



The Mathematical Creative Thinking Skills of Students with Procrastination in E-Learning Assisted Problem-based Learning Method

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Abstract

This study aims to analyze the creative thinking skills on procrastinating perspective. The research method is a mixed method with a sequential explanatory model. The population of this study was students of class VIII SMP Negeri 3 Temanggung in the academic year 2020/2021 with class VIII E as the experimental class, and class VIII F as the control class. The data were collected using tests, documentation, questionnaires, observations, and interviews. The quantitative data were tested using the average test, the proportion test, the average difference test, and the different proportions test, while the qualitative data were tested with data validity, data reduction, data representation, and draw a conclusion. Students with high procrastination character who have low mathematical creative thinking skills do not master the fluency, flexibility, originality, and elaboration indicators well. Students with high procrastination character with mathematical creative thinking skills are not mastering the indicators of flexibility, originality, and elaboration. Students with moderate procrastination have low mathematical creative thinking skills and do not master the indicators of flexibility, originality, and elaboration well. Students with moderate procrastination characters who have the mathematical creative thinking skills are not good at mastering the elaboration indicator. Students with low procrastination characters who have the mathematical creative thinking skills, but they do not master the elaboration indicator. Students with low procrastination character have high mathematical creative thinking skills that fulfill all indicators.

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INTRODUCTION

21st century demands higher competitive skills in every aspect. Everyone should possess at least critical thinking, creative thinking, communicative, and collaborative skills. The education should prepare the students for the competitive global society (Nahdi, 2019). Mathematics as the universal knowledge, that have laid foundations of modern technology advancement, has the strategic role in every major knowledge and helps to improve the humankind thinking skills development. Besides, Mathematics is the primer subject in every educational aspect to train consistency and patterns (Siagan, 2012). Thus, Mathematics is a way to teach the students to be a creative person.

Creative defined the ability to create something, and mathematics define certainty and accuracy. Hence, mathematical creative thinking could define the thinking ability to create or find new, original, and uncommon ideas that bring up the certainty and accuracy (Abidin et al., 2018). The creative thinking skills are the students employed skills to develop a new perspective to solve a problem (Putri et al., 2017). (Sholihah & Suyitno, 2019) stated that mathematical creative thinking skills in problem solving are urgent to investigate ideas and solutions for the current problems to generate an accurate problem solving. Mathematical creative thinking skills is one of every student must possess divergent thinking skills in current technology and information era. Regarding the urgency of the creative thinking skills, mathematics learning activity should aim for the development and improvement of the skills. There are four indicators to help measure the students' creative thinking level. They are fluency, flexibility, authenticity, and elaboration. Fluency defines the ability to solve and provide several problem-solving options for a problem. Flexibility indicates the ability to provide clear and ideal strategies of a problem solving. Authenticity means the ability to contribute new or uncommon ideas in a problem solving. Elaboration defines the skill to detail a problem or an object using several mathematical representatives (Arista & Mahmudi, 2020).

Field facts indicated that the students' mathematical creative thinking skills are low. It was found during the observation in SMP Negeri 3

Temanggung in which students had been given an exercise of rectangular. The students served similar answers and made similar mistakes. It was because of the students' low level of creative thinking that the given answers were monotonous. In fact, the Indonesia students' creative thinking skill is very low (Fardah, 2012). (Widiastuti & Putri, 2018) in Global Creativity Index stated that the Indonesian creativity level is in 115 out of 139 countries.

The low level of creative thinking skills could come from the students' procrastinating habit. Procrastination defined an intended postpone of a task (Abu & Saral, 2016). Academic procrastination is the procrastinating activities related to the school tasks. (Freeman et al., 2011) argued that procrastination is related to emotional, habitual, and cognitive factors. Postponing drives a student to learn less than those who did not procrastinate. Hence, the unprepared learning activity obstructed the thinking skills. It was found that procrastination obstruct the students' learning process, conduce in cumulative unfinished tasks, lead into unable to solve a mathematics problem, and unable to catch up the teacher's explanation of certain learning material. Therefore, teachers should provide a learning model that stimulate the students to be active, focus on the learning activity and tasks.

Teacher's perspective and understanding to teaching methods affects the students' creativity in Mathematics learning activity. Moreover, teacher's teaching creativity depends on how well the understanding of the learning methods. Constructivism theory stated that students learn to construct the knowledge through interactions with his/her environments. One of the constructivism learning method is Problem-based Learning Method (PBL). (Huang & Foreign, 2012) argued that the Problem-based learning method provided a meaningful learning experience that it could promote the students' interest and achievement in the learning activities. (Badriyah & Kiptiyah, 2021) argued that Problem-based Learning Method could improve scientific skills and learning impacts compare to conventional methods. Problem based learning method trained the students to find his/her concept of real-life problems and to possess investigating skills that it is the highest level of learning methods (Mugla, 2011). The use of Information Technologies

enhanced the learning process alongside the use of learning methods. Information Technologies could help to create a new learning environment to promote students' interest in learning activities. The employed Information Technologies here is called the Learning Management System (LMS). (Handayanto et al., 2018) argued that internet-based learning activities promoted students' interest, participation, and achievement. E-learning assisting learning activities open the possibility to learn anywhere and everywhere. The use of E-learning gave advantages to the students and teachers in terms of understanding concepts that had been attractively as well as informatively prepared (Adha & Sumarti, 2019).

Based on the background, this research aimed to reveal the quality and analysis of the student's mathematical creative thinking skill in the perspective of procrastination of the use of E-learning assisting Problem-Based learning methods.

METHODS

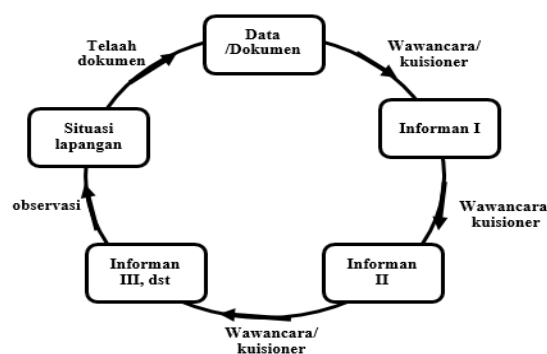
This research method is a mixed method with a sequential explanatory model. The design in this study is post test control group design. The population of this study was students of class VIII SMP Negeri 3 Temanggung in the academic year 2020/2021. The sample in this study was students of class VIII E as the E-learning assisting problem-based learning method, and the control class was students of class VIII F which given treatment by E-learning assisting Discovery Learning method. The sampling technique was purposive sampling. The research subject was the procrastination level categories which are high, middle, and low. Each level had two students' sample from each experimental and control group. The students' creative thinking capability was comprehensively analyzed.

The quantitative research approach was employed to examine the quality of E-learning Assisting Problem Based Learning method. The design adopted the true experimental design (posttest control group design). Besides, the qualitative research approach was employed to analyze the students' mathematical creative thinking capability in terms of procrastination. The applied qualitative approach was the Grounded Theory to allow the

researcher to investigate the problem comprehensively.

The collected data was quantitative and qualitative data. The quantitative data was gained from the questionnaires, test, and observation sheets. The qualitative data was gained from the interviews, observations, and documentations. The analysis of the quantitative data was held on the question items, pretest data, and hypothesis testing. The pretest data analysis was aimed to investigate the initial capabilities of the experimental and control groups; the result showed that the initial capabilities were level. Hypothesis testing was done through minimum mastery standard test, classical completeness test, proportion difference test, and average difference test. Pretests include normality tests, and homogeneity test were taken in advance employing Kolmogorov-Smirnov test set and SPSS 25.0.

The qualitative data analysis employed four phase tests including data validity, data reduction, data presentation, and conclusion drawing test. The validity test was taken with triangulation technique as what described in the following Picture 1.



Picture 1. Triangulation

Research data validity and credibility was checked through triangulation technique. The collected procrastination data from questionnaires was triangulated within interviews. The mathematical creative thinking skills data was collected from the examination and was triangulated through interviews as well. To provide thorough research report, detailed transferability check was taken that the report could comprehensively described the contexts of the research. Dependability check employed the auditing system of two volunteers of each procrastination level group. Confirmability test was done by reducing subjectivity during the data collection employing

interviews guides, assessments guides, and present true data.

RESULTS AND DISCUSSIONS

Creativity in terms of higher order thinking skills is necessary in elementary as well as high school level. (Fakhriyani, 2016) argued that creativity is not a talent that need development and improvement from the early young age. Students need to attain sufficient mathematical creative thinking from the elementary school level (Ramadhani & Nuryanis, 2017). Mathematical Creative Thinking skills are important to be taught especially in Mathematics, because the skills trained the students to not focus on single problem-solving technique. Thus, students could provide alternative solutions and produce new ideas that powerful enough to help them develop their mindset. Mathematics learning activity should employ appropriate learning method to achieve the goal. One of the methods is the E-Learning Assisting Problem-based learning method. This method could reduce procrastination and develop the creative thinking skills. The implementation of the method in early school would result in gaining advantages to promote higher learning quality.

The result of the research is divided in two parts based on the research questions. The two parts included (1) the learning quality of E-learning assisting problem-based learning model in promoting the students' mathematical creative thinking abilities and (2) the description of the abilities based on students' procrastination. The quality of the method should cover up three stages of preparation, execution, and assessment (Mukaddas, 2019).

The preparation stage aimed to test the learning media validity check. There were two employed validity check. The tests were expert validation and empirical validating. The expert validity test of the learning instruments included the syllabus, lesson plan, students' portfolio, E-learning media, procrastination questionnaires, mathematical creative thinking test instruments, and interview guides. The tabulation of the expert validating test is served in the following Tables.

Table 1. Tabulation of Validity Test Result

No	Instruments	Average Score	Category
1	Syllabus	4.57	Excellent
2	Lesson Plan	4.67	Excellent
3	Portfolio	4.57	Excellent
4	Question Sheet	4.16	Good
5	Questionnaire	4.2	Good
6	E-Learning Media	4	Good
7	Interview Guides	4.1	Good

Table 1 showed that the validity test result in good average score in which 4 for the lowest and 4.67 for the highest score. Hence, the learning media were relevant to the research.

Table 2. Result of Test Instruments Trial

Question	Validity	DL	DP	Reliability	Description
1	Valid 0.77	Med 0.62	Adequate 0.26		Used
2	Valid 0.67	Med 0.55	Adequate 0.25	Med 0.65	Used
3	Valid 0.78	Med 0.56	Adequate 0.37		Used
4	Valid 0.6	Hard 0.29	Adequate 0.18		Used

Table 2 presented the validity, difficulty level, distinguishing power, and reliability of 4 test instruments trial and competence mastery which showed that the instruments were reliable to apply for the posttests.

The execution quality check of the learning activity was described by observation of the lesson plan execution and students' questionnaires. The lesson plan implementation would not be regarded qualified unless the implementation attains sufficient score and 75% of the students gave positive responses. The description of the learning activity would narrate every meeting.

The learning subject in the first meeting was cube; the learning activity resulted 86.7% out of the minimum proficiency criteria that regarded very good. The main activity was congenial with the lesson plan though the E-learning usage was not optimal. In the guiding step, individual inquiry and

group inquiry, the students had not got accustomed to the E-learning application that the discussion process was not run well. In the promoting step, the students work presentation was not run well because of the inappropriate discussion process that drove several students less focus to present the works. In the evaluation step, the teacher was in rush to close the meeting due to the limited time allocation. The discussion subject in the second meeting was block; the meeting achieved 84.7% achievement criteria and was regarded very good.

The main stage was congenial with the lesson plan. On the guiding step, the students had held sufficient discussion through the individual and group inquiry though there were several students to be less active. On the developing step, the students presented their work creatively and attractively.

The evaluation step was better than the previous meeting though there were 10 minutes remain of the allocated time. The learning subject in the third meeting was block; it gained 84.7% of the standard thoroughness criteria and regarded very good. The learning activities was in line with the lesson plan. The students had done discussion session nicely even though there were less-active students. The students had better creatively and attractively present their works than the previous meeting. The evaluation section had better result than the previous meeting though the 5 minutes remain of the allocated time. The subject of the previous meeting was block; it gained 88% of the standard thoroughness criteria and regarded very good.

The learning activities was in line with the lesson plan. The students had done discussion session nicely even though there were less-active students. The students had better creatively and attractively present their works than the previous meeting. The evaluation section had better result than the previous meeting and was in line with the allocated time. The gained learning criteria showed relative improvement from meeting to meeting with advantage percentage 86.5% and was regarded very good. In sum, the learning activities has achieved very good criteria.

The students' responses of the questionnaire indicated high quality learning activity with positive responses out of 20 questions in 5 scales. It was concluded that the good learning process would result from the well-prepared lesson plan. This was in line

with (Nurqolbiah, 2016) stated that the improvement of the students abilities to solve problems and creatively think in a class that use the problem-based learning model could not be separated from the characteristic of the model. The problem-based learning method required the students to collect their knowledge and to develop their inquiry and thinking skills.

The E-learning assisted Problem-based learning method quality to help the development of mathematical creative thinking was investigated. The prerequisite tests were taken before running the effectiveness test. The prerequisite tests were normality and homogeneity test employed the SPSS 25.0. The data revealed that the experimental population had normal and homogeneous distribute. The next test was the average mastery test employed the t test, in which $\alpha = 0.05$. It was concluded that $t_{count} = 4,410 > 1,689$ or in other words the students' mathematical creative thinking skills was average and suitable to use the E-learning assisted Problem-based Learning method. The classical completeness test employed the z test resulted in $z_{count} = 1,970 > 1,65$ that the percentage of the mathematical creative thinking skill average mastery achieved 75%. The average distinction test employed the t test resulted in $t_{count} = 4,430 > 1,672$ which means that the average thinking skills gained from the E-learning Assisted Problem-based Learning method was better than the control group that was not given the equal method. The ratio distinction test employed z test resulted in $z_{count} = 4.25 > 1,65$ which means that the thinking skills of students who had been taught using E-learning assisted Problem-based Learning method were higher than the students who had been taught with other E-learning assisted learning methods.

Based on the collected data and the discussion, it concluded that E-learning assisted Problem-based Learning method is potential to improve the students' mathematical creative thinking skills. This result is in line with the (Elyas, 2018) argument that the learning activity in virtual classes (E-learning) was a new innovation in education since it can reduce teaching styles and learning material. Thus, it can result a consistent learning quality. (Surat & Jayani, 2019) argued that the E-learning assisted Problem-based learning method affect the learning creativity

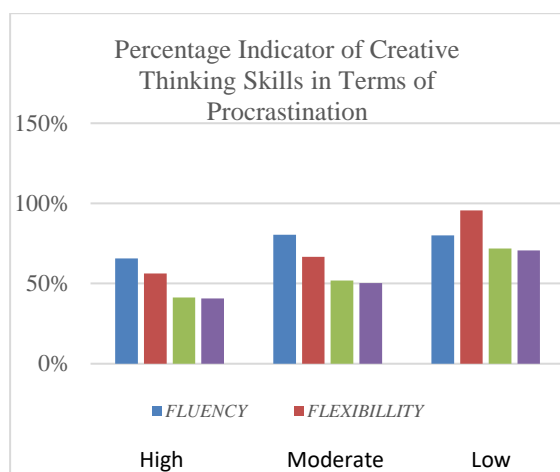
and achievement. The use of technology in the learning process increased the learning quality as well as effectiveness and efficiency (Andri, 2017). (Ashtian, 2012) revealed that E-learning assisted Problem-based Learning method could help the students in the problem-solving process, uncover the students critical thinking, and attract the students to solve the learning problems. Hence, IT-based learning activities such E-learning assisted learning process could up to date the technology development, provide attractive learning activity, and open possibility to learn anytime and anywhere.

The tabulation of the group classification data of VIII E class of SMP Negeri 3 Temanggung is as follow:

Table 3. Classification Procrastination-based Level

Category	Students Member	Percentage
High	4	13 %
Medium	23	74 %
Low	4	13%

Table 3 showed the collected data of students' procrastination on high, medium, and low level. There were 4 students with high procrastination level in 13%, 23 students with medium procrastination level in 74% and 4 students with low procrastination level in 13%. The students were given treatment E-learning assisted Problem-based Learning method. Mathematical creative thinking skills posttests were given. Picture 2 showed the posttest percentage with indicators of mathematical creative thinking skills.



Picture 2. SMAT Indicator Percentage

Picture 2 revealed that the students with low procrastination were always more eminent than the others on every indicator except fluency. On the fluency indicator, it had the same percentage with the students with medium procrastination level; it was 80%. On the other hand, the students with high procrastination level showed lowest percentage on every indicator. The choosing of 6 subjects of the experiment with high, medium, and low procrastination level is shown in the Table 4.

Table 4. Subject List of Mathematical Creative Thinking Skills Research of students with Procrastination

Procrastination Level	Score	Subject
High	43.8	Subject 12
	60.0	Subject 1
Medium	48.1	Subject 16
	76.9	Subject 27
Low	65.0	Subject 28
	79.4	Subject 5

Based on Standard Mastery Achievement Test (SMAT), subject 12 gained low score 43,8 and subject 1 gained low score 60. The result is reserved in the Table 4. Subject 12 could not fulfill the standard indicators, that are fluency, flexibility, originality, and elaboration. Subject 1 had only fulfilled the fluency indicator. Most of the students with high procrastination level provided incorrect, imprecise, and irrelevant answers of the given questions.

The students could not solve the given problem. Subject 12 cheated on his/her friend to get the answer for the questions. This violated the originality standard indicator. Moreover, both subjects did not fulfill the originality standard indicator. (Ami & Yunianta, 2020) revealed common characteristic of students with high procrastination level. (1) He/she preferred to cheating to solve the given problem that he/she did not get the steps of solving the similar problems, and (2) he/she did not catch the meaning of the taught learning material. (Zuraida, 2017) believed that procrastination affect the students' achievement. Students with high procrastination level had low academic achievement and vise-versa. (Ningsih & Nirwana, 2019) argued that the lower math self-concept, the higher

procrastination would be. High procrastination level affect emotion, trigger stress, and harm the academic achievement (Putri & Kurniasari, 2020). Mathematics is identical with terrifying, abstract, and whole-formula subject. This usually drove the students indifferent to Mathematics and even hate. These emotions drove the students to postpone finishing the given Math tasks (Arnasih & Hartaya, 2015). Table 5 showed the comparison of the fulfilled indicators of the high procrastination level.

Table 5. Indicators Comparison of Students with Medium Procrastination Level

Creative Thinking Skill Indicators	Subject	
	Subject 12	Subject 1
<i>Fluency</i>	not achieved	achieved
<i>flexibility</i>	not achieved	not achieved
<i>Originality</i>	not achieved	not achieved
<i>Elaboration</i>	not achieved	not achieved

Picture 6 showed the answer sheet of subject 27 that he/she had given correct answers on question 1.a, 1.b, and 1.c. The answer of question 1.d on elaboration indicator shown that the process of the problem solving met the standard. However, the substitution formula of the process was imprecise that resulted in incorrect answer.

The experiment of mathematical creative thinking skills of students with medium procrastination level revealed that subject 16 gained lowest score that was 48; subject 27 gained higher score that was 77. It was found out that the students with medium procrastination level attain different creative thinking skills on every standard indicator. The comparison of fulfilled indicators between subject 16 and 27 showed that subject 16 had only fulfilled one indicator, fluency. Otherwise, subject 27 fulfilled 3 indicators, that are fluency, flexibility, and originality. It was found out that subject 16 hesitated to provide the answers.

The factors that influence the procrastination level difference are Math anxiety and motivation. Math anxiety is the anxiety that came from phenomena or experience related to Math that might

happen in the future. Besides, motivation is the value that encourage someone to learn (Putri & Kurniasari, 2020). The students creative thinking will not get developed unless they reduce or avoid postponing. Undeveloped creative thinking would drive the students to precipitant to finish given tasks or tests without paying attention and conscientious. The habitude would affect the students' creativity to solve problems. The comparison of fulfilled indicators of subject 16 and subject 27 is shown in the table. Picture 6 showed that subject 27 answered the question 1.a, 1.b, and 1.c correctly. The findings on question 1.d on elaboration indicator showed that the provided explanation of the process was correct. However, the substitution formula was incorrect that resulted in incorrect answer. The result comparison can be seen in the Table 6.

Table 6. Indicators Comparison of Students with Medium Procrastination Level

Creative Thinking Skill Indicators	Subject	
	Subject 16	Subject 27
<i>Fluency</i>	achieved	achieved
<i>flexibility</i>	not achieved	achieved
<i>Originality</i>	not achieved	achieved
<i>Elaboration</i>	not achieved	not achieved

Subject 28 and subject 5 represented the students with low procrastination level. Subject 5 collected score 79 of the standard mastery achievement test and fulfilled all indicators. Subject 28 collected score 65 of the test and fulfilled the fluency, flexibility, and originality indicators. Subject 5 did not show procrastination and did not seem to face such difficulty in the problem-solving process. (Muyana, 2018) argued that procrastination is psychological belief of ability, distraction, social factors, time management, individual initiative, obstacles on decision-making, and laziness. Interview on subject 5 revealed that procrastinating could not be separated from inner motivation to self-improve to be better humankind. (Rumiani, 2006) argued that procrastination appeared because of internal and external factors. Internal factors included low motivation and personality; external factors included environment, and task load. The comparison of

students thinking skills with low procrastination level is preserved in the Table 7.

Table 7. Indicators Comparison of Students with Low Procrastination Level

Creative Thinking Skill Indicators	Subjects	
	Subject 28	Subject 5
<i>Fluency</i>	achieved	achieved
<i>flexibility</i>	achieved	achieved
<i>Originality</i>	achieved	achieved
<i>Elaboration</i>	not achieved	achieved

CONCLUSION

Based on the analysis and discussion, it was obtained that the results, e-learning assisted problem-based learning method is promotive to the development of student's mathematical creative thinking skills. The students with low procrastination level do not merely produce low creative thinking skills.

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