

The effect of E-LKPD on the inquiry-flipped classroom model and self-efficacy on students' creative thinking ability

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Keywords

E-LKPD
Chemical bond
Creative thinking
Inquiry-flipped classroom
Self-efficacy

Abstract

The active role of students is also very closely related to the confidence that students have in solving various problems and discovering concepts in chemical bonding material. This study aims to see the effect of the inquiry-flipped classroom model assisted by E-LKPD media on students' creative thinking abilities in chemical bonding material. The sample used was 2 classes at Al-Falah High School, Jambi City. The data collection instruments used were self-efficacy questionnaires and essay test questions. The results showed that there was an effect of E-LKPD on the inquiry-flipped classroom model on students' creative thinking abilities in chemical bonding material with a significance level of 0.027. Then students who have high self-efficacy with students who have low self-efficacy influence the ability to think creatively on chemical bonding material with a significance value of 0.04. Furthermore, there is no interaction between the E-LKPD in the inquiry-flipped classroom model and self-efficacy on students' creative thinking abilities in chemical bonding learning, which can be seen from the significance value of 0.694 > 0.05.



Introduction

Chemical material is material that is quite difficult to learn, because the concepts in chemical material are classified as abstract and have the characteristics of three levels, namely the macroscopic level, the submicroscopic level, and the symbolic level (Kumalaningtyas and Sukarmin, 2019). So that resulted in students having difficulty in learning chemistry material. According to Sari and Nasrudin (2015) chemical bond material is material that is classified as abstract and is related to students' daily lives, however students cannot see atoms, structures, and how an atom interacts with other atoms. This makes it difficult for students to understand the concepts contained in chemical bonding material. Desmarani et al. (2022) said that chemical bond material is material that is classified as abstract, where 82.8% of students have difficulty understanding the concept of chemical material. Especially in the sub material of elemental stability, Lewis structure, ionic bonds, covalent bonds and comparison of the properties of ionic and covalent compounds.

Students' concerns about difficult chemistry subjects result in lower knowledge obtained, so that students become less confident (self-efficacy) when faced with complex tasks or questions. The ability to think creatively is also strongly influenced by self-confidence (self-efficacy). According to Putra et al. (2016) the ability to think creatively is a thinking process capable of expressing new relationships, seeing things from a new perspective, and forming new combinations of two or more concepts that have been mastered before. Students' ability to answer or solve problems, seen from the ability and quality of questions asked by students, is also included in students' critical thinking skills (Siahaan et al. 2021)

Achieving cognitive abilities and generic science skills in chemistry learning during the Covid-19 pandemic One way to overcome the problems experienced by students in chemical bonding material is to apply the inquiry-flipped classroom model with the help of E-LKPD media. According to Nasution et al. (2018) said that the inquiry model has the advantage of giving freedom to students in obtaining information from a material concept so that students can learn independently, not only from the teacher who provides material and is



able to apply it in everyday life. In addition to the advantages of the inquiry model it turns out also has a weakness, namely that the implementation of the learning process requires quite a long time, thus causing the teacher to find it difficult to adjust to the set time (Silaban, 2021). Also supported by research by Effendi-Hasibuan et al. (2019) who applied learning using the inquiry model (ibTI), there were obstacles, namely the lack of time during the learning process due to the steps of inquiry learning that were too long and structured. To overcome the weaknesses of the inquiry model, it is modified with the flipped classroom approach.

Flipped Classroom is an approach that connects technology learning with students' active learning. Through this approach, students can learn wherever they are, whether outside the can, at home, in the library, so that students have the provision or initial knowledge before they study in class. According to (Brooks, 2014) with the flipped classroom approach students' self-efficacy and creative thinking abilities can be further increased, because students more easily construct their knowledge during the learning process in class. In its implementation, it is in line with research by Lestari et al. (2020) have implemented the guided inquiry learning model - flipped classroom. The conclusions from his research stated that the application of the guided inquiry model combined with the flipped classroom approach could improve students' creative thinking abilities in the matter of reaction rates. The syntax of the inquiry - flipped classroom model according to what has been developed by previous researchers consists of 8 steps, namely orientation, formulating problems, reviewing, formulating hypotheses, collecting data, testing hypotheses, making conclusions, and post-testing (Novira et al. 2022). However, the model developed has not been tested in the learning process, researchers say that this model can be applied or experimented with in the learning process to improve students' creative thinking abilities.

Chemistry learning by applying the inquiry-flipped classroom model assisted by E-LKPD media makes learning more effective and students' understanding is also higher. Compared to learning to apply the usual inquiry model, students' understanding tends to be lower. Desmarani et al. (2022) said that the inquiry model flipped classroom is assisted by E-LKPD is a model that can be applied in learning chemistry, because the advantages of this model are able to provide provisions for students and information related to the material to be studied before class and make students more active in the process of solving problems during the discussion process in class. So that students' creative thinking skills and self-efficacy can be further improved, especially in chemical bonding material. According to Syafitri and Tressyalina (2020) student worksheets (LKPD) can provide learning experiences that are systematically designed and planned to achieve learning objectives. Therefore LKPD can be a potential support to assist teachers in teaching material.

Learning in class is more effective because it is also influenced by the E-LKPD media used, because this E-LKPD is made as attractive as possible by displaying animations, pictures, and videos explaining abstract chemical bonding material. That way students don't feel bored quickly and are more eager to learn. This is supported by research by Hidayati et al. (2018) which states that learning outcomes in terms of knowledge and students' skills using the inquiry-based learning model with the flipped classroom approach tend to improve more than conventional models, and students respond more positively to learning. Desmarani et al. (2022) states that 97.9% of students need learning multimedia (E-LKPD) in chemistry lessons. So that the inquiry-flipped Classroom model assisted by E-LKPD can be used as a solution to meet the needs of students and teachers, because this learning model is oriented towards the activeness of students and uses technology in the learning process. Based on the description above, the writer wants to see the effect of using E-LKPD on the inquiry-flipped classroom model and self-efficacy on students' creative thinking abilities on chemical bonding material.

Method

This research is included in the quasi-experimental research (quasi experiment). This research was conducted at Al Falah Islamic High School, Jambi City, class X MIPA on chemical bonding material. The research design used was a 2 x 2 factorial design, presented in Table 1.

Table 1. Factorial design research design 2x2

Learning Model (X)	Experiment (A ₁)	Control (A ₂)
Self-Efficacy (Y)		
High learning Self Efficacy (B ₁)	Y _{A₁B₁} (creative thinking)	Y _{A₂B₁} (creative thinking)
Low learning Self Efficacy (B ₂)	Y _{A₁B₂} (creative thinking)	Y _{A₂B₂} (creative thinking)

The population in this study were students of class X MIPA SMAS Islam Al Falah Jambi City for the 2022/2023 academic year. The sampling technique was carried out by simple random sampling and obtained

two classes, namely X MIPA 2 being the experimental class while X MIPA 1 was the control class , each class consisting of 35 students.

The data analysis technique used is descriptive quantitative, prerequisite test and hypothesis test. The prerequisite test used is the normality test or the Kolmogorov-Smirnov test and the homogeneity test uses the Levene test. To test the hypothesis, the researcher used data analysis techniques with two-way analysis of variance (2 way ANOVA) with an interaction significance level of 0.05 or 5%.

Results and Discussion

Based on research that has been conducted at SMAS Islam Al-Falah Jambi, in the odd semester academic year 2022/2023. This study aims to see the effect of E-LKPD on the inquiry-flipped classroom model and student self-efficacy on creative thinking skills in chemical bonding learning. The data obtained in this study are the essay test scores for students' creative thinking abilities who take part in learning using the inquiry-flipped classroom model assisted by E-LKPD (A1) and the essay test scores of students who learn using the inquiry model (A2) without using media assistance. other. Before carrying out the learning process, each class is first given a self-efficacy questionnaire to see the level of self-efficacy students. Then the results of the questionnaire are divided into 2 categories, namely students who have high self-efficacy and low self-efficacy. Data on the results of the essay test scores for students' creative thinking skills are presented in [Table 2](#).

Table 2. Data on the average results of students' creative thinking abilities based on the level of self-efficacy in each class

Class	Self-efficacy	Average
Assisted <i>inquiry-flipped classroom</i> E-LKPD (experimental class)	High	87.471a -
	Low	80.314a -
<i>Inquiry</i> (control class)	High	82.502a -
	Low	75.002 ^a

Based on the data above, for the experimental class that applied electronic student worksheets (E-LKPD) based on the inquiry-flipped classroom model in the learning process, it was found that 26 students had a high level of self-efficacy and 9 students who had a high level of self -efficacy. -low efficacy. Whereas for the control class that applied the Inquiry model without the flipped classroom approach in the learning process, it was found that 24 students had a high level of self-efficacy and 11 students had a low level of self-efficacy.

The learning process applies the inquiry-flipped classroom model assisted by this E-LKPD media, the learning is designed carried out outside the classroom, meaning in their respective homes. Where is the E-LKPD media shared with the WhatsApp group of students, the goal so that students find it easier to find and learn in advance the material to be studied in class. Students are also given practice questions, to ensure they read and study the material in the E-LKPD media that has been distributed. So that when in class they already have initial knowledge, and of course there is confidence that students have because they have previously studied at home.

According to [Yulindariati et al. \(2019\)](#) said that the E-LKPD Media has advantages including: a) being able to minimize time, students can use it anywhere and anytime, b) the material presented is not only in the form of writing but contains animation, pictures, and videos explanation of the material, c) students can be more confident, because the media is given before learning in class. So that the learning time in class is maximized, because it is used by students to collaborate, collaborate with their colleagues, practice and we can see feedback on their learning progress ([Milman, 2012](#)).

Before testing the hypothesis, a prerequisite test is carried out by testing the normality and homogeneity of the data obtained. This test was carried out using statistical analysis software, namely SPSS version 16. Data from the normality and homogeneity tests are presented in [Table 3](#).

Table 3. Results of the data normality test for the ability to think creatively

		Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
Creative thinking	Experiment class	.128	35	.164	.967	35	.368
Ability essay test	Control class	.127	35	.159	.965	35	.322
Value							

Based on the data in [Table 3](#), obtained in the experimental class with the inquiry-flipped classroom learning model and the control class with the Inquiry learning model significance value > 0.05 . So it can be concluded that both classes are normally distributed. Seen in [Table 3](#) . There is an experimental class , namely 0.1 64 > 0.05, while the control class is 0.1 59 > 0.05.

Based on calculations data, a sig value > 0.05 is obtained, which is 0.16 8 > 0.05, which indicates that the significance value of the variance is greater than 0.05. This means that the results of students' creative thinking

skills from the two samples used are homogeneous. Then a hypothesis test was carried out using a two way variance analysis technique (2 way ANOVA) with interactions at a significance level = 0.05 or 5% using SPSS software version 22 after previously measuring the results of creative thinking skills. The data description of students' creative thinking abilities in the self-efficacy category is presented in Table 4.

Table 4. Description of the value of students' creative thinking skills category of student self-efficacy

Inquiry Class	Self-efficacy	Means	N
<i>Flipped classroom</i> (Experimental class)	High	82.92	26
	Low	81.40	9
	Total	82.49	35
<i>Non flipped classroom</i> (Control class)	High	80.29	24
	Low	75.27	11
	Total	77.29	35
Total	High	79.18	50
	Low	78.19	20
	Total	78.89	70

Based on the results of the data in the table above, it can be seen that there is a difference in the average value of students' creative thinking abilities between the experimental class and the control class. The average score for students whose learning applied the inquiry-flipped classroom model assisted by E-LKPD media obtained a higher level of self-efficacy (self-confidence) of 82.92. While the average value of students whose learning applies the same model with a low level of self-efficacy (self-confidence) is 81.40. Then the average value of students whose learning only used the inquiry model without using other learning approaches or media obtained a higher self-efficacy (self-confidence) of 80.29. while the average value of students whose learning applies the same model with a low level of self-efficacy (self-confidence) is 75.27. The difference in the average scores for the two groups of students above shows that the average score for the group of students with a high level of self-efficacy is 81.18, and for students with a low level of self-efficacy is 78.19.

Furthermore, the results of hypothesis testing were carried out using the two way variance analysis (ANOVA) technique with interaction. Calculation of the results of hypothesis testing data is presented in Table 5.

Table 5. Two-way ANOVA test results

Source	Type III Sum of Squares	df	MeanSquare	F	Sig.
Corrected Model	3379.536 ^a	3	91.339	5,797	.002
Intercepts	282968.519	1	363760088	6848948	.000
SelfEfficacy	1748.116	1	694.180	13,070	.027
Class	616.016	1	8.689	.164	.004
SelfEfficacy * Class	698.290	1	8.266	.156	.694
Error	1049550	66	53.112		
Total	440036000	70			
Corrected Total	4429086	69			

Based on Table 5, the results are obtained to see the effect of the E-LKPD on the inquiry-flipped classroom model on creative thinking skills. It can be seen in the influence of the learning model that the sig value is 0.027 <0.05, it can be concluded that the average learning outcomes are different or H₀ is rejected and H₁ is accepted. This means that there is a significant influence from the use of E-LKPD in the inquiry-Flipped Classroom model on students' creative thinking abilities in chemical bonding material. Then the second hypothesis looks at the effect of self-efficacy on students' creative thinking abilities. It can be seen that the self-efficacy section has a sig value of 0.004 <0.05, so it can be concluded that the average self-efficacy is different or H₀ is rejected. This means that there is an influence of self-efficacy on students' creative thinking abilities in chemical bonding learning.

This is also evidenced by the learning process applying the inquiry-flipped classroom learning model assisted by E-LKPD media which has a higher average value for creative thinking skills. When compared to the control class in learning that applies the inquiry model without using additional media, the average value of creative thinking skills tends to be lower. Due to the learning model used able to make students to be active in discovering and building their own knowledge. Because students given the opportunity to find solutions in solving problems related to the material being studied. It is also supported by the use of media in the learning process to be more active and able to increase collaboration among students. According to Herawati et al. (2016) learning using E-LKPD has the advantage of making learning more interactive and the material presented becomes livelier, more in-depth, so that students' interest and creativity increase.

In Fig. 1, the experimental class value is 82.59 and the control class is 75.35, meaning 82.59 > 75.35. One of the factors causing the low creative thinking ability results in the control class which only applies the inquiry model, where in the learning process students are more passive because there is no readiness in learning. Or it can be said that students do not have prior knowledge regarding the material being studied. Lestari et al. (2020) said that the application of the

inquiry model requires a longer time, so that the application of learning requires quite a long time so that learning becomes less than optimal and the delivery of material that is not completed ultimately gives homework to students. Whereas in the experimental class the model has been modified with a flipped classroom approach assisted by E-LKPD media. According to research by Desmarani et al. (2021) also said that electronic LKPD media or E-LKPD based on inquiry-flipped classrooms can overcome the lack of study time at school. As well as being able to make it easier for students to understand chemical bonding material by displaying animations, pictures, and videos teaching chemical bonding material which is classified as abstract. According to Putra et al. (2016) some elements of creative thinking skills that must be possessed by students are in the form of fluency, flexibility, originality, and elaboration.

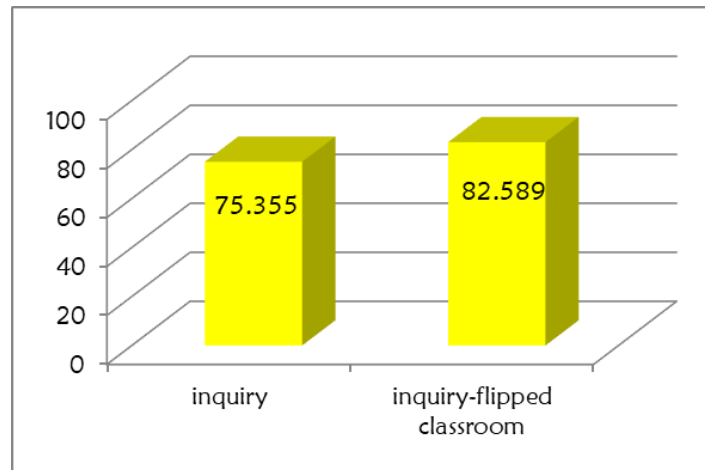


Figure 1. Average essay test scores for students' creative thinking skills based on the learning model.

The results of the second hypothesis test using 2-way ANOVA obtained a significance value on the effect of self-efficacy according to Table 5. with a sig value <0.05 , which is equal to $0.004 < 0.05$, it can be concluded that the average learning outcomes are different or H_0 is rejected and H_1 is accepted. This means that there is a significant influence of students' self-efficacy on the ability to think creatively in chemical bonding material. The graph of the results of creative thinking skills based on the level of self-efficacy of students can be seen in Fig. 2.

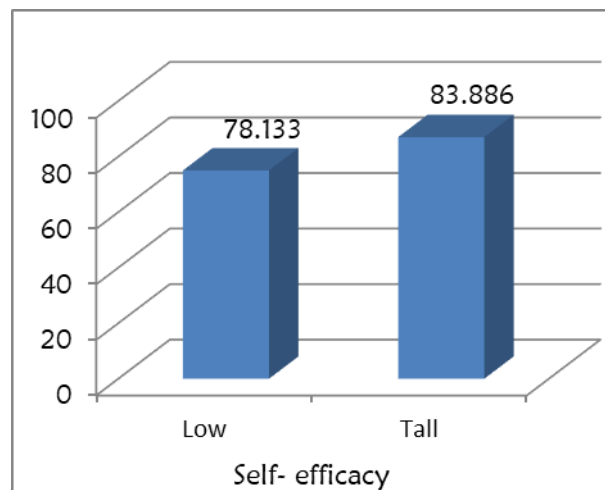


Figure 2. Creative thinking ability by level high self-efficacy and low self- efficacy.

Based on Fig. 2. above, it can be seen the effect of self-efficacy on the results of students ' creative thinking abilities is proven by students with low levels of self-efficacy only getting low scores. Because students who belong to low self-efficacy tend to be more passive and not confident in the learning process. While students who have self-efficacy higher score also gets a high score, because P is in the learning process of students very active and more enthusiastic. In line with the opinion (Fadilah, 2021) that the higher the level of self-efficacy of students, the better achievement and student learning outcomes.

In the learning process in the experimental class and control class, students who have high self-confidence are more courageous in arguing, because they are confident in their abilities. Looks very enthusiastic in learning, this can be seen at the stages of formulating problems, formulating hypotheses, and when collecting data/practicum. Supported by the opinion of Bandura (1997) says that someone who has high self-efficacy (self-confidence) tends to do tasks, and is confident of being able to complete the task even though it is difficult. According to Desmarani et al. (2022) inquiry model flipped classroom assisted by E-LKPD has the advantage of being able to provide provisions for students and information related to the material to be studied before class and make students more active in the process of solving problems during the discussion process in class, so that the ability to think creatively and self-efficacy of students can

further improve. Sulistiani and Agustini (2022) said that the learning process using the guided inquiry model develops students in independent responsibility, both in problem solving, and skills in making reports. Evidenced by the increased academic achievement of students in acid-base material after using guided inquiry-based worksheets.

In contrast to students who have low self-efficacy, in learning they tend to be more passive and silent a lot. Then do not dare to issue an opinion, because they lack confidence in their abilities. This can be seen at the stage of learning to formulate problems, formulate hypotheses, and when collecting data/practicum. Students tend to rely on other friends to work in groups so that when working on essay tests students with low self-efficacy get less than optimal scores. This is reinforced by the opinion of Isnadini et al. (2014) students with low self-confidence will give up more easily when completing difficult tasks, because they think they are unable to complete them. So that makes students' learning motivation low and academic achievement decreases. Aldholay et al. (2018) said that self-efficacy is divided into four aspects, namely self-confidence in facing an uncertain problem, self-confidence in one's abilities, confidence in the goals to be achieved, and confidence in the problems that will arise.

The results of the third hypothesis test on the line self-efficacy learning model show a sig value > 0.05 , which is equal to 0.694. It states that H_0 's decision is accepted and H_1 is rejected, which means that there is no interaction between the self-learning model the efficacy of students in influencing the ability to think creatively on chemical bonding material. Graph of interaction between the inquiry-flipped classroom model and the inquiry model with students' self-efficacy (high and low) in influencing students' creative thinking abilities can be seen in Fig. 3.

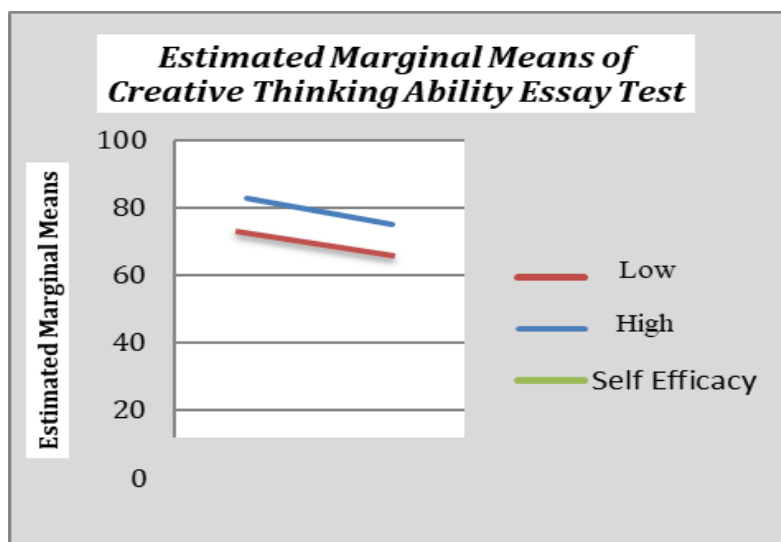


Figure 3. Interaction of learning models with self-efficacy of students.

Based on Fig. 3. Above, the results of students' creative thinking abilities in learning with the inquiry-flipped classroom model (experimental class) and the inquiry model (control class) with students' self-efficacy levels (high and low) do not produce lines that cross or do not intersect. This indicates that the learning model with self-efficacy influences the ability to think creatively independently. So it can be concluded that there is no interaction between the learning model and students' self-efficacy on the ability to think creatively on chemical bonding material.

Inquiry-flipped classroom learning model influences the results of the ability to think creatively independently. This is because students are given learning treatment assisted by E-LKPD media that has been designed by the teacher, to make it easier for students to understand chemical bonding material. The research results are strengthened by the research of Nurhayati et al. (2017) applying the Inquiry learning model blended learning flipped classroom approach assisted by interactive media, makes learning more active, fun, and student-centered, as well as students' critical thinking processes increase. Supported by research by Juniar and Sianipar (2022) who say that the guided inquiry model can increase scientific understanding, and be productive in creative thinking, students become skilled in obtaining and analyzing information. Shown by increasing learning outcomes in chemical equilibrium material.

High or low levels of student self-efficacy affect the results of students' creative thinking skills independently. This is because self-efficacy is the belief of students in carrying out an action during the learning process. That way, students with high self-efficacy categories will produce better creative thinking skills when compared to low self-efficacy levels. The results of this study are also supported by Hari et al. (2018) who say that students' creative thinking abilities are strongly influenced by self-efficacy.

Conclusion

Based on the research results, it can be concluded that there is an influence of E-LKPD on the inquiry-flipped classroom model on students' creative thinking abilities, there is an influence of students' creative thinking abilities on students' self-efficacy in chemical bonding material, and there is no interaction between E-LKPD on the inquiry-flipped classroom model with self-efficacy on students' creative thinking abilities on chemical bonding material.

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