure 2.

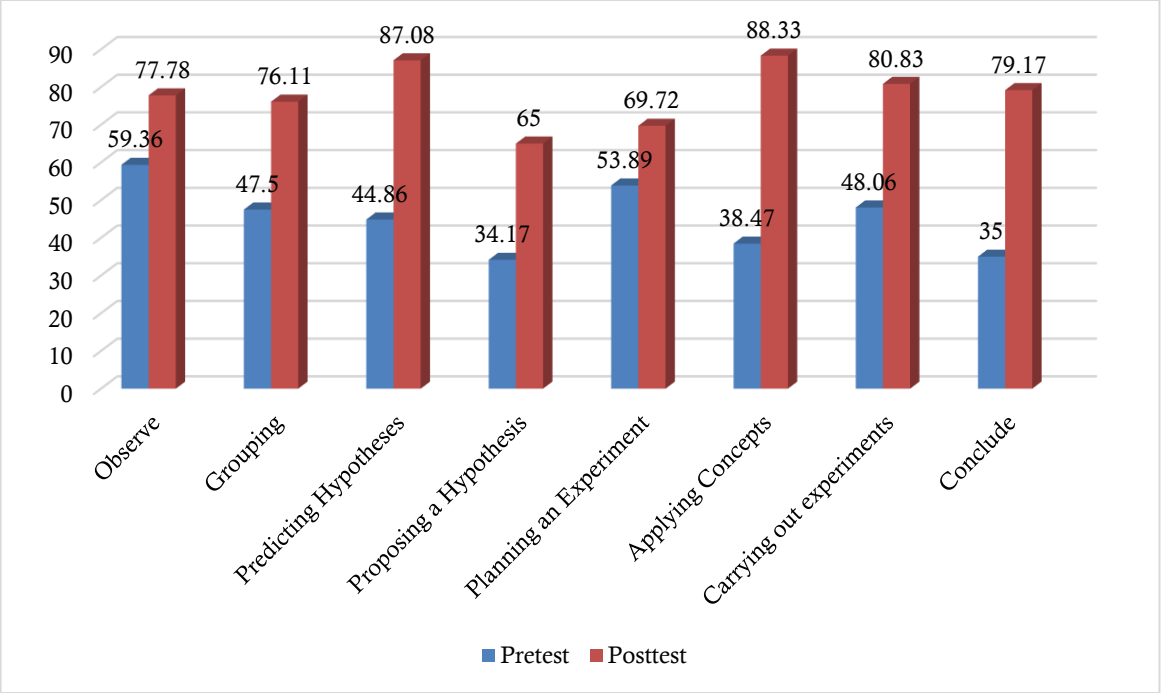

Figure 2. Percentage results of pretest and posttest achievement of science process skills for experimental class II students

Figure 2 shows the result of increasing the achievement of indicators of students' science process skills in experimental class 2, which was taught using the DL model assisted by animated video media. Before being given treatment, the value obtained was 44.79. After being given treatment in the form of implementing a learning model, the students' science process skills increased to 78.00. In experimental class 2, the highest achievement indicator was applying concepts (88.33), and the lowest was proposing hypotheses (65.00). If the results are categorized as the class mean score, then it is included in the good category. The results of this research are in line with previous research conducted by (Doyan et al., 2020), which shows that the experimental class with the PBL model obtained an N-Gain value of 68.06, while the experimental class with the Discovery Learning model obtained an N-gain value of 57. 29. It can be concluded that the PBL model is better at improving students' science process skills.

CONCLUSION

Based on the results of the research and discussion above, it can be concluded that there is an increase in the scientific literacy skills of students who are taught using the PBL model with the DL model assisted by animated video media on chemical equilibrium material. The average pretest-posttest score in experimental class 1 was from 47.05 to 82.94. Meanwhile, in the experimental class II, the initial score was 44.16 to 79.94. Apart from improvements, the application of the two models also provides different results. This is proven by the results of hypothesis test calculations using the Independent Sample T-Test; it is obtained that count < table, namely 0.024 < 0.05, that Ha is accepted.

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