The Effect of Flipped Classroom Model with Information Search Strategy Through Moodle-Based *E-Lematika* on Students' Self-Efficacy in Mathematics

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Abstract. Self-efficacy has a great influence on learning outcomes and academic achievement. However, many students have low self-efficacy in mathematics. For this reason, a learning process is needed that can help improve students' self-efficacy in mathematics. This study aimed to determine the effect of the inverted classroom model with information search strategies through moodle-based e-lematika media on students' self-efficacy in mathematics. This research is a type of quantitative research with a quasi-experimental design method. The population of this research is class XI students of SMK N 1 Jambi City and two sample classes, namely 31 students of class XI TKJ 1 and 31 students of class XI TKJ 5, respectively, the experimental class and control class. The self-efficacy questionnaire data analysis for the two classes was carried out using the independent sample t-test, which showed the value of sig. (2-tailed) is $0.000 < 0.05$. So, there is a significant effect on the application of the flipped classroom model with information search strategies through moodle-based *e-lematika* media on students' self-efficacy.

Keywords: Flipped classroom model, information search strategy, self-efficacy, e-lematika

Abstrak. Self-efficacy memilki pengaruh yang besar pada hasil belajar dan prestasi akademik. Namun banyak peserta didik yang mempunyai self-efficacy yang rendah pada mata pelajaran matematika. Untuk itu, dibutuhkan suatu proses pembelajaran yang dapat membantu meningkatkan self-efficacy siswa pada matematika. Tujuan penelitian ini untuk mengetahui pengaruh flipped classroom model dengan strategi information search melalui media e-lematika berbasis moodle terhadap self-efficacy siswa pada matematika. Penelitian ini adalah jenis penelitian kuantitatif dengan metode quasi experimental design. Yang menjadi populasi penelitian adalah siswa kelas XI SMK N 1 Kota Jambi dan dua kelas sampel, yaitu 31 siswa kelas XI TKJ 1 dan 31 siswa kelas XI TKJ 5, masing-masing sebagai kelas eksperimen dan kelas kontrol. Analisis data angket self-efficacy kedua kelas dilakukan meggunakan independent sample t-test yang menunjukkan nilai sig. (2-tailed) adalah 0,000 < 0,05. Jadi, terdapat pengaruh yang signifikan pada penerapan flipped classroom model dengan strategi information search melalui media e-lematika berbasis moodle terhadap self-efficacy siswa.

Kata kunci: Model flipped classroom, strategi information search, self-efficacy, e-lematika

INTRODUCTION

Mathematics is a compulsory subject that has the potential to prepare a superior generation in the era of globalization (Widiantara, 2014) mathematics will have a positive effect on improving children's cognitive abilities (Husna & Nurhafizah, 2022). However, many students are afraid and do not like mathematics. Students do not have the confidence to solve mathematical problems because, from the beginning, the student did not have confidence in their abilities to be able to solve mathematical problems. This is in line with what Prakosa (1996) stated, "often students are not able to show their academic performance optimally according to their potential. One of the reasons is that they often feel unsure that they will be able to complete the tasks assigned.

Student belief is known as self-efficacy, which Bandura introduced as a social learning theory. Self-efficacy is an individual's belief in his ability to solve a problem or action (Bandura, 1995).

The students' low confidence in mathematics was also found in class XI of SMK N 1 Kota Jambi. Based on the observations, it was found that students' self-efficacy is still low in mathematics, especially in matrix material. Among these problems are:

1. Do not dare to solve math problems in front of the class, especially matrix material.
2. Do not dare to ask the teacher for mathematical material that has not been understood.
3. Not sure to be able to solve math problems on matrix material.
4. Poor understanding of matrix material
5. It is not being able to solve the same math problem in different contexts.

Several studies found that students ' self-efficacy will affect student achievement and learning outcomes in the classroom. Therefore, self-efficacy in students needs to be improved so that achievement and learning outcomes are optimal. One of them is through the learning flipped classroom model. Research shows that students' self-efficacy can be improved using the flipped classroom

model (Apriyanah et al., 2018; Ulya et al., 2019). Flipped Classroom model organizes students so that they independently understand the theory before entering class and discuss it in class (Basal, 2015: 30).

In the application of the flipped-classroom model, it should be combined with an active learning strategy (Brooks, 2014). In this study, researchers used information search as an active learning strategy to support the implementation of the flipped-classroom model. Information search is a learning strategy that aims to get students directly involved in discussing topics by collecting information independently (Silberman, 2009).

Due to learning being carried out during a pandemic, e-learning assistance is needed as a medium for student learning. E-learning improves the learning process (Sari, 2017: 86; Arifin & Herman, 2018: 8-9). According to the Ministry of Education and Culture (2020), flipped classrooms can be an alternative learning model suitable to be applied during the Covid-19 pandemic. From this explanation, in this study, as a medium for implementing the flipped classroom model with an online information search strategy, e-learning mathematics (*e-lematika*) will be used.

Several studies relevant to this research are conducted by Vang (2017) entitled "*The Impact Of The Flipped Classroom On High School*." This study examines the impact of the *flipped classroom* on mathematics achievement and students*' self-efficacy*. The research subjects comprised 60 students who studied mathematics in grades 11-12 senior high school from four different classes. Thirty-four students from two classes acted as the treatment group with a *flipped classroom teaching method*. Twenty-six students from the other two classes were the control group with *the traditional lecture-homework teaching method*. First, an ANCOVA series was run to compare the mean across four separate measures, the final test, and the three-unit exams. In addition, a survey was conducted to collect *self-efficacy data*. Then, the research was conducted by Ulya (2019) with the title "*The Effectiveness of Flipped Classroom Learning with Indonesian Realistic Mathematics Approach to Representation Ability in terms of Self-efficacy*." The results of the study conclude *that flipped classroom is* able to increase students' *self-efficacy* so that it has a

positive impact on their mathematical representation abilities. Then, the research conducted by Apriyanah et al. (2018) entitled "*The Effectiveness of the Flipped Classroom Model in Learning Physics in terms of Self Efficacy and Student Concept Mastery*." results showed that the *flipped classroom model was* effectively used to increase students' *self-efficacy.* Furthermore, research conducted by Namaziandost & Akmak (2020) entitled "*An account of EFL learners' self-efficacy and gender in the Flipped Classroom Model*." The results showed a significant increase in students' self-efficacy through learning in the flipped classroom.

A. Definition of *E-Lematika*

Electronic learning or e-learning is currently used in various ways. Sometimes it refers to learning where content or activities are delivered via computer in any way, sometimes learning content from the worldwide web (www) and sometimes using virtual learning environments (VLE) or digital social networks (DSN) (Rice, 2014). Moodle is an application to create learning media in web form. Moodle is a joint product and will continue to grow (Suartama and Sastra, 2014).

E-lematika is an abbreviation of electronic learning mathematics. *E-lematika* can be a software development result to support the implementation of e-learning in a moodle-based mathematics education environment to assist teachers and participants in conducting quality mathematics learning.

B. Flipped Classroom Model

According to Basal (2015), the flipped classroom is a learning model by changing the role of the teacher into a guide, facilitator, and organizer. Due to this role, a more student-centered classroom environment can be created, opening up ways for students to achieve a more active role in their learning. The flipped classroom is a learning innovation by completing learning at home or studying the material before entering class, which was originally done traditionally in class. Nevertheless, there will be more classes that flip than this. The point is in the flipped classroom, and we will start each class with a few videos before entering the class (Bergmann & Sams, 2012). Flipped classroom provides students with topics in advance online, usually through short videos in preparation for learning activities

in class (Reidsema et al., 2017). The flipped classroom syntax is: a) The pre-class stage; b) during class; c) after class (Bates et al., 2017).
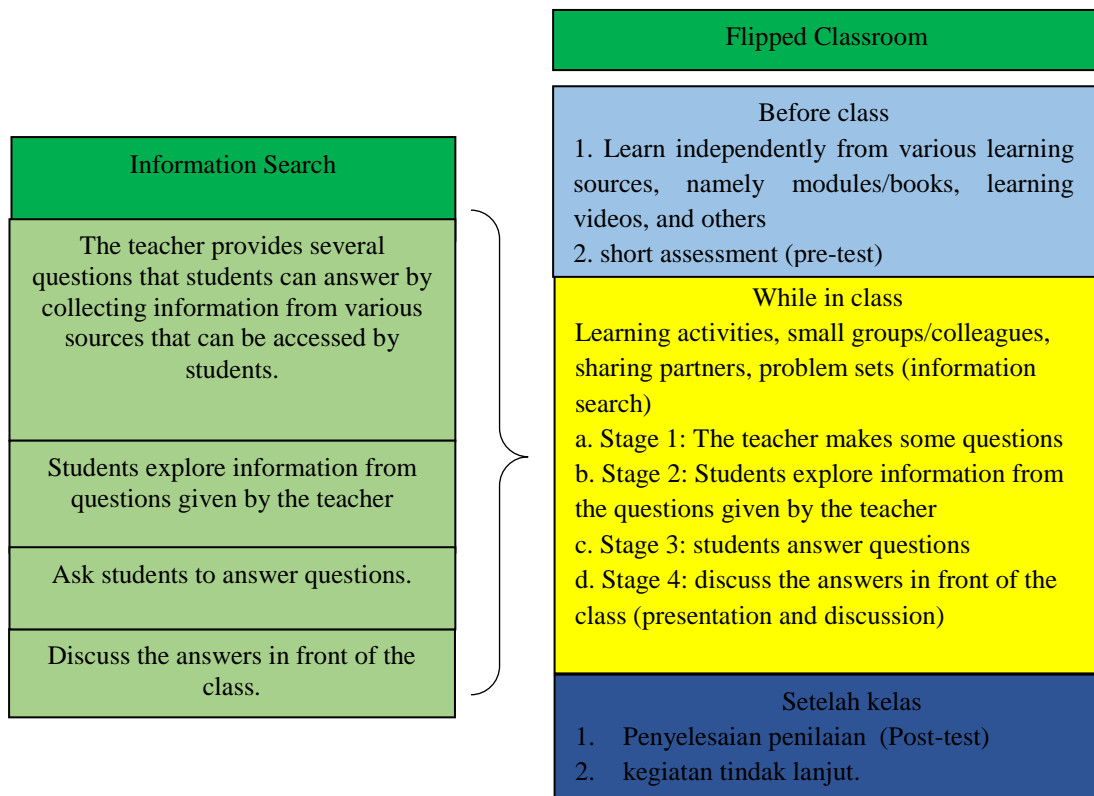
C. Information Search Strategy

Active learning strategy Information Search (IS) is a strategy that can take advantage of IT, such as computers or internet networks. It is intended that students have broad knowledge about the material/problem to train students to find accurate information (Purbasari et al., 2019).

Silbermen (2009) describes the stages of information search, namely:

1. Create questions that lead students to search for information related to the topic
2. Share a question
3. Ask students to discuss in small groups
4. Presenting the results of the discussion

The description of the Flipped Classroom Syntax with the Information Search Strategy is presented in the image below 1 following.

Figure 1. Flipped Classroom Syntax with Information Search Strategy

RESEARCH METHODS

This research is quantitative research with a Quasi-Experimental Design method. One of the objectives of quantitative research is to test research hypotheses (Fauzi et al., 2021). The hypothesis for this case is:

H_0: there is no difference in the post-test self-efficacy scores of students in the experimental class and the control class

H_a: there is a difference in the post-test self-efficacy scores of students in the experimental class and the control class

Testing Rules:

The test criteria are taken based on the probability value.

If Probability (sig) > 0.05 then H_0 accepted

If Probability (sig) < 0.05 then H_0 rejected

The research design used in this study is a post-test-only control group design (Sugiyono, 2015), as shown in table 1 below.

Sample	Treatment	Posttest
Experiment (R)	X_1	O_1
Control (R)	X_2	O_2

Table 1. Post-test Only Control Group Design

Information:

R: Randomly picked class

X_1: Learning by applying the flipped classroom model with an information search strategy through moodle-based *e-lematika* media

X_2: Learning by applying conventional models

O_1: The results of the experimental class p osttest

O_2: Result control class posttest

This study's population was all class XI SMK N 1 Kota Jambi students in the academic year 2020/2021. The number of class XI students at SMK N 1 Kota Jambi is presented in table 2 below:

Class	Total students
XI TKJ 1	31
XI TKJ 2	32
XI TKJ 3	32
XI TKJ 4	32
XI TKJ 5	31
XI TKJ 6	34
Amount	192

Table 2. Data for students of class XI SMK N 1 Kota Jambi

In selecting the sample, it must be representative. Therefore, it is necessary to test the normality and homogeneity of the population from the grades of mathematics in class XI at SMK N 1 Jambi City. Furthermore, two classes as experimental and control classes were selected with a simple random sampling technique as the experimental and control classes.

Self-efficacy questionnaire instrument. The measurement scale on the questionnaire instrument uses a Likert scale. The questionnaire in this study was created and developed by referring to the dimensions proposed by Bandura (1995) and the questionnaire grid that had been used in Yuliana and Winarso's research (2019).

Next, the data was analyzed by changing the ordinal data to interval data. After that, the requirement for an independent sample t-test is that the data must be normally distributed and homogeneous. In this research data analysis, the independent sample t-test was conducted on the self-efficacy questionnaire data for the experimental class and control class students. Because the type of data to be processed is interval data and the comparison of two independent samples, it is used to test the independent sample t-test (Siregar, 2013).

RESULTS AND DISCUSSION

After being given treatment, at the end of the study, the two-sample classes were given a post-test self-efficacy questionnaire. After that, the post-test data were tested for normality and homogeneity as a prerequisite test which showed that the data were normally distributed, and it was concluded that the two groups of data had the same variance (homogeneous). Then, the results of the average post-test score self-efficacy in the experimental class and control class were analyzed using

the t-test, namely the independent sample t-test. The results of these tests can be seen in Table 3 below.

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std Error Difference	95% Confidence interval of the Difference Lower	upper
Equal variances assumed	1.028	,315	-11.011	60	0.000	-15.7025	1.4261	-18.5551	-12.8500
Equal variances not assumed			-11.011	57,942	0.000	-15.7025	1.4261	-18.5571	-12.8479

Table 3. Results of Independent Sample T-Test Posttest Student Self- efficacy

From the table Independent samples test can be seen sig. (2-tailed) of 0.000. 0.000 < 0.05. Then H_0 was rejected, and H_1 was received. It can be concluded that there is a difference in the average self-efficacy of students between the experimental class and the control class. If there is a significant difference in results, it means that the treatment has a significant effect (Sugiyono, 2015). So it can be said that there is a significant effect on the application of the flipped classroom model with information search strategy through *e-lematika* media based on moodle on the self-efficacy of class XI TKJ 1 in SMK N 1 Kota Jambi students.

Implementation of this research took place in each experimental class and control class four times for the same material, namely the matrix. This study aims to determine the effect of the flipped classroom model with information search strategy through moodle-based *e-lematika* media on self-efficacy. The self-efficacy questionnaire used in this study is shown in table 4 below.

No	Statement	Criteria				
		SS	S	N	TS	STS
1.	I am sure I want not to give up on solving matrix problems until I find the answer.					
2.	I believe that every matrix problem has a solution.					
3.	I never cheat on my friend's matrix assignments because I believe in my own answers.					
4.	When the teacher gives a difficult matrix assignment, I believe I can solve it.					
5.	During the matrix learning process, I was not sure I could follow it well.					
6.	If I do not succeed in solving problems, assignments, and studying matrix material, I am sure I want not to be able to increase the effort I have until I succeed.					
7.	When I can not use e-learning, I believe I can improve my business so that I can take part in e-learning- based matrix learning well.					
8.	When discussing matrix material, I believe I am able to work together with groups and take part in completing the given task or problem.					
9.	I am not confident in myself, so I want not to be able to study the matrix well.					
10.	When I was learning matrices, I was sure that I would stick with it to the end even if there were other exciting things I wanted to do.					
11.	When entering a new sub-matrix material, I believe I can use the past learning experience as a reference for the better.					
12.	When studying complex matrix material, I am not sure I will be able to learn it.					
13.	When the teacher suddenly asked me to present the results of the group discussion on the matrix material, I was not sure I could do the presentation well.					
14.	When the matrix exam questions given by the teacher are different from the questions I have studied before, I am not sure I can do it well because of the understanding I have.					
15.	I am not sure I dare to ask and ask the teacher for help when I can not understand the matrix material.					
16.	When the teacher gives an assignment, I believe I can take the time to do it.					
17.	With the experience of learning matrix at the previous stage in the class that I have, I am sure that I will be able to follow the matrix learning well at the stage in the classroom.					
18.	I sure would never plan to complete the matrix task.					
19.	I am not sure I can make the pre-test an experience so that I can do the post-test better.					
20.	I am not sure I can really put in the effort to practice matrix learning, and I am passionate about doing it.					

Table 4. Self-Efficacy Questionnaire

Each stage of learning is carried out in *e-lematika*, according to the stages of the Flipped Classroom model. Before learning is carried out on the learning schedule, the participants first carry out activities before the class that has been provided by the teacher, consisting of student self-study activities from teaching materials in the form of hangouts, books, and learning videos that have been provided by the teacher in *e-lematika*, after that the teacher gives a pre-test namely a quiz about the matrix material that will be studied and guides and directs students to ask questions that they do not understand the material and problems given.

Activities before class, as shown in Figure 2 are carried out to provide initial experience to students before entering class. With this initial experience, it is hoped that students will be able to maintain the success they have experienced and overcome the failures experienced by giving them more activities during class, and students will get an initial picture of the learning that will be passed so that students will be more confident to follow the learning process. In accordance with the factors that make students' self-efficacy good, one of which is the experience that has been passed (enactive mastery experience) (Bandura, 1977). Experience will be information and real lessons to be a benchmark in order to maintain success and fix the failure so that it has an impact on a person's self-efficacy.
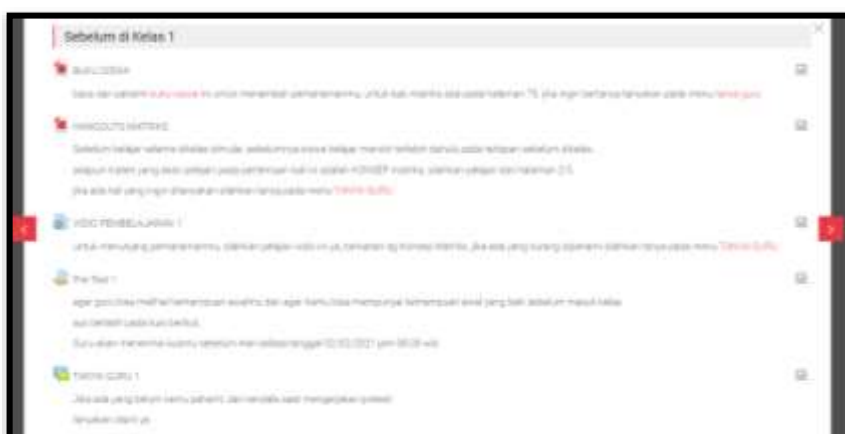
Figure 2. Learning Before Class

After that, students carry out activities during class which consists of a series of activities, starting with discussion activities discussing the results of the pre-test and questions asked by students. After that, students are formed into several groups to work on the LKPD, and the teacher guides students to work on the LKPD and

accepts questions from students if there is material that students do not understand. In this LKPD, work is carried out by students with an active learning strategy Information search consists of the following stages: the teacher gives the LKPD; students look for information and summarize it to answer the LKPD; complete LKPD; present it; in this activity, students will discuss more to share experiences from the learning they have gone through. By looking at the experiences of other students, thus students will be able to assess their abilities. If they feel inadequate, they can increase their efforts in learning activities so that they can increase students' self-efficacy. In accordance with the factors that make students ' self-efficacy good, one of which is the experience of others (vicarious experience) (Bandura, 1977): 3-4). By looking at the experiences of other people, one can judge the abilities they have. If it is considered less, then they can increase it. Seeing the experiences of other people can also increase motivation. When you see someone with the same ability capable of completing a task, it will give them confidence that they will also be able to do the task.

Figure 3. Learning During Class

Figure 4. Ask the Teacher and Discuss

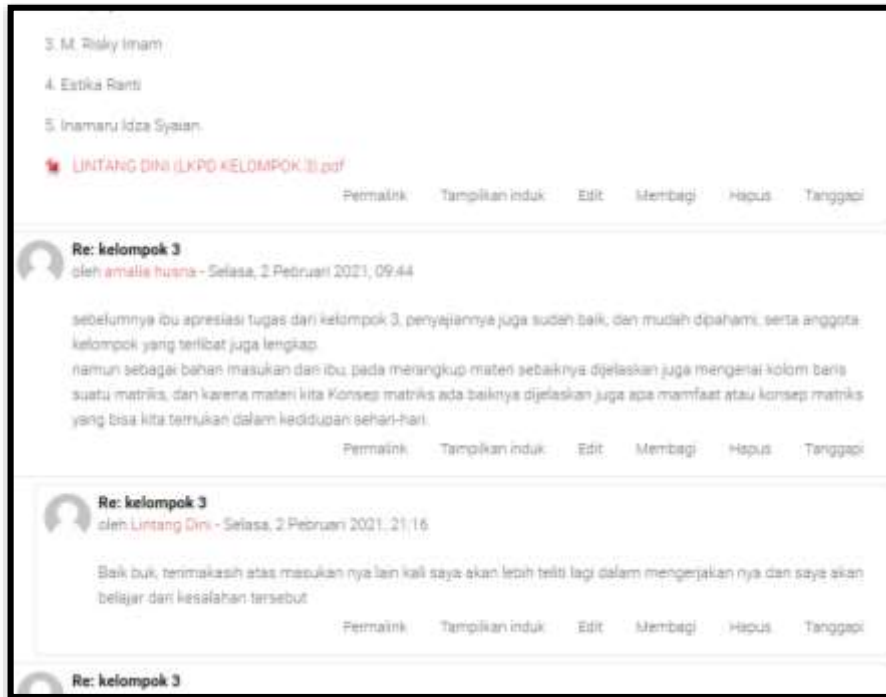
Figure 5. Student LKPD Collection

Figure 6. Discussion of Student LKPD Results

Furthermore, after students carry out activities during class, students will carry out activities after class, which consist of follow-up activities from the teacher and giving a post-test in the form of a quiz consisting of matrix questions to determine the final ability of students.

Figure 7. Learning after Class

In every learning activity, the teacher provides good support to students. The teacher guides students, gives students the opportunity to ask questions, provides feedback provided in *e-lematika* on every quiz result that the teacher has given, in the form of motivation for students to maintain their learning achievement if they get good learning outcomes, and provide enthusiasm to improve their learning efforts. If the quiz results are not good, the teacher tells the students in which part

the students have made mistakes while doing the quiz. Besides being a facilitator for students by providing good learning to students and with three stages of learning, namely: before class, during class, and after class which is carried out on three different schedules, this means that the teacher gives a lot of time and guidance to students. Learning that is also supported by *e-lematika* will have a good impact on students because previously, students used school websites that often experienced interference. With this good support, it will be able to increase self-efficacy. In accordance with the factors that make students' self-efficacy good, one of which is positive support (verbal persuasion) (Bandura, 1977). Through positive support, individuals will feel valued (Mursal et al., 2021). With the support given by others who do not doubt their abilities, a person will have reasonable confidence in their abilities and be able to survive when faced with difficult situations.

With good support from the teacher and the learning facilities provided by the teacher, students will be comfortable participating in learning so that they experience a good emotional state. In accordance with the factors that make students' self-efficacy good, one of which is physiological and affective states (Bandura, 1977). Good student self-efficacy in the learning process can also be seen from the value of good student learning outcomes, where students have an average test score of 92.1 matrix material with a very good category.

In the control class, learning with a conventional learning model runs as is usually done by mathematics teachers at SMK N 1 Kota Jambi. Learning activities begin with preliminary activities and core activities and end with closing activities. In the core activity, the teacher explains the learning material briefly and provides examples of questions. Then the teacher gives the opportunity for students to ask questions that have not been understood and provide exercises for students to do.

In the implementation of learning in the conventional model, it has been going very well. However, in practice, no visible factors can make students' self-efficacy high as in the flipped classroom model. with an information search strategy through Moodle-based *e-lematika* media. One of the reasons is that the conventional learning model is teacher-centered, where step-by-step learning takes place based on the instructions from the teacher.

Some of the obstacles experienced when implementing the e-flipped classroom model learning with information search strategy through the Moodle-based *e-lematika* media include students are still not used to using *e-lematika* and students are not used to learning before and after class, so at the beginning of the lesson for one week the teacher provides a learning simulation to students so that students can adjust to the learning that will be carried out. Obtained by students.

CONCLUSION

From the table Independent samples test can be seen sig. (2-tailed) were 0.000. $0.000 < 0.05$. Then H_0 rejected H_1 received. It can be concluded that there is a difference in the average self-efficacy of students between the experimental class and the control class. If there is a significant difference in results between the experimental class and the control class, it means that the treatment has had a significant effect. So it can be said that there is a significant effect on the application of the flipped classroom model with information search strategy through *e-lematika* media based on moodle on the self-efficacy of class XI TKJ 1 SMK N 1 Kota Jambi students.

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