The Effect of Problem Based Learning (PBL) Learning Model on Students' Argumentation Ability on Salt Hydrolysis Material

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Abstract
The application of problem-based learning model teaches students how to deal with problems and find solutions by expressing opinions and providing logical justification for real problems, so it is expected to improve students' argumentation skills. This study aims to determine the effect of problem-based learning model on students' argumentation skills on salt hydolysis material. This study was carried out in the even semester of the 2022/2023 academic year at MAN 2 Kampar, class XI IPA. Pretest-posttest Non-Equivalent Control Grub Design was the experimental design for this study, which used quasi-experimental methods. The sample consisted of XI IPA[1] students as the experimental class and XI IPA[2] as the control class. Data collected to measure students argumentation skills through tests and observations and analyzed using t-test and coefficient of determination test in SPSS 24. In the t-test, the Sig (2-tailed) = 0.000 outcome is more modest than 0.05, and that implies H0 is dismissed and Ha is accepted. For the determination test, the value $(r^2) = 0.284$ is obtained, it can be concluded that the problem-based learning model affects students argumentation skills on salt hydrolysis material by 28.4%.

INTRODUCTION

Education is a learning organized in formal educational institutions and has all the consequences aimed at providing students with perfect skills. In the form of educational activities that are programmatically arranged in the form of a curriculum so that educational activities are planned and managed in certain materials (Anggriani & Atmojo, 2022; Trianah, 2021). Learning chemistry in high school students learn about the structure, material changes, properties, composition, and the accompanying energy changes (M. Purba & Sunardi, 2012). A hydrolysis reaction is the reaction of one or both ions of a salt solution with water (Chang, 2006).

In the Chemistry learning process, students can not only understand the theory, and can practice, but can also use their language skills both in speech and explicitly applied to social activities or the environment (Sa'adah, 2015). Interesting and varied learning can improve students' concept understanding and improve learning outcomes (Armiati & Pahriah, 2015; Trisnayanti et al., 2019). Chemistry learning requires attention to the ability to speak or convey arguments, not just convey an appreciation of the nature of science. Argumentation plays an important role in the scientific process. Therefore, the purpose of learning is not only to develop scientific concepts and knowledge, but also to encourage students' active participation in arguments in science learning. In fact, science studies do not provide opportunities for students to develop argumentation skills. Learning to encourage students'

arguments is limited to questions and answers, but with little class discussion, argumentation in the form of affirmation, refutation, and reinforcement is still lacking in the classroom (Firdaos et al., 2021). Therefore, choosing the right learning model can achieve effective learning (Ario & Asra, 2018).

Problem based learning is learning where students are expected not only to listen, record, and store learning materials, but effectively think, convey, search, and process information and reasoning. The PBL learning model has the characteristics that learning focuses on students, students can work together, and learning is driven by the context of the problem (Graaff, 2013; Sofyan, 2017). So that this learning model has advantages, is able to increase student learning, help students in obtaining new information, help students apply their knowledge to real problems, and help students improve their ability to think so that they can develop students argumentation skills in learning chemistry (Syamsidah & Hamidah, 2018).

Argumentation trains students in using their thinking skills. According to Wahid Rizaldi Akili, et al (2022), argument skills are significantly improved in the Chemistry learning process because it can expand ideas to measure students' knowledge. Scientific argumentation is the main method used in the field of science education to develop reasoning skills. Reasoning requires informal reasoning skills and includes the ability to solve or resolve a problem, make decisions, make statements and form ideas and notions.

As a problem-solving process, individuals must use the reasoning process to identify multiple points of view and develop and select the most appropriate one, offering a reasonable solution supported by data and evidence. As has been found from several components in presenting scientific arguments including claims, data, warrant, backing, qualifiers and rebuttals. Argumentation is a conversation that aims to determine the relationship between ideas and the evidence used to support them (Akili et al., 2022; Robertshaw & Campbell, 2013). Argumentation according to Tippet (2009) has 2 types, namely oral and written argumentation Written argumentation is useful for improving students' scientific knowledge and writing skills. Students' argumentation skills can be developed through discussion activities carried out by students during the learning process (Tama et al., 2016).

Based on the interview findings, it is stated in classroom learning students are less active in terms of finding responses and answering questions in the learning process in the room or in a small team. This condition is caused by the rarity of students in expressing their opinions related to the material. Students when asked to answer questions and write answers, they tend to be shy and even afraid of being wrong. Instead, students should get used to composing answers based on feelings with coherent reasons and criticize each other on the material being taught. Not being taught how to argue effectively is suspected to be one of the problems faced by chemistry teachers is due to the lack of information about learning models that can improve argumentation in the classroom in chemistry learning. Many students continue to learn through the lecture method because teachers usually use a scientific approach that is less than ideal in the learning process.

The cause of students' argumentation skills is low, namely the learning system that does not maximize students in arguing both orally and in writing. Thus, one of the right models is needed to develop students' argumentation skills, namely the problem-based learning (PBL) model. Problem Based Learning (PBL) is a learning model that aims to develop students conceptually through problems that exist in everyday life (Dinda Nur Azizah et al., 2021).

The choice of problem-based learning model as a way to solve problems in learning by arguing, that this model can teach students how to face problems and find solutions by expressing opinions and providing logical justifications for real problems (Miterianifa et al., 2019). Students will find it easier to convey arguments and write answers if faced with real

problems in the environment (Yuniarti et al., 2015). This study aims to determine the effect of problem-based learning (PBL) learning model on students' argumentation skills on salt hydrolysis material in class XI students.

METHOD

This type of research is Quasi Experiment. Quasi experiment is research that is carried out by using all subjects in the study group (intract grub) to be given treatment and not using subjects taken randomly. The research design used was pretest-posttest Non-Equivalent control group design (Kurniawati, 2019).

Table 1. Research Design

Class	Pretest	Treatment	Posttest
Eksperimen	O_1	X_1	O_2
Control	O_3	X_2	O_4

Description:
X1 and X2   : Treatment in the experimental class control class.
O1 and O3   : Experimental and control class pret-test results.
O2 and O4   : Experimental and control class post-test results.

The quality of argumentation can be measured by referring to Toulmin's Argument Pattern (TAP). Argumentation skills based on Toulmin's Argument Pattern include six basic indicators namely claim, data, warrant, backing, qualifier, and rebuttal.

Table 2. Argumentation Skill Indicators

No	Argumentation Skills Indicator
1	Claim is an opinion or statement
2	Data is a statement related to the evidence needed to support the claim.
3	Warrant is a statement used to explain the relationship between data and claim.
4	Backing is a conjecture or theoretical justification that supports the evidence.
5	Qualifier is a justification of the claim.
6	Rebuttal is a statement that contradicts the data.

(Zairina & Hidayati, 2022)

The instrument used in this study was an essay-shaped test totaling 10 questions, and an observation sheet of argumentation skills and the implementation of the problem-based learning model. Initially, the prerequisite test was carried out which included normality test and homogeneity test. Furthermore, the hypothesis test used in this study was the "t" test with the help of SPSS version 24 software. The "t" test was conducted to measure and show the difference in pretest and posttest scores on students' abilities (Sugiyono, 2017). Then the determination coefficient test was carried out with the aim of knowing the magnitude of the influence of the independent variable on the dependent variable with statistical tests using SPSS version 24 software, as for the formula: (Riduwan, 2009)

$$Kp = r^2 \, x \, 100\%$$

RESULTS AND DISCUSSION

This research begins with a pretest. Pretest is a test given with the aim of knowing students' initial argumentation skills and to find out both classes have the same argumentation skills before being given treatment. Students are stimulated to provide solutions to solve a problem,

so that in the process of solving these problems students must discuss and communicate with their groups to exchange opinions or argue about the problems presented which are related to everyday life.

Argumentation only uses 4 indicators, claim, data, warrant or guarantee, and backing or support. While two indicators of argumentation are used during the learning process because these two indicators are seen when giving rebuttals or rebuttals to their friends, namely qualifiers or justifications and rebuttal indicators or conflicting statements. Based on the tests that have been carried out, the pretest and posttest questions are descriptions of 10 questions which have previously been validated by content and empirical validation. The results of the typical presentation of students' ability to argumentation are as follows in Figure 1.
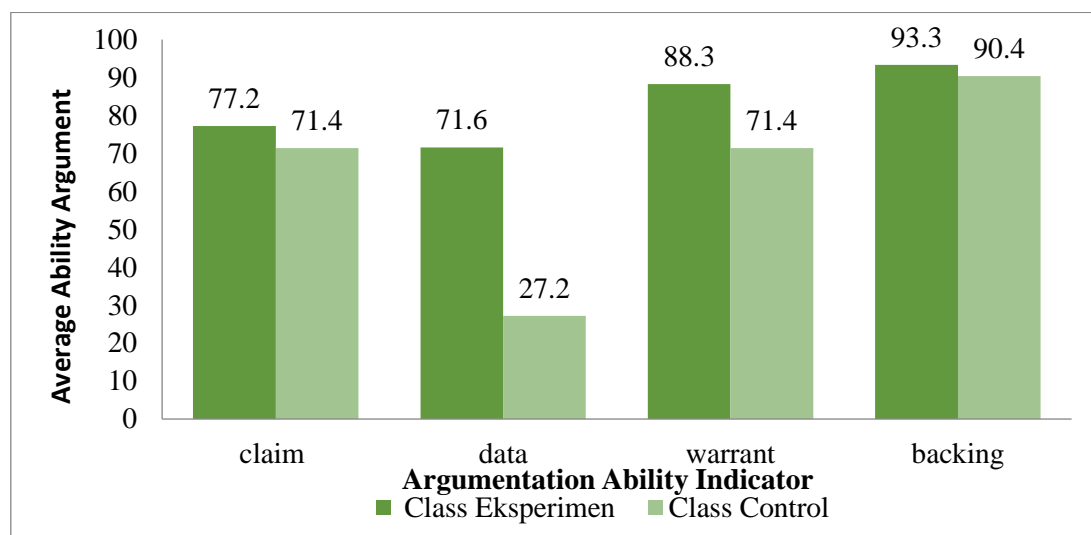

Figure 1. Percentage of Students' Argumentation Ability

Based on picture 1, it can be seen that the average argumentation ability of students on salt hydrolysis material in the experimental class is greater than the average argumentation ability of students in the control class. The average percentage of argumentation skills in salt hydrolysis material in the experimental class and control class is highest in the backing indicator which is 93.3% and 90.4%, while the lowest average percentage is in the data indicator which is 71.6% and 27.2%.

The difference in the average ability to argue in salt hydrolysis material is due to learning activities carried out in experimental classes using problem-based learning models and in control classes learning activities using conventional learning models. This shows that the average test of students' argumentation skills is better after applying the problem-based learning model. The problem-based learning model is able to help students be motivated in analyzing problems and expressing arguments about problems that exist in everyday life (Dewina et al., 2017).

This research data was processed using SPSS V.24. To see the effect of problem-based learning model on students' argumentation skills, the first step in data analysis is to conduct prerequisite tests, namely normality and homogeneity tests. This normality test aims to see whether the data on students' argumentation skills are normally distributed or not (Kariadinata, 2012), while the homogeneity test aims to determine whether the sample comes from a homogeneous variance or not (Nuryadi, 2017).

After conducting homogeneity and normality tests, it can be concluded that both samples, namely the experimental class and the control class, are homogeneously and normally distributed. Further data analysis was carried out to test the hypothesis using the t-test and the

coefficient of determination. Data analysis using SPSS V.24 software can be done with the Independent Sample t Test method. The t-test results are presented in Table 3.

Table 3. Hypothesis Test Results

		t-test		
		df	Sig.(2-tailed)	Mean difference
Different of *pretest-postest*	Equal variance	27	0.000	14.880
	Separeted variance	20.786	0.000	14.880

SPSS V.24 is used to calculate posttest scores using t-tests. The significance value of the t-count results shows the criteria for accepting the hypothesis. If Sig (2-tailed) is less than 0.05, then H0 is rejected and Ha is accepted. On the off chance that Sig (2-tailed) > 0.05 H0 is acknowledged and Ha is dismissed. The obtained data demonstrate a 2-tailed significance level of 0.000 and a significantly difference $0.000 < 0.05$, indicating that Ha can be accepted and H0 is rejected. So one might say that there is an impact of expanding the argumentation capacities of understudies who study utilizing the Issue Based Picking up learning model with the argumentation capacities of understudies who study utilizing regular learning techniques on salt hydrolysis material.

The coefficient of determination test was then performed. The coefficient of assurance is utilized to perceive how much impact the issue put together learning model has with respect to understudies' capacity to contend on salt hydrolysis material. SPSS V.24 was used for data analysis. The aftereffects of the coefficient of assurance are introduced in Table 4.

Table 4. Determination Coefficient Test Results

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,533[a]	,284	,212	3,13799

Based on the data obtained, the r^2 value shows 0.284, so the Kp value obtained is 28.4%. So it can be concluded that in this study there is an influence of the problem based learning model on students' argumentation skills on salt hydrolysis material 28.4%.

In the oral argumentation ability test on the qualifer and rebuttal indicators obtained during the learning process, where students present the results of the discussion in front of the class. And when the discussion took place there were only a few students who provided rebuttal from the results of the discussion presented by other groups. This is due to the limited time in the discussion because the learning time is interrupted by routine school activities, namely dhuha prayer activities in congregation.

In this study, the application of the PBL model in class was able to stimulate students in determining the solution to the problem studied (Siswanto et al., 2014). During the learning process students conduct problem-solving discussion activities, present the results of the discussion, and individually evaluate learning through questions given by the teacher so that they exchange ideas and provide opinions in solving a problem (Mudhofir, 2021; Permatasari, 2019). Problem-based learning consists of five stages: the process of orienting students, organizing students, guiding individual and group investigations, developing and presenting work, and analyzing, evaluating the problem-solving process (Rahman et al., 2022; Yuli Ifana Sari, 2021).

Problem-based learning (PBL) can be developed in laboratory-based discovery activities. It is proven that problem-based learning is able to improve students' skills in determining the right steps to test and solve problems as in previous studies (Dina, Agus Setiabudi, 2015; Nurhaedah, 2022). Based on the research conducted, the conclusion is that the problem-based

learning model shows the superiority of an increasing influence on students' argumentation skills compared to using conventional learning models.

CONCLUSION

In conclusion, based on the results of data analysis and discussion, there is an effect of the problem-based learning (PBL) model on students' argumentation skills, seen from the results of hypothesis testing using SPSS V.24, which shows a significance value (2 tailed) posttest of 0.000 and shows that there is a significant difference between the experimental class and the control class. Because the significance value of 0.000 <0.05, it can be said that the alternative hypothesis is accepted. Based on the coefficient of determination test, the problem-based learning (PBL) learning model affects students' argumentation skills on salt hydrolysis material by 28.4%. This means that there is an increase in students' argumentation skills by 28.4% in the experimental class with the application of the problem-based learning (PBL) learning model. The application of the problem-based learning (PBL) learning model can be used as an alternative learning model in chemistry learning in an effort to improve students' argumentation skills in the process of solving a problem.

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