Creative Critical Thinking Skill Reviewed by *Curiosity* on Independent Learning Assisted by *E-Learning*

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Article Info	Abstract
	This research aims to find out mathematics creative thinking skill of students on independent learning assisted by *E-learning*. This *mixed method* used *sequential explanatory* design. There were 32 subjects of VIII C of Public JHS 1 Bodeh selected by high, moderate, and low *Curiosity* categories. The techniques of collecting quantitative data were creative thinking skill test and curiosity questionnaire. Technique of collecting qualitative data was done by interview based on *curiosity* questionnaire and critical thinking skill test result. The findings showed that creative thinking skill pattern reviewed by curiosity realized into high, moderate, and low variety categories. It was shown by six high *curiosity* students, 3 students whom equal creative level patterns. They met four indicators, such as fluency, reliability, originality, and elaboration. One student met fluency indicator. One student met reliability indicator and originality. One student met reliability and elaboration indicators. The same thing goes for moderate *curiosity*. There were 20 students. For of them had patterns which met four indicators, 6 of them met 3 indicators, 7 of them met two indicators, 2 of them met one indicator, and 1 of them did not meet any creative thinking skill indicators. There were six students with low *curiosity* whom had 2 patterns which met three indicators, 2 met two indicators, and 2 students did not meet creative thinking skill indicators.

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INTRODUCTION

Education is conscious effort to develop students' potencies optimally. (Bito, 2018). Students' potencies would develop and grow optimally if they are supported by supportive educational aspects. One of supportive aspects is mathematics curriculum.

2013 curriculum prioritizes physical and mental encouraging learning optimally. Such learning practices support active learning development. This learning mobilizes all physical and mental activities for students to allow them having lots of learning experience through individual potency developments. This learning trains students to think critically, creatively, collaboratively, and communicatively as required by 21st century life.

Mathematics is a compulsory lesson for Primary, Junior, Senior and Vocational educations to be mastered by students. The importance of learning mathematics given at school is due to mathematics is required in daily lives.

Mathematics learning needs to be designed properly. It is in line with Junaedi & Asikin (2012) that learning mathematics needs to be designed properly to encourage students having mathematics skills, such as understanding, communicating, connecting, reasoning, and mathematics problem solving. These skills are needed to make students able to implement, process, and use mathematics information in their daily lives, to keep survive from dynamic, competitive, and uncertain conditions.

According to Nawaddah et al (2015), creative thinking skill is the most basic skill to have by each individual inf acing technology challenge. Therefore, creative critical thinking skill needs to be internalized to train students' *flexibilities, fluencies, originalities,* and *elaborations.* Those are creative thinking features as stated by Guilford (in Munandar, 2012: 65).

According to Mahmudi (2010) in Khoiri *et al* (2013), creative thinking skill development is needed because it is a demanded skill in working world. Therefore, creative thinking skill development is a learning focus of mathematics. In another hand,

according to Kadir (2017) that it is one of most basic skills to have in learning process in this fast - growing technology and information era. According to Nuha (2018), creative thinking skill is important in this modern era so it should be improved by having efforts such as creating lesson which trains students to propose their own problems.

Speed in creative thinking becomes collective purpose in the world and it triggers better creative thinking skills for students. It has been the most important trend in education revolution. Creative thinking skill is a skill which based on ideas or new inventions done by individuals in solving problems so the new invented ideas could be used to solve various problems. However, it is still in the same concept. This creative thinking process is frequently called as creativity. According to Henneberg (2013) stated that creativity deals with skills, qualities, and actual performances concerning to potency and behavioral types of each individual. According to Dolect *et al* (2017), creative thinking is a part of critical thinking which is important by implementing computational principles in solving problem. It also implements cognitive activities of students.

It is in line with Kiptiyah *et al* (2016) stated that creative thinking skill is a higher order mathematics thinking skill in which the components consisting of mathematics activities in solving a problem. According to Trnova & Josep (2014), students' creativities could be developed maximally when teachers had sufficient skills in learning process. It is in line with Nuha *et al* (2018) that creative thinking skill is a skill to implement new ideas in solving problems. So, there is a need a combination between rational and systematical thinking to check validity from the obtained conclusion. Al-Zubi *et al* (2017) stated that intelligence and imagination dominate individuals in creatively thinking. It is in ine with Solehuzain (2017), Dewi & Masrukhan (2018) that creative thinking skill is a basic skill to have in learning mathematics. It covers four main components: *fluency, flexibiilty, originality,* and *elaboration.*

Observation results at Junior High School 1 Bodeh shows that students were still less creative. Students' creativities need to be developed as early as possible. One of them is by independent learning.

The referred independent learning is students learning by using the prepared module by teacher and it are individually learned. Independent learning is a learning method to make students more creative. To promote this learning, it is not limited by time. One of them is independent learning assisted by *E-learning.*

In this independent learning assisted by *E-learning,* teacher designs the learning process by considering individuals' differences because each individual is unique with his or her different characteristics. Therefore, teachers must consider learning principles which provide chances for them to find out, learn basis of various learning sources, integrated learning, multidimensional truth learning, applicative skill learning, balance physical and mental skill learning, and valuable exemplary learning. Independent learning assisted by *E-learning* is used for geometry learning material by providing BRSD module application which is accessible from Playstore or shared directly by teachers.

According to Chau (2010), independent learning is understood as learning which uses interactive process to regulate their own learnings. According to Bandura in Maliya et al (2018), independent learning is a learning done by purpose to monitor individual behavior and it is human personality independence. Teachers act as facilitator of independent learning assisted by *E-learning* because children, especially JHS, have not been fully independent. In this research, besides providing BRSD module application media, it was given both indirect and direct accompaniment. Direct accompaniment was realized into face - to face activity outside of learning hours. Meanwhile, indirect accompaniment was held through WhatsApp group online media for all members of experimental groups consisting of VIII C students.

According to Zain et al (2015) in Ihwanah (2016), *E-learning* is abbreviation of *Electronic Learning.* It means learning electronically. Learning electronically is a learning process done and managed electronically in which the learning process is adjusted to students' needs. *E-learning* is a system of educational concept which uses information in teaching - learning process. (Riadi, 2014).

According to Michael (2013), *E-Learning* is an arranged learning with purpose to use electronic or computational system so it could support learning process. According to Chandrawati (2010), *E-Learning* is a distant learning process by combining principles into learning process with technology. It is in line with Ardiansyah (2013) that *E-Learning* is a learning system used as learning process mean to teach which is promoted without face to face meeting between teacher and students directly. According to Korucu et al (2011), *E-Learning* occurs as new different learning embodiment compared to conventional learning.

In accompaniment stage, both directly and indirectly, it could notice curiosity of students toward learned materials. It is in line with Ministry of National Education (2010) that in enhancing character education on all educational unit, there have been 18 values sourced from religiosity, pancasila, culture and national education, one of them is curiosity.

Curiosity is eager to know. It is an internal motivation which becomes key to encourage active and exploratory learning spontaneously (Qudeyer, 2016). O'kefee (2017) argued that basic interest to create attractiveness of something is curiosity. *Curiosity* is an influential and important precursor of mathematics skill (Widiastuti & Rusgianto. 2014; Hidayat and Jamilah. 2015). Curiosity is an internal motivation which becomes key to encourage active and exploratory learning spontaneously (Qudeyer, 2016). Curiosity in this research is seen from four dimensions: *epistemic curiosity* (EC), *perceptual curiosity* (PC), *exploration,* and *absorption.*

Based on the background, this research aims to describe independent learning assisted by *E-learning* toward creative thinking skill of VIII graders and find mathematics creative thinking skill patterns of the students reviewed by *curiosity* on independent learning assisted by *E-learning.* This research benefits are such as: (1) being applicable as one of independent learning model, and (2) providing independent learning experience for students, sot hey obtain meaningful learning.

METHOD

The research methodology is mixed method. According to Creswell (2014), *mixed method* is a method focusing on data collection, analysis, combination of both quantitative and qualitative data into a research. Meanwhile, this research design is *sequential explanatory.* According to Clark (in Subedi, 2016), *sequential explanatory,* in its first stage, consists of quantitative data collection and it continued by qualitative data collection.

The procedure of this research consists of two stages: pre-field stage and on-field stage. During on in-field stage, the activity covered finding out and determining problems in learning mathematics at JHS 1 Bodeh. Then, it was continued by designing and arranging learning and research instruments, such as accompaniment guidance, online module android application containing characters, creative thinking skill test question, questionnaire, and interview guideline. Then, the independent learning instrument assisted by *E-Learning* was validated by experts. The judgment of the experts took form into excellent and valid. Thus, the learning instrument could be used for research purposes.

In on-field stage, it was initiated by giving creative thinking skill test to find out the initial condition of students. Then, they were given *curiosity* questionnaire before intervening them by independent learning assisted by *E-Learning.* The next stage, teacher conducted independent learning assisted by *E-Learning* by giving online BRSD module in the form of android application. It could be downloaded in Playstore to be learned independently by students. However, accompaniment was still carried out both online and face to face. The accompaniment was done for 5 times in the end of school time so it did not disturb learning activities on regular learning hours. The online accompaniment was unlimitedly done by using WhatsApp grup media for experimental group. After all stages were completed, creative thinking skill test was done for all subjects. The data analysis technique covered test and non-test analysis. The test technique should be tested first by having CTST questions. They would be analyzed to find the questions validity, reliability, and sufficient comparative power. Based on the analysis of question try out, all question could be used. The

obtained data was analyzed quantitatively and qualitatively.

The quantitative data was used to find out effectiveness of independent learning assisted by *E-Learning* toward the students' mathematics creative thinking skills. It was obtained that students' mathematics creative thinking test results on volume geometry and surface area of cubes and bars. This research used one experimental group with independent learning assisted by *E-Learning.*

The qualitative data was used to analyze and describe students' creative thinking skill based on quantitative data. It was obtained from *curiosity* questionnaire, observation, interview, and documentation. The used questionnaire had purpose to collect data about students' curiosities which were categorized into high, moderate, and low. The observation had purpose to obtain information about class condition, attitude, and motivation of students during independent learning process assisted by *E-Learning.* The interview in this research was used to obtain direct data about creative thinking skills on cubes and bars seen from *curiosity.* Documentation of this research was used to collect data in the forms of portrays and students' works to strengthen observation and interview results which were done during the research.

FINDINGS AND DISCUSSION

This research was conducted at VIII C of JHS 1 Bodeh, in academic year 2018/2019. Before being intervened, initial skill test was given to find out students' creative thinking skills. The results of the test were used as reference to determine the minimum passing grade, the Actual Accomplishment Threshold (AAT). Normality test was done toward the students' initial skill data. The normality test was purposed to find out the obtained data whether it was normally distributed or not. Based on the test, it was obtained $sig = 0.200 > 0.05$, meaning that H_0 was accepted or the critical thinking skill test data was from normal distribution. Then, quantitative and qualitative data analysis were carried out.

The quantitative data analysis was used to find out effectiveness of independent learning assisted by *E-Learning* toward the students'

mathematics creative thinking skills Curiosity. Independent learning assisted by *E-learning* was effective toward creative thinking skills since it met several criteria: (1) students' creative thinking skills reached minimum passing grade 75% classically and reached excellent criteria individually; (2) students' creative thinking skills in independent learning assisted by *E-Learning* was better than the regular learning students.

The first criterion dealt with minimum accomplishment 75% achievement of creative thinking skill classically. To test the first criterion, average test by using t-test obtained $t_{count} > t_{(0,95)}31$ y. It is 5.62 > 1.689 so that H_0 is denied and H_1 is accepted. It meant students' creative thinking skills on independent learning assisted by *E-Learning* was higher than 63. Then, the classical accomplishment test was done by using accomplishment test or one party proportional test. It was obtained z_{count} = 1.63. Based on z distribution table list, it obtained z_{table} = 0,4484. Thus, $z_{count} \geq z_{table}$ then H_o was denied. It means that creative thinking skill proportion was higher than 75% or it could be said that the students' creative thinking skill had passed the classical accomplishment, higher than 75%. Then, analysis of creative thinking skill test scoring by using scoring rubric as referred from scoring guidance of Bosch' creative thinking skill in La Moma (2015) was used. It covers fluency, flexibility, originality, and elaboration. The final score calculation is in scale 0 - 100. Based on the test, it was obtained highest score of independent learning assisted by *E-Learning* was 63.

The qualitative data analysis had purpose to analyze and describe creative thinking skill seen from *curiosity.* There were 32 subjects of VIII C of Public JHS 1 Bodeh selected by high, moderate, and low *Curiosity* Criteria.

Here are the results of the test reviewed from *curiosity.*

Table 1. Creative Thinking Skill Analysis Reviewed from *Curiosity*

Curiosity Categories	Students' Numbers	Indicators of Creative Thinking Skill			
		K1	K2	K3	K4
High	3				
	1		X	X	
	1	X			X
	1	X		X	X
Moderate	4				
	2	X			X
	2	X			
	4			X	
	1		X	X	X
	1	X		X	X
	3	X			X
	1		X		X
	1		X	X	X
	1	X	X	X	X
Low	1	X			
	1			X	
	1	X	X		
	1			X	X
	2	X	X	X	X

Remark:
K1 = Fluency   K3 = Originality
K2 = Flexibility   K4 = Elaboration

based on the analysis results of creative thinking skill data reviewed from *curiosity* on table 1, it is known that students with high *curiosity* had various creative thinking patterns. The same thing went to moderate and low *curiosity* students. On high *curiosity* students, 3 students had met all indicators of creative thinking skill, 2 of them met two indicators, and only one of them met one indicator. On fluency indicator (K1), 4 students met fluency indicator while 2 students did not meet the indicator. On flexibility indicator (K2), 5 students met flexibility indicator but only 1 student did not meet it. Meanwhile, dealing with originality (K3), 4 students had met the indicators because they worked on the questions independently without asking assistance, 2 of them did not meet the indicator. Students with high *curiosity* on elaboration indicator (K4), 5 of them met the indicators but only 1 of them did not meet it.

Moderate *curiosity* students had various creative thinking skill patterns. Four of them met

four indicators, 6 of them met 3 indicators, 6 of them met two indicators, 3 of them met one indicator, and 1 of them did not meet any creative thinking skill indicators. Therefore, there were student whom had met creative thinking skill indicators as *high curiosity* students did but there were also some of them did not meet creative thinking skill indicators. Fluency indicator (K1) was reached by 12 students. Flexibility indicator (K2) was reached by 18 students. Originality indicator (K3) was reached by 9 students. Elaboration indicator (K4) was reached by 15 students.

Low *curiosity* students had various creative thinking skill patterns. 2 students had met three indicators of creative thinking skill, 2 of them met two indicators, and only one of them did not meet all indicators. Fluency indicator (K1) was reached by 2 students. Flexibility indicator (K2) was reached by 3 students. Originality indicator was reached by 2 students. Elaboration indicator was reached by 3 students. Based on the findings, it was obtained 1 student with *curiosity* had similar pattern to low *curiosity* category student. It showed that *curiosity* of students could not guarantee to determine students' creative thinking skill patterns.

It is in line with Istiani (2015), Herayani (2016), Saironi (2017), and Solehuzain (2017) arguing there is positive influence of curiosity to students' creative thinking skills although it has slight percentage because many factors influencing students' creative thinking skills.

CONCLUSION

Based on the findings, it could be described that students' creative thinking skill patterns reviewed from *curiosity* showed various results. It proves that *curiosity* cannot determine creative thinking skill so that independent learning assisted by *E-Learning* is needed as one of independent learning methods to support creative thinking skill achievements.

REFERENCE

Al-Zu'bii, M. A. A., Mohd S. O., & Amrita K. 2017. "The Relationship Between Creative Thinking and Motivation to Learn Creative Thinking Among Pre- Schoolers in Jordan". *European Journal of Education Studies*, 3(3), 426-442.

Belecine, R. & Jose M. Ocampo, JR.2016. "Mathematical Curiosity, Epistemological Beliefs, and Mathematics Performance of Freshman Preservice Teachers". *Jurnal Indonesia untuk Kajian Pendidikan*, 1(1)

Bito, N et all.2018. "The Aplliacation design of interactive Mltimedia of IT-based Mathematics Learning on Strengtening Students'character". *IJSBAR*, 39(2): 129-138

Candrawati, Sri Rahayu.2010. "Pemanfaatan *E-Leraning* dalam pembelajaran".*http://jurnal.untan.ac.id/*,2(8).

Chau, J & Cheng, G 2010. "Towards understanding the potential of e-portfolios for independent learning: A qualitative study". *Australasian Journal of Educational Technology* 26(7): 932-950.

Creswell, J.W, 2013. Research Design: *Pendekatan kualitatif, Kuantitatif dan Mixed.* Terjemahan Achmad Fawaid. Yogyakarta: Pustaka Belajar.

Doleck, T., Paul B., David J. L., Anoop S., & Ram B. B. 2017. "Algorithmic Thinking, Cooperativity, Creativity, Critical Thinking, and Problem Solving: Exploring the Relationship Between Computational Thinking Skills and Academic Performance". *J. Comput. Educ.*, 1-15. DOI 10.1007/s40692-017-0090-9.

Dewi, N. R. & Masrukan. 2018. "Peningkatan Kemampuan Berpikir Kreatif Mahasiswa Program Magister". *PRISMA 1*. Seminar Nasional Matematika UNNES: 539-546.

Henneberg, M. 2013. "Creative and Reasoning Skills Are Low Among Health Sciences Students Who Rely Mostly on Memorized Templates: An Australian Case". *Medical Science Educators*, 23(1), 35-46.

Ihwanah, Al. 2016. "Implementasi E-Learning dalam Kegiatan Pembelajaran PGMI IAIN Sulthan Thaha Saifuddin Jambi". *Cakrawala,* XI (1): 76-91.

Istiani, E. (2015). *Pembentukan berpikir kreatif dan rasa ingin tahu melalui model advance organizer berbasis atong materi geometri kelas viii* (Doctoral dissertation, UNIVERSITAS NEGERI SEMARANG).

Junaedi, I. & Asikin, M. 2012. "Pengembangan Pembelajaran Matematika Humanistik untuk Meningkatkan Kemahiran Matematis".*UJMER* 1(2): 114-120.

Kadir, dkk, 2017. "The Implementattion of Open-Inquiry Approach to Improve Students ' Learning Activities, Responses, and Mathematical Creative Thingking Skills". *Journal on Mathematics Education*, 8(1): 103-114.

Khoiri, Wafik, dkk. 2013. "Problem Based learning Berbantuan Multimedia dalam Pembelajaran Matematika untuk meningkatkan kemampuan berpikir Kreatif".*UJME* 2 (1).

Kiptiyah, Masrukan, & Ngurah. 2016. "Kemampuan Berpikir Kreatif pada Problem Based Learning Etnomathematics Berdasarkan Minat Belajar". *Journal of primary Education*, 5(2), 104-112.

Korucu, A.T & Alakan. 2011. "Differences between m-leraning (mobile-leraning) and e-learning basic terminology and usage of m-learning in education". *ELSEVIER* 15: 1925-1930.

Litman, J.A & Mussel, P. 2013. "Validity of the interestand Deprivation-Type Epistemic Curiosity Model: Epistemic Curiosity". *Journal of Individual Differences*. 34 (2): 59-68.

Maliya, N. Isnarto & Sukestiyarno. 2019. "Analysis of Mathematical Problem Solving Ability Based on Self Confidence in Creative Problem Solving Learning and Independent Learning Assisted Module".*UJMER* 8(1): 118-124.

Mahmudi, Ali. 2010. Mengukur Kemampuan Berpikir kreatif Matematis. Makalah disajikan pada konferensi Nasional Matematika XV UNIMA Manado, 30 Juni-3 Juli.

Nuha, M.A, Waluya & Junaedi, 2018. "Mathematical Creative Process wallas Media in Students Problem Possing with Lesson Study Aproach". *International Journal of Intruction*, 11 (2) : 527-538.

Oudeyer, P.Y, Gottlieb. J, Lopes, M. 2016. "Intrinsic Motivation, Curiosity, and Learning: Theory and applicational technologies". Progress in Brain Researc. *Elsevier* B.V.

Paul A. O'Keefe & Judith M. Harackiewiez. 2017. "The Multifaceted Role of interest in Motivation and Engagement". Science of Interest, *Spinger International Publishing AG.*

Riadi, Muchlisin, 2014. Pengertian, Karakteristik dan Manfaat *E-Learning*. http://www.Kajian Pustaka.com downloaded 8 January 2019.

Saironi, M. & YL. Sukestiyarno. 2017. "Kemampuan Berpikir Kreatif Matematis Peserta didik dan Pembentukan Karakter Rasa Ingin Tahu Peserta didik pada Pembelajaran Open Ended Berbasis Etnomatematika ". *UJMER*, 6 (1), 76-88.

Solehuzain, dkk. 2017. Kemampuan berpikir Kreatif dan rasa Ingin Tahu pada Model Problem-Based Learning dengan masalah Open Ended. *UJMER* 6(1): 103-111.

Trnova, E & Josep. T. 2014. "Implementation of Creativity in Science Teacher Training". *International Journal on New Trends in Education and Their Implications*, 5(3), 54-63.

Widiastuti & Rusgianto, 2014. Pengaruh Metode Inkuiri terhadap Ketercapaian Kompetensi Dasar, Rasa Ingin tahu, dan Kemampuan Penalaran Matematis. *Jurnal Phytagoras*, 9: 2.