Scientific approach learning implementation based on lesson study for learning community in solving sequence and series and its effect to student creative thinking ability

Scientific approach learning implementation based on lesson study for learning community in solving sequence and series and its effect to student creative thinking ability

E Guswanto[1,2], Susanto[2,1], Hobri[2,2], P A Inawati[1,2], A R Sya'Roni[1,2]

[1]LSiMel (Lesson Study in Mathematis Learning), University of Jember, indonesia
[2]Department of Mathematics Education, University of Jember, Indonesia

Email: ervinguswanto123@gmail.com

Abstract. This research aimed to describe the creative thinking of Junior High School students in solving sequence and series. This type of research was mix methode research. This research was conducted on students of SMP AL-AZHAR Muncar Banyuwangi. The data collection method used in this research was test and interview. The instruments used were the researcher itself, creative thinking test, and interview guidelines. Based on data analysis results, it could be concluded that the students could pass creative thinking well. At the illumination stage for all questions given, the student could finish appropriately and clearly. The students could write ideas under their own words so that the students' creative side had appeared well. At the incubation stage, the students could give many ideas and could explain their ideas fluently and appropriately. Seen from the number of answers, the students' tended to be similar to what the teacher had taught, however, there was also students' answer different from the way the teacher taught so that it showed a unique explanation.

1. Introduction

Education is an important issue inseparable from human life. The education quality in Indonesia is considered still not good enough as measured by the learning process or the students' learning outcomes. To date, students' competence, which is deemed essential for students, is in fact given only peripheral priority [1].

Teachers as the spearhead of education are required to be able to optimize the attitudes, skills, and knowledge of their students through strategies and learning patterns that are in accordance with the demands and developments of the times. In order to improve teaching and learning of mathematics in the classroom needed an effort to improve the understanding of teachers, students, and materials used for learning and interaction between them. In order for the learning objectives to reach the expected targets, in addition to the selection of appropriate learning methods and strategies, a learning device and curriculum that are very supportive of the learning process are needed.

Learning tools are one of the supporting tools for learning success. In a learning device set out the learning process plan, assessment, media and methods that will be used in learning. Good tool planning has an impact on the successful implementation of learning. Students will be more actively involved in learning if the teacher is able to use learning tools that are appropriate to the characteristics of the subjects. To create a conducive learning atmosphere and good learning outcomes, we need an effective learning tool that can support all aspects of learning activities. These tools include a lesson plan (RPP), Student Worksheet (LKS). The lesson plan (RPP) plays a role in the preparation and support stages of implementation. Whereas student worksheets (LKS) are used to support the implementation of learning. The worksheet in question is a worksheet that can bring out the creativity of students in finding and choosing appropriate problem solving

strategies.

To increase interaction between students, students and teachers can be done by implementing Lesson Study for Learning Community (LSLC). LSLC is an implementation of Lesson study which is intended to build a learning community. Learning community is formed on 2 main pillars, namely: 1) the values of cooperative characters in togetherness and equality or collaborative learning, 2) the values of caring characters and the spirit of progressing together or caring community (Mustadi, 2014). Based on Hobri and Susanto's research (2015), the existence of a scientific based worksheet combined with the concept of LSLC has an impact on student activities very well and student learning outcomes as a whole are very high. Likewise in discussions, understanding material, and solving problems very well.

LSLC is based on collegiality and mutual learning to build learning communities. Learning community is expected to be able to create new breakthroughs in creating innovative learning. In this way, every member of the community involved is very potential to be able to do self development so that they have the independence to develop together with other learning community members in a learning practice that uses a collaborative learning model that is designed so that each student gets the right learning without exception, and involving parents and school.

In order to improve those qualities, the government always makes improvements to every curriculum across education levels and, these days, they take into consideration the curriculum of 2013. According to Hosnan, learning activities in 2013 curriculum are directed to empower every student's potential in order to achieve expected competencies through the efforts to grow and improve their attitude, knowledge, and skill [2]. Scientific approach is one of the approaches applied in 2013 curriculum. The learning process using scientific approach is a learning system designed in such a way to empower students to actively construct concepts, judgements, or principles through observing stages (to identify and discover problems), propose or formulate hypothesis, collect data using various techniques, analyse problems, draw conclusion and communicate learnt concepts. Therefore, they can solve problems at hand. Applying the scientific approach requires particular conditions and learning environments, which ensure that students play an active role in every learning process [3]. The scientific learning process is a combination of learning processes focusing on exploration, elaboration, and confirmation complemented by observing, examining, trying, reasoning, and communicating [4].

A fun learning process is not understood merely the extent to which students feel interested in it but also to what extent they are capable of searching and finding out learning information and then constructing it into a new comprehension [3]. The process of searching and finding the information independently by the students in order to construct the understanding becomes the hallmark of the implementation of scientific approach. Recently, the scientific learning process has been implemented in the schools that apply the curriculum 2013 but it focuses only on the scientific learning process but it has not been able to improve creative thinking ability.

Learning is strongly influenced by a learning approach used by a teacher. Teachers should be able to design a learning that can increase motivation, activeness and creativity of students in learning. To improve the quality of learning, according to Permendikbud Number 81 A of 2013 Appendix IV regarding learning activities need to use principles namely: centered on students, develop students' creativity, create pleasant and challenging conditions, charged with values, ethics, aesthetics, logic, and kinesthetic, and provides a diverse learning experience through the application of various learning strategies and methods that are fun, contextual, effective, efficient, and meaningful.

A scientific approach is a learning approach that follows scientific activities, with a sequence of activities or learning experiences as follows: observing, asking questions, gathering information or trying, reasoning / associating, and communicating. In learning activities using a scientific approach, at the beginning of learning the teacher facilitates students by observing a problem and students are expected to be able to explain the problems that occur using their own sentences. Then students are expected to ask questions or the teacher provides questions related to what has been observed. The next step is that students collect information from various sources selectively to solve a problem at

hand. In this step students are expected to be able to do detailed and detailed steps to find a certain number pattern on a problem that is presented and be able to work faster and more accurately than other friends and also be able to think of new ways. After gathering information, students do reasoning (look for conclusions), express ideas smoothly or associate results from various sources to get a conclusion and develop ideas from friends in the group. For the next step, students can communicate the results of the discussion both in groups or with the teacher. Usually communicating activities can take the form of group presentations. In communicating activities students are expected to be able to convey ideas or ideas and be able to see the shortcomings of an object or situation. Based on the steps and activities contained in the scientific approach it can be seen that the scientific approach makes students active.

The urgency of creative thinking ability is stipulated in Government Regulation Number 19 of 2005 concerning National Education Standard Article 19 Section 1. It states that learning process in educational unit is held interactively, inspiring, fun, challenging, and motivating to learners in order to take active role in learning. What is more, the learning process is to provide enough space for initiative, creativity, independence with talent, interest, and the physical as well as psychological development of learners [5]. This study applied three components frequently used according to Silver, which include fluency, flexibility, and novelty. Silver states that to assess the creative thinking ability of children and adults The Torrance Tests of Creative Thinking (TTCT) oftentimes comes into use. The three key components of creativity assessed by TTCT are fluency, flexibility, and novelty [6]. According to Siswono, fluency refers to a students' ability in generating the right solution to various problems, and flexibility refers to students' ability in solving the problems using divergent solutions. Another concept, novelty, refers to a students' skill in proposing various right solutions or one "unusual" answer beyond their knowledge level [7].

Table 1. **The indicators of creative thinking skills**

The Characteristic of Creative Thinking	The Creative Thinking Indicators
Fluency	The students are able to solve problem correctly and fluently.
Flexibility	The students are able to solve problems with various solutions.
Novelty	The students are able to create a new problem or different ideas from problems in general.

Furthermore, those three indicators determined the five levels of students' creative thinking, namely (0) not creative, (1) hardly creative, (2) fairly creative, (3) creative, and (4) very creative. The Levels of Mathematical Creative Thinking (LMCT) are a stage of hierarchy thinking ability categorized based on fluency, flexibility, and novelty. Using LMCT in learning Mathematics, teachers can measure the levels of students' creative thinking. Furthermore, they can improve students' creative thinking skills. This study applied the Levels of Mathematical Creative Thinking (LMCT) s proposed by Siswono, comprising of level 4, level 3, level 2, level 1, level 0 as presented in table 2 below.

Table 2. Levels of Creative Thinking

Levels of Creative Thinking	Indicators		
	Fluency	Flexibility	Novelty
4 (very creative)	√	√	√
3 (creative)	--	√	√
	√	-	√
	√	√	-
2 (fairly creative)	-	√	-
	-	-	√
1 (hardly creative)	√	-	-
0 (not creative)	-	-	-

Based on the explanation above, this study deems necessary to conduct a study entitled "Scientific Approach learning implementation based on lesson study for learning community in solving sequence and series and its effect to creative thinking ability"

2. Method

The research method used is a combination of research (Mixed-Method), which is a combination of qualitative methods and quantitative methods (Sugiyono, 2017). In the first stage of research using qualitative methods, namely by developing learning tools in the form of lesson plans, worksheets, and tests of creative thinking abilities. The development of tools in this study uses the development of a modified Thiagarajan model that starts with the defining stage, the design phase, and the development stage. This device is then tested to determine the validity and suitability of the device. Devices are deemed fit for use if they meet valid, practical and effective criteria.

The next stage uses quantitative methods. The type of research used is experimental research. The research design is quasy experiment with type of nonequivalent control group design.

The population in this study was grade IX students of SMP AL-AZHAR Muncar. The sampling technique used was cluster random sampling, which had previously been tested and stated that the students' abilities were homogeneous. The researcher took three classes as samples which were used as the experimental class and the control class. The experimental class, class IX-A and IX-B, is a class where the learning uses LSLC-based mathematics scientific approach learning. Devices that have been declared valid and feasible are then applied in the experimental class. While the control class, class IX-C is a class that uses conventional learning but still based on LSLC. The following is an illustration of the design pattern of treatment administration in the study sample.

Table 3. Research Design Pattern

Kelas eksperimen 1	R_1	X	R_4
Kelas Eksperimen 2	R_2	X	R_5
Kelas control	R_3	-	R_6

with:
R1, R2, R3: Pre-test
R4, R5, R6: Post-test
X: The treatment of the experimental class is in the form of research-based learning tools

Data collection techniques used in the study are (1) observation, this technique is implemented in the open lesson process in the classroom by several observers, to determine the activities of the teacher and students during learning. These observational data will be reviewed as material for further learning improvement; (2) tests, tests are given in both classes, namely the control class and

the experimental class; (3) questionnaire, to determine student responses to learning that has been applied. The research instruments in this study were observation sheets, tests of creative thinking skills, student questionnaire responses, validation sheets of learning tools.

3. Results

The results of the problem submission test from the control class and the experimental class were corrected and assessed according to the creative aspects that were met by students. This data is used to determine students' creative thinking skills in both classes. The analysis of creative thinking skills tests is assessed according to the creative aspects that are met by students, namely fluency, flexibility and novelt.

The result of the development research shows that the device produced has been declared valid, practical and effective. The average validation of all learning tools, namely RPP, LKS and THB, is 4.85; 4.80 and 4.83. Whereas the practicality of the learning tools in terms of the results of observations of the feasibility of learning is 4.67 with the criteria classified as high and when viewed from open class activities shows that the teachers participating in the open lesson are inspired to apply the learning tools developed in the subjects they teach. In the aspect of effectiveness in terms of the results of observations of student activities showed a value of 4.05 which is classified as active with a percentage of more than 80% classified as at least quite active,

Data generated in three classes (experimental class 1, experimental 2 and control class) are normal and homogeneous. In experimental research shows that the results of the implementation of learning tools developed affect the ability of students' creative thinking. This is based on the results of the Anova Test showing a significant value of 0,000 ($p < 0.05$). In addition, if viewed from the results of the assessment of observations of student activities related to aspects of creative thinking during learning activities and the results of the post-test showed a significant difference in the number of students based on the category of creative thinking abilities.

The results of the validation of experts and practitioners on learning tools and research instruments are presented in Figure 1 and 2 below.

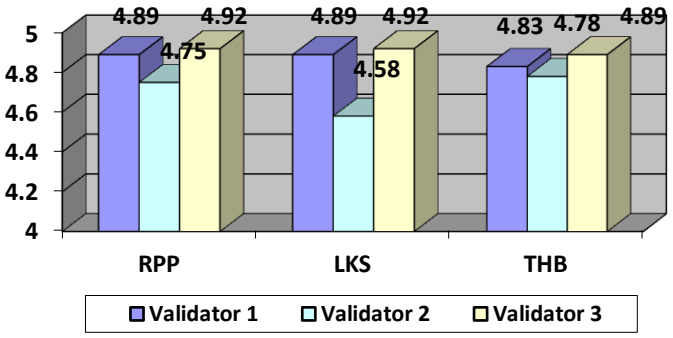


Figure 1. Results of Validation of Learning Devices

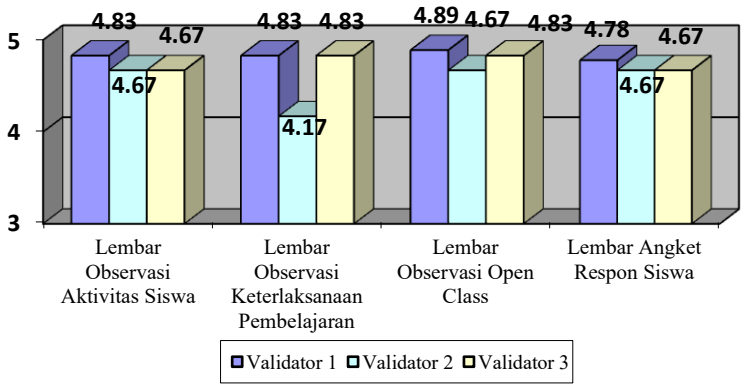
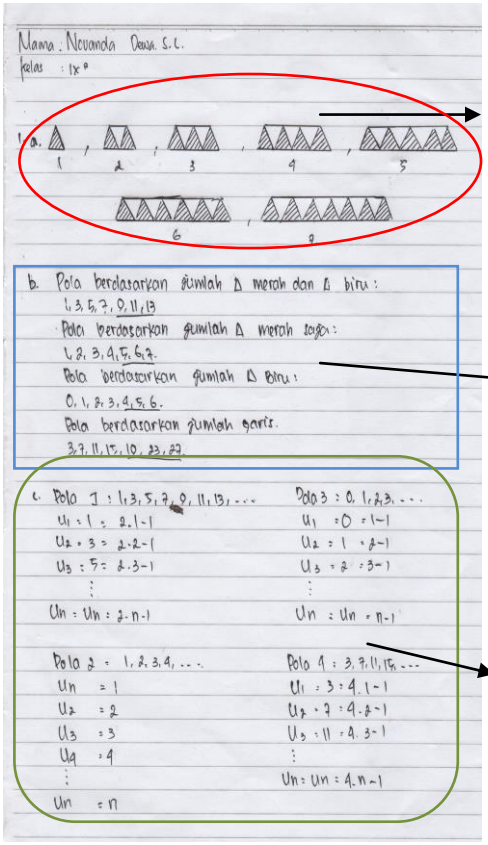


Figure 2. Results of Research Instrument Validation

The indicators in this study aim to measure the ability to think creatively which refers to the opinion of Munandar (2012). Following are the answers of students who have the ability to think creatively that have revealed 4 indicators.



Fluency aspects; able to draw 3 subsequent image arrangements.

Fluency aspects; able to continue the next 3 numbers in the number pattern

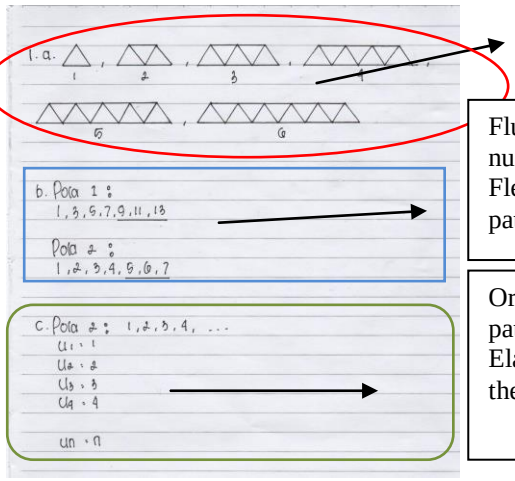
Flexibility aspect; able to mention 3 kinds of number patterns.

Originality aspect; able to mention the rules on 3 number patterns that have been made

Elaboration aspects; able to specify 3 or more rules to find the nth term.

Figure 3. Answers for Students Who Have Creative Thinking Abilities

Students with the ability to think classified as not creative have not been able to show the four indicators of creative thinking as the answers of students presented in Figure 4.



Fluency aspects; not yet able to draw 3 subsequent image arrangements.

Fluency aspects; able to continue the next 3 numbers in the number pattern
Flexibility aspect; only able to mention 2 number patterns that can be formed from images.

Originality aspect; only able to make a rule on the pattern of numbers that have been made
Elaboration aspects; only able to specify a rule in the pattern of numbers to find the nth term.

Figure 4. Answers for Students Who Have Creative Thinking Abilities

Normality and Homogeneity Test

The initial step taken in data analysis which aims to determine the effect of LSLC-based scientific learning on students' creative thinking abilities is a prerequisite test. This prerequisite test is a step that must be done before testing the hypothesis that is the normality test using the Shapiro-Wilk statistical test. The normality test uses the Shapiro-Wilk statistics presented in table 4.

Table 4. Pre-test normality test results for the experimental class and the control class

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Kelas	Statistic	Df	Sig.	Statistic	Df	Sig.
Pre Test	Kelas Ekspeimen 1	.172	22	.088	.956	22	.420
	Kelas Eksperien 2	.134	21	.200*	.941	21	.227
	Kelas Kontrol	.121	19	.200*	.951	19	.418

a. Lilliefors Significance Correction

*. This is a lower bound of the true significance

Based on the results of the normality test of pretest data, the Shapiro-Wilk table shows the significant value of experimental class 1 is 0.420, experimental class 2 is 0.227 and the control class is 0.418. Because the significance of the three data is more than 0.05, it can be concluded that the three classes are normally distributed.

Table 5. Pre-test Homogeneity Test

Levene Statistic	df1	df2	Sig.
.885	2	59	.418

Based on table 5 above, it is known that the homogeneity test results for students' creative thinking abilities show a significance value of 0.418 for all three homogeneous classes.

4. Discussion

Development of scientific learning tools based on lesson study for learning community using the Thiagarajan model (Four-D Model). At the stage of defining consists of five main steps, namely the initial-end analysis (front-end analysis), student analysis (learner analysis), concept analysis (concept analysis), task analysis and specification of learning objectives (specifying instructional objectives). Based on the steps that have been made at this define stage, it is known that a learning tool is needed that can improve the creativity of students of class IX AL-AZHAR SMP Muncar Banyuwangi. One approach that is appropriate for the development of tools is a scientific approach based on lesson study for learning community.

The next stage after define is the design stage. At this stage the researcher compiles the learning tools to be developed, namely scientific learning tools based on lesson study for learning community and supporting research instruments. The learning tools developed are RPP, LKS and THB with material sequence and number sequence equipped with problem problems that can train students' abilities in creative thinking. While the research instruments compiled consisted of an observation sheet of the implementation of the learning device, an observation sheet of student activity, an open class sheet and a student response questionnaire.

The stages of development (develop) are the stages after the define stage. At this stage, the validity of the learning tools developed was tested by experts, namely two mathematics education lecturers at the Faculty of Mathematics and Natural Sciences, Jember University and a practitioner, a mathematics teacher at Al-Azhar Muncar Banyuwangi Middle School. The results of the validation of the learning tools developed include: for RPP with a validation value of 4.85; LKS of 4.80 and

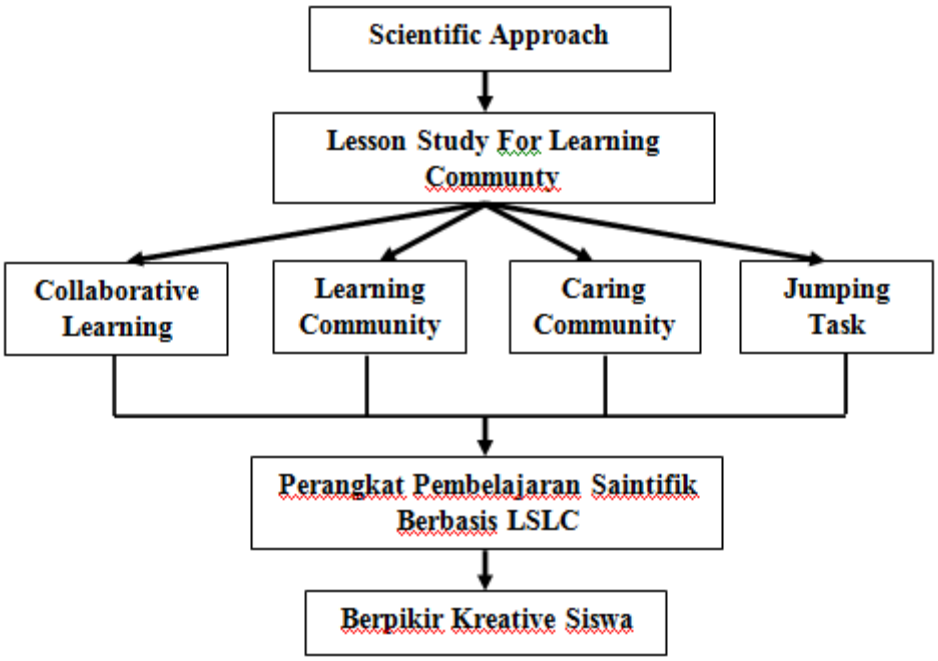
Learning Outcomes Test (THB) of 4.83. While the results of the validation of his research instruments averaged 4.78. Thus the learning tools and research instruments can be said to be valid with a range of 4 Vr <5.

The results of observations of the feasibility of the learning device showed a result of 4.79 with high criteria. Judging from the results of observations of student activities known overall student activity in learning classified as active categories, with an average of 4.05.

5. Conclusion

Based on ANOVA test results it is also known that the difference in students' creative thinking abilities in the experimental class and the control class shows the value of sig. 0,000. Therefore, because the significance value is less than 0.05, Ho is accepted and H ditolak is rejected. So it can be concluded that there are differences in the ability to think creatively between the control class and the experimental class.

Learning tools with a scientific approach based on lesson study for learning community have several advantages. As for the advantages of this tool among other things: 1) Scientific learning tools make students able to learn meaningfully because students in their groups try to find material concepts through worksheets distributed to each group, besides the teacher also provides scaffolding when needed, 2) worksheets that are developed can direct and train students to discuss with members of the group, 3) Collaborative learning activities can generate feelings of mutual concern with fellow peers and train student creativity, 4) Questions given can train students' creative thinking abilities.
The following product specifications are the results of research made in the form of a diagram below.



Specifications This research produces a product that is an increase in the ability to think creatively and student learning outcomes. Learning presented through a scientific approach can make students feel comfortable in the learning process, the teacher can also easily deliver material according to the syntax of a scientific approach that is known to be relatively systematic so that it has a good impact on student learning success.

Acknowledgment
I thank you for the support and motivation to the head of the master mathematics education study program of Faculty of Teacher Training and Education Science University of Jember, MAGENTA

and LSLC research group.

References

[1] Baswedan A 2015 *Strategic Plan of the Ministry of Education and Culture* 2015- 2019. Jakarta: Ministry of Education and Culture
[2] Hosnan M 2013. *Scientific and Contextual Approaches in 21st Century Learning The Key to Successful Implementation of the 2013 Curriculum*. Jakarta : Ghalia Indonesia.
[3] Amiruddin 2014 Use of Multimedia in Implementing Scientific Aproach in the 2013 Curriculum *Journal of the East Java Quality Assurance Institute*
[4] Kemdikbud *2013 Curriculum Documents* Jakarta : Kemdikbud
[5] Silver E A 1997 *Fostering Creativity Through Instruction Rich in Mathematical Problem Solving and thinking in Problem Posing* **29** (3)
[6] Siswono T Y E 2011 Level of Student's Creative Thinking in Classroom Mathematics *Educational Research and Reviews* **6** 548-553
[7] Siswono T E Y 2010 Leveling Student's Creativity In Solving and Posing Mathematical Problem *IndoMS.J.M.E.* **1**(1): 17-40
[8] Kharimah I R 2016 Effect of Scientific Approach with Mind Mapping Techniques on Basic Process Skills and Biology Learning Outcomes of Class XI Students of SMA Negeri 2 Tanggul Jember *Education Jurnal* III (3) 30-34
[9] Wulandari R 2015 *Development of Interactive Mathematics Learning Media Assisted by Geogebra with Scientific Opinion Based on Guided Findings on Circle Equation Materials for Class XI Students* Yogyakarta State University
[10] Ratnasari D 2015 *Students' Creative Thinking Process Based on the Level of Critical Thinking in Solving Story Questions Sub-Subject and Area of Square Based on Wallas Stages* Universitas of Jember