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Analysis of Students' Mathematical Creative Thinking Ability in Module-assisted Online Learning in terms of Self-efficacy

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Abstract. *The research aims to describe the underlying cause of students' low Creative Thinking Ability (CTA), and examine the effectiveness of online learning assisted by module in improving CTA in terms of self-efficacy. The research applied a mixed-method. The subjects were 8-grade students. The qualitative research subjects were selected purposively, generating two students for each category of low, medium, and high self-efficacy. While quantitative research used cluster sampling to classify experimental and control classes. The independent variable of the study was self-efficacy, and the dependent variable was CTA. Data collection was conducted by observation, interviews, documents, questionnaire, and test. Data was analyzed using descriptive analysis, statistical regression tests, and t-test. The results showed that the underlying cause of low CTA was in students' low and medium self-efficacy. Students with low and moderate self-efficacy highly depended on teacher help. For students with high self-efficacy, the CTA worked well. The results also revealed that the average CTA in the experimental class reached the minimum criteria of mastery learning; the average CTA of the experimental class was better than the CTA of the control class; and the effect of positive self-efficacy on CTA was 38.50% in the experimental category, showing that this learning was effective.*

Keywords*: Creative thinking ability, self-efficacy, online learning, module*

Introduction

The 21st century is closely related to the era of industrial revolution 4.0, marked by the increasingly rapid development of technology, demanding people to become more creative (Maskur, Sumarno, Rahmawati, Pradana, Syazali, Septian & Palupi, 2020). In education, to develop their creativity in achieving learning goals, teachers and students have to create innovative learning activities. Therefore, one of the abilities students must develop is the creative thinking ability (CTA) (Ulfah, Prabawanto, & Jupri, 2017).

The CTA is an effort made by the students to develop new idea or ideas and solve problems (Ernawati, Muhammad, Asrial & Muhaimin, 2019). Therefore, the students have to think creatively by giving non-routine questions following their creative thinking abilities. The five aspects which assess the stages of creative thinking steps consist of; sensitivity, fluency, flexibility, originality, and elaboration (Aini, Narulita, & Indrawati, 2020; Arvyati, Ibrahim, & Irawan, 2015; Husna, Zubainur, & Ansari, 2018; Toheri, Winarso, & Haqq, 2019).

The CTA is one of the essential factors that support the success of learning. However, the CTA shows that the creative thinking ability of Indonesian students is still low (Susanti,

Waluya, & Masrukan, 2020; Wahyuningtyas, Suyitno, & Asikin, 2020; Qadri, Ikhsan, & Yusrizal, 2019). Moreover, students' creative thinking abilities differ from one to another, requiring learning conditions that involve learning experiences (Yusnaeni, Corebima, Susilo, & Zubaidah, 2017). Therefore, this study conducted an in-depth analysis of the causes of junior high school students' low creative thinking skills based on those problems.

Lack of self-confidence (self-efficacy) of students towards their abilities, such as feeling embarrassed or afraid of being wrong to show themselves, feeling tense working on questions, is a factor that affects their CTA (Suciawati, 2019). Self-efficacy is a student's belief in achieving specific performance levels (Razzaq, Samiha, & Anshari, 2018). Self-efficacy strongly influences the students to learn and do assignments (Lunenburg, 2011). Self-efficacy encourages students to participate in ongoing learning activities to optimize students' creative thinking skills (Wulansari, Suganda, & Fitriana, 2019). Self-efficacy refers to internal mental conditions represented by fluency, flexibility, originality, and elaboration skills (Alzoubi, AlQudah, Albursan, Bakhiet, & Abduljabbar, 2016). Therefore, it is necessary to study the student CTA in terms of self-efficacy.

Based on the study of student CTA in terms of self-efficacy, it is necessary to design learning to provide services to students who have low, medium, and high self-efficacy categories. Online learning, considering that the Covid-19 pandemic is still not over. Online learning is one of the learning innovations that can do remotely. Online learning is using educational technology to design, provide, and manage learning (Sudiana, 2016). The application of online learning extends the implementation of learning during the Covid-19 pandemic as it is today. We can do learning activities online without face-to-face activities, and the students are more flexible to study wherever and whenever they want with the help of modules. Online learning requires a Learning Management System (LMS) to monitor student learning activities independently. We can also apply Google Classroom of the LMS in online learning (Ramadhani, Umam, Abdurrahman, & Syazali, 2019).

The application of Google Classroom in this study aims to make it easier for teachers to monitor independent learning activities. Independent learning is an active learning activity motivated by a motive to solve a problem using competencies (Bahri & Sukestiyarno, 2018) provide modules as the primary learning resource. The purpose of this module is that the students are accustomed to learning independently and developing new ideas in dealing with existing problems. Creative thinking skills are in line with the results of Koroh's research (2019), Kusumaningtyas and Supaman (2020), and Rubiyanti and Suparman (2020) state that the use of modules can improve students' creative thinking skills. In addition, the use of

modules in online learning can increase student self-efficacy (Fitri, 2017; Hidayah & Alsa, 2016).

Based on that explanations, the questions are 1) what is the root cause of the students' low CTA in self-efficacy? 2) Is online module-assisted learning effective in improving student CTA in terms of self-efficacy?

Method

This study applied a mix method with a sequential explanatory design. This research activity began with qualitative research. It explored student's CTA in terms of self-efficacy. The scope of the study was the eighth-grade students of SMPN 1 Rembang, Central Java Indonesia, and the teaching material is about the number pattern. The research subjects were selected by considering representativeness, choosing the two students in the low, medium, and high self-efficacy categories.

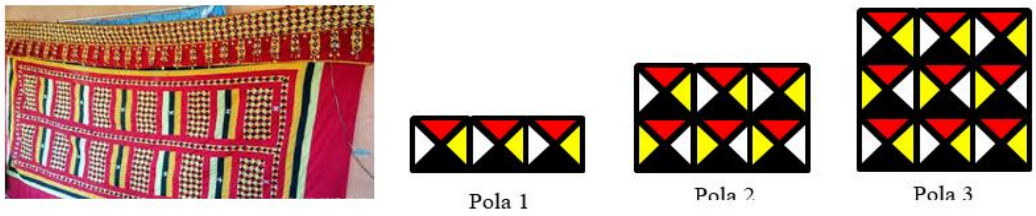
The focus of the study was the CTA and student's self-efficacy. Data collection were conducted through observation, in-depth interviews, and documentation. Students' self-efficacy when facing mathematical problems about preparing for learning and the learning process was observed. The Interviews depended on the steps taken by students in solving CTA questions, including at work stages where students experienced deadlock, what made efforts to deal with deadlocks, what problems and solving CTA questions is what feelings by the student. Meanwhile, to see students' written answers in working on CTA questions viewed by the documentation.

The self-efficacy data collection was conducted using a questionnaire with indicators covering three dimensions: magnitude (the difficulty of the task that one believes can be achieved); strength (a belief about solid or weak importance); and generality (the extent to which expectations are generalized in various situations) (Lunenburg, 2011). While the test instrument in Figure 1, the CTA indicators were prepared (Aini et al., 2020; Arvyati et al., 2015; Husna et al., 2018; Toheri et al., 2019). The questionnaire of this study was tested for validity and reliability, and also the CTA test instrument was tested for validates, reliability, differentiation power, and level of difficulty. The data collected was processed descriptively by reducing the data.

The following research is experimental, with a population like the scope above. Sampling was carried out by cluster sampling, namely from a population of four classes randomly selected, one experiment class, and one control class. The independent variable of this study is student self-efficacy, and the dependent variable is the CTA. Questionnaires were obtained through Self-efficacy data and CTA data through the test. We analyzed the

experimental data to test the effectiveness of learning, and we were fulfilling the three criteria 1) learning in the experimental class achieved the minimum completeness of the CTA, it is 70; This data is processed by comparative test analysis one-sample t-test; 2) CTA in the experimental class is better than the CTA in the control class; Tasted this data by comparing the mean difference with the independent t-test; 3) self-efficacy has a positive effect on students' CTA in the experimental class; tasted this data using the regression effect test analysis (Sukestiyarno, 2020).

Perhatikan diagram berikut:



Masyarakat Lampung Saibatin memiliki kain khas yang selalu digunakan dalam setiap upacara adat yang disebut dengan kain kebung. Kain kebung digunakan dalam upacara adat. Kain tersebut memiliki symbol berupa suatu ide yang dipakai sebagai tanda. Perhatikan desain kain kebung di atas.

a. Berdasarkan pola kain kebung di atas buatlah **dua** barisan bilangan yang berbeda.
b. Tentukan **dua cara** yang berbeda untuk mencari suku ke-n dari masing-masing barisan bilangan tersebut.
c. Tentukan **suku ke-10** dari masing-masing barisan.

In English

Pay attention to the following diagram:
The people of Lampung Saibatin have a distinctive cloth that is always used in every traditional ceremony called the Kebung cloth. Kebung cloth is used in traditional ceremonies. The cloth has a symbol in the form of an idea that is used as a sign. Pay attention to the flower design above.
a. Based on the *Kebung* pattern above, make two different sequences of numbers.
b. Find the nth term of two different sequences of numbers.
c. Find the 10th term of each sequence.

Figure 1. CTA test questions

Results and Discussion

Students' Creative Thinking Skills in Terms of Self-Efficacy

The CTA's answers in the High Self Efficacy (HSE) category to the CTA test can be seen in Figure 2.

The subject's answer in Figure 2 shows that the HSE subject has no difficulty making two different numbers based on the *Kebung* cloth pattern. Therefore, they fulfilled the aspect CTA of Sensitivity and flexibility. Moreover, the HSE subject can determine how to look for the nith term in the fluency aspect using two different ways and explain how. The results of these answers illustrate the authenticity of the subject's thoughts, so to be fulfilled, we can conclude that aspect CTA of originality. Fulfilling the detailed part is by demonstrating clear and precise short answer steps.

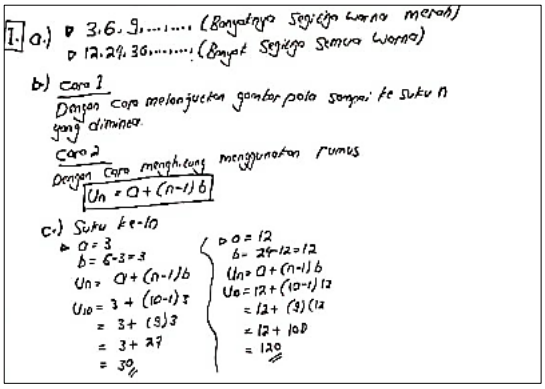


Figure 2. The results of student CTA from the HSE category.

The CTA's answers with the Medium Self Efficacy (MSE) category to the CTA test can be seen in Figure 3.

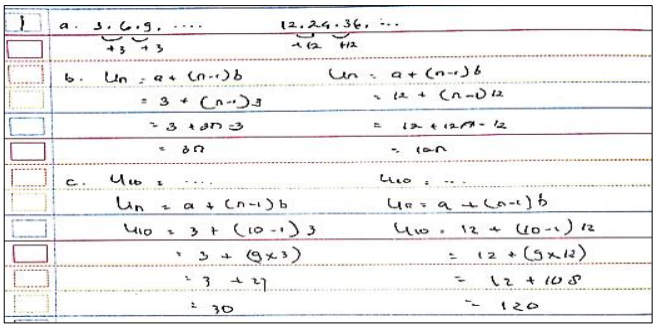


Figure 3. The results of student CTA from the MSE category.

The answer to the MSE subject in Figure 3 shows that the subject can answer each question well. There are two ways of answering, and they are present coherently. This answer indicates that the three aspects of CTA, namely sensitivity, fluency, and authenticity, are fulfilled. However, based on the interview, the MSE subject did not explain how and the steps. Therefore, the answer is seen as a rote by knowing the formula and arriving at the solution. So, the aspect CTA of authenticity and detail is still not optimal.

The CTA's answers with the Low Self Efficacy (LSE) category to the CTA test can be seen in Figure 4.

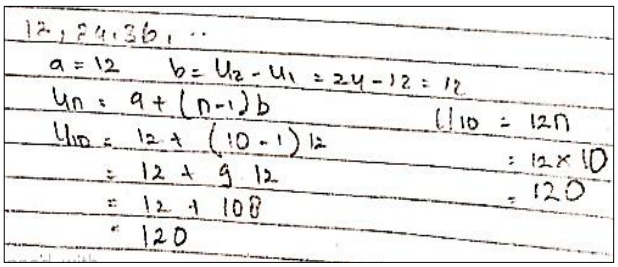


Figure 4. The results of student CTA from the LSE category.

Based on the answers to the LSE shown in Figure 4, the subject can answer of CTA can only display one answer without a complete explanation. Based on in-depth interviews, We knew that students received information from friends' help, and some stated that they obtained

the answers from memorizing the formula. This answer shows that LSE subject CTA still has many difficulties in solving CTA questions.

Based on the results of the CTA test, it can be explained that students in conditions of low self-efficacy will have difficulty starting to learn. Besides that, they have sensitivity in dealing with questions and feel like giving up to solve the problem. Of course, continuing at the next stage is a challenging step for students. For students in a moderate self-efficacy condition generally have tried to arrive at the location of sensitivity, fluency, and flexibility. However, to show authenticity, it is still lacking. They highly depend on teacher help. The results of the interview below reinforce this interpretation. It cannot be successful if students are required to be independent in learning. Furthermore, students in conditions of high self-efficacy generally do not experience much difficulty in working on questions.

The interviews for each subject with LSE, moderate MSE, HSE, after given the CTA measuring test, can be seen in the following snippet.

The step of sensitivity

Question : *How did you feel after being given creative thinking questions, and how to start working on them?*
LSE : *I feel a pounding heart, just imagining the problem was that it feels like it is getting dizzy.*
MSE : *I tried to accept it, then read it, trying to understand the problem.*
HSE : *I tried to answer wherever possible.*

The step of fluency

Question : *Whatever happens, you have to solve the problems. So how did you respond to it?*
LSE : *I had to do it but try to read it repeatedly while waiting for help from others.*
MSE : *I had to do it but tried to read repeatedly while waiting for help from others. I try to dive into the problem and do it according to the steps.*
HSE : *I tried to do my best and, if possible, as soon as possible. However, if I did not understand, I immediately asked the teacher.*

The step of flexibility

Question : *Should the questions do as much as possible to do how you asked for help from the teacher?*
LSE : *I tried to ask the teacher so I could do it.*
MSE : *I did it first. If there were difficulties, I asked the teacher.*
HSE : *I was doing well. I was sure I could.*

The step of originality

Question : *How could I, as a teacher, believe that the work you were doing was original from your thoughts?*
LSE : *I sometimes gave up because it was challenging to do the questions.*
MSE : *I could try to work first, asked friends before asking the teacher.*
HSE : *I believed in my work.*

The step of elaboration

Question : *The problem did; how did you come to the completion of the problem?*
LSE : *I was having a hard time, Mom, so I had to keep trying.*
MSE : *I tried to solve the problem, check and control as much as possible.*
HSE : *I did my best, and sometimes it took time, then collected it to the teacher.*

Based on the interview excerpt above, we can conclude that the lack of student self-efficacy causes the students' low CTA. The deepening results through interviews show that students in the low self-efficacy category have difficulty following the steps in the CTA stages. Students with moderate self-efficacy can carry out the measures of sensitivity, fluency, and flexibility. However, they still do not dare to rely on the authenticity of their work, let alone go into detail. On the other hand, students with high self-efficacy can carry out the stages of creative thinking skills, and it is just that it takes quite a long time to arrive at details.

Qualitatively, it is recommended that special assistance is needed for students with low and moderate self-efficacy. Junior high school students are still in a transition period between learning and still need mentoring and independent learning; moreover, it is online education with zoom meetings and assignments through Google Classroom.

The Effectiveness of Module-Assisted Online Learning in Improving Students' CTA in Terms of Self-Efficacy

Based on the data analysis, the self-efficacy data of the experimental class students were obtained after online module-assisted learning, as presented in Table 1.

Table 1. Student self-efficacy in the high (H), medium (M), and low (L) categories

No	***Self Efficacy Question***	***Self Efficacy* before the experiment**			***Self Efficacy* after the experiment**			**N-Gain *Self Efficacy***		
		T	S	R	T	S	R	T	S	R
1	I feel enthusiastic about taking lessons on number patterns	4.4	3.1	2.2	4.5	3.6	3.3	0.167	0.263	0.393
2	I feel happy after taking the lesson on number patterns online	3.6	2.9	2.3	3.8	3.7	3.3	0.143	0.381	0.370
3	I like the number pattern lessons learned online	3.9	2.9	2	4.4	3.2	2.6	0.455	0.143	0.200
4	I like to do number pattern assignments independently.	4.3	3.1	2	4.8	3.4	2.1	0.714	0.158	0.033
5	I like to study number pattern material when facing tests	4.3	3.2	1.8	4.4	3.6	2.1	0.143	0.222	0.094
6	I can learn number pattern material based on my understanding ability	4.1	3.2	2	4.3	3.7	2.7	0.222	0.278	0.233
7	I can learn number pattern material based on my ability to get a test score on the number pattern material above the minimum completeness criteria value.	4.3	3.1	1.7	4.4	3.4	1.9	0.143	0.158	0.061
8	I can complete all complex number pattern material assignments correctly and adequately	4.1	2.8	1.8	4.3	3.1	2.4	0.222	0.136	0.188
9	I feel happy when given a number pattern assignment with story questions that require a more profound understanding	4	2.8	2.3	4.1	2.9	2.6	0.100	0.045	0.111
10	I never give up on number pattern material problems that require a lot of steps to find the answer	4.3	3	2.2	4.4	3.3	2.6	0.143	0.150	0.143

Table 1. Student self-efficacy in the high (H), medium (M), and low (L) categories (continue)

No	*Self Efficacy Question*	*Self Efficacy* before the experiment			*Self Efficacy* after the experiment			N-Gain *Self Efficacy*		
		T	S	R	T	S	R	T	S	R
11	I was able to quickly solve number pattern material problems with the same type as I had tried before	4	3.4	2.5	4.3	3.6	2.9	0.300	0.125	0.160
12	I can easily remember the number pattern material that has been studied online	4	3.3	2.7	4.4	3.5	3.3	0.400	0.118	0.261
13	Previously I had never worked on number pattern material problems, and I felt challenged	3.9	3.1	1.8	4.6	3.4	2.6	0.636	0.158	0.250
14	Previously I had never studied number pattern material, and I felt challenged	4	3.1	2	4.5	3.4	2.1	0.500	0.158	0.033
15	I came up with different ideas to solve it if I encountered another number pattern matter problem.	4.1	3	2	4.6	3.3	2.6	0.556	0.150	0.200
	Mean	4.087	3.067	2.087	4.387	3.407	2.607	0.323	0.176	0.182
									0.227	

Furthermore, the descriptions of the students' CTA test scores are presented in Table 2.

Table 2. Description of CTA scores for the experimental class and control class

	SE exp	**CTA exp**	**CTA Control**
N valid	31	31	32
N missing	0	0	0
Mean	3.53	75.7	63.7
Std. Deviation	.75	8.60	8.98
Minimum	2.00	53.1	50.0
Maximum	4.60	90.6	78.1

From Table 1 regarding the increase in self-efficacy data based on the gain value, it is concluded that students with high self-efficacy have a gain value of 0.323 (medium criteria). For students with moderate and low self-efficacy, the gain value is below 0.3 (standard criteria). Overall, the students had a gain score of 0.227 (common standards). Thus, although the gain value is low, it has shown an increase due to the application of this learning. It is just that for junior high school students to increase students' self-confidence in their abilities. They still need continuous encouragement and habituation because they have not yet fully learned independently. Then analyzed the self-efficacy and CTA value the experiment class and the CTA value the control class. The mean value of self-efficacy for the control class was 3.043, equivalent to 70.6% with reasonable criteria (more than minimum standard score 70%). The standard deviation of 8.6 was slight, and the range of values between the maximum and minimum was not too extensive, indicating a pretty good score and tended to be homogeneous. Meanwhile, the CTA score for the control class was below the standard.

The effectiveness of module-assisted online learning is seen based on the completeness test, the average difference test, and the simple regression test. Therefore, the first step was to test the students 'CTA completeness using the students' CTA test results. We can see the results of completeness testing with the one-sample t-test in Table 3 below.

Table 3. The output of the CTA completeness test data

Var	**Test value = 70**			
	T	Df	Sig (2 tailed)	Mean difference
KBK	3.694	30	.001	5.7077

Ho: μ = 70 (CTA mean of the experimental class is equal to 70)
H1: μ ≠ 70. (CTA mean of the experimental class is not the same as 70).

Based on Table 3, it can be seen that the sig value = 0.001 = 0.1% <5%. It means that Ho is rejected or accepts H1. So, the mean CTA for the experimental class is not equal to 70. The empirical average is equal to 75, which indicates that it is more than the minimum standard score = 70. It indicates that the CTA experimental class has exceeded the minimum standard score value.

Furthermore, it is a comparison test for the mean of the two samples. Thus, the compromise between the experimental class and the control class does appraise the independent t-test. We can see the summary of the results of the average difference test with SPSS in Table 4 below:

Table 4. Results of the comparative test for the difference in the mean CTA for the Experiment class and the control class

KBK	**Test homogeneity**		**Test for equality of means**			
	F	Sig	t	df	Sig (2 tail)	Mean diff
Eq var assumed	.823	.368	4.833	.000	11.9955	2.4822
Eq var not assumed			4.833	.000	11.9955	2.4822

Ho: μ1 = μ2 (the mean CTA for the experimental class and control class is the same)
H1: μ1 ≠ μ2 (the mean CTA for the experimental class and control class is different)

Based on the output of Table 4, that sig = 0.000 = 0% <5%, meaning that Ho is rejected or accepts H1. So, the mean of the two classes is different. Based on the practical value of the CTA mean for the experimental class, 75.7 is greater than the CTA average for the control class, 63.7. It shows that the CTA achievement in the practical class is better than the CTA achievement in the control class.

Furthermore, it tested the third learning effectiveness test requirements, whether self-efficacy in the experimental class positively affects CTA outcomes? By using a simple regression effect test, we can see the output in Table 5.

Table 5. The output of the regression equation x (self-efficacy) against y (CTA)

Model	**Unstandardized coefficients**		**Standard coefficients**		
	B	Std error	Beta	T	Sig
Constant	51.535	5.805		8.878	.000
SE exp	.235	.055	.621	4.261	.000

The regression model $y = \beta o + \beta 1\ X + \varepsilon$ with an estimator of $y = a + bx$, based on Table 5, the regression equation $y\hat{} = 51.535 + 0.235x$ is obtained. Hypothesis testing:

Ho: $\beta 1 = 0$ (nonlinear equation / x has no effect on y)

H1: $\beta 1 \neq 0$ (linear equation / x has effect on y)

Based on the output of Table 5, that sig = 0.000 = 0% <5%, meaning that Ho is rejected or accepts H1. So, the regression equation is proven to be linear, or there is a positive effect of x (self-efficacy) on y (CTA). We can see the magnitude of the impact in the SPSS output value R2 = 38.5%. So, the experimental class self-efficacy affected the CTA achievement by 38.5%, and there were still 61.5% influenced by other factors. So, the influence here on the result is sufficient.

Based on the three statistical test evidence mentioned above: (1) the CTA reaches the minimum standard score; (2) the comparative test that the CTA experimental class is better than the CTA control class; and (3) there is a positive effect of self-efficacy on the experimental class to CTA. The conclusion that learning online module assistance is effective in improving student CTA in terms of self-efficacy.

Independent learning assisted by module means effective in improving student learning outcomes supported by the results of research by Asih, Isnarto, and Sukestiyarno (2021), which concluded that the use of modules is effective on mathematical communication skills. In addition, Rahmawati, Suyitno, and Sukestiyarno (2020) concluded that Model Eliciting Activities (MEAs) and module-assisted independent learning were effective against mathematical connection skills.

Independent learning with the module gives students free in studying the module provided. The learning activity begins by providing a number pattern module to students through Google Classroom. The module provided contains learning activities that students can do independently and with problems that require students to come up with new ideas. Therefore, they must be more active in learning activities. Also, the given module contains practice questions that meet the CTA aspect. In independent learning, the teacher's task with monitoring learning activities carried out by students independently through Google Classroom.

Students self-learning can be accustomed to using the module, thus causing increased self-efficacy. It is supported by Fitri (2017), which concluded that learning using mathematics modules could increase student self-efficacy. In line with the study results by Afifah and Agustini (2017), the use of modules can increase self-efficacy in number pattern material. Can improve student self-efficacy in learning English by using the Mind Map for English (MMFE) module (Hidayah & Alsa, 2016).

Students who have high self-efficacy will have high creative thinking skills, in line with the opinion of Lestari, Hasibuan, and Muhammad (2020). High CTA is because students who have high self-efficacy do not feel afraid, doubtful, and embarrassed to submit opinions. In contrast, those who have low self-efficacy do not have the enthusiasm to work on questions (Arifin, Trisna, & Atsnan, 2018). Meanwhile, students with low self-efficacy categories tend to give up easily in encountering difficulties in questions. It is supported by the opinion of Nadia, Waluyo, and Isnarto (2017) that students with low self-efficacy tend to avoid questions that are considered complex and are only interested in questions that are considered easy. Based on the results of extensive research, self-efficacy support affects CTA by 38.5% (only sufficient). The size of the influence that is not so big occurs because students categorized as low and medium self-efficacy are more than students with high categories. It shows that increasing self-efficacy from the low level and being towards the high level requires a more comprehensive study to achieve a better CTA score.

Conclusion

The results show that the fundamental problem of the low level of students in achieving creative thinking skills lies in the self-efficacy of each student. Students who have low self-efficacy will experience many difficulties compared to students with high self-efficacy. The recommended stages of creative thinking for junior high school students to follow the steps of sensitivity, fluency, flexibility, collaborative, originality, and elaboration.

Online learning assisted by modules effectively increases CTA, marked by students in the experimental class achieving the minimum criteria of mastery learning. The average CTA of the experimental class is better than the average CTA of the control class, indicating a positive effect of students' self-efficacy on CTA in the experimental class.

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