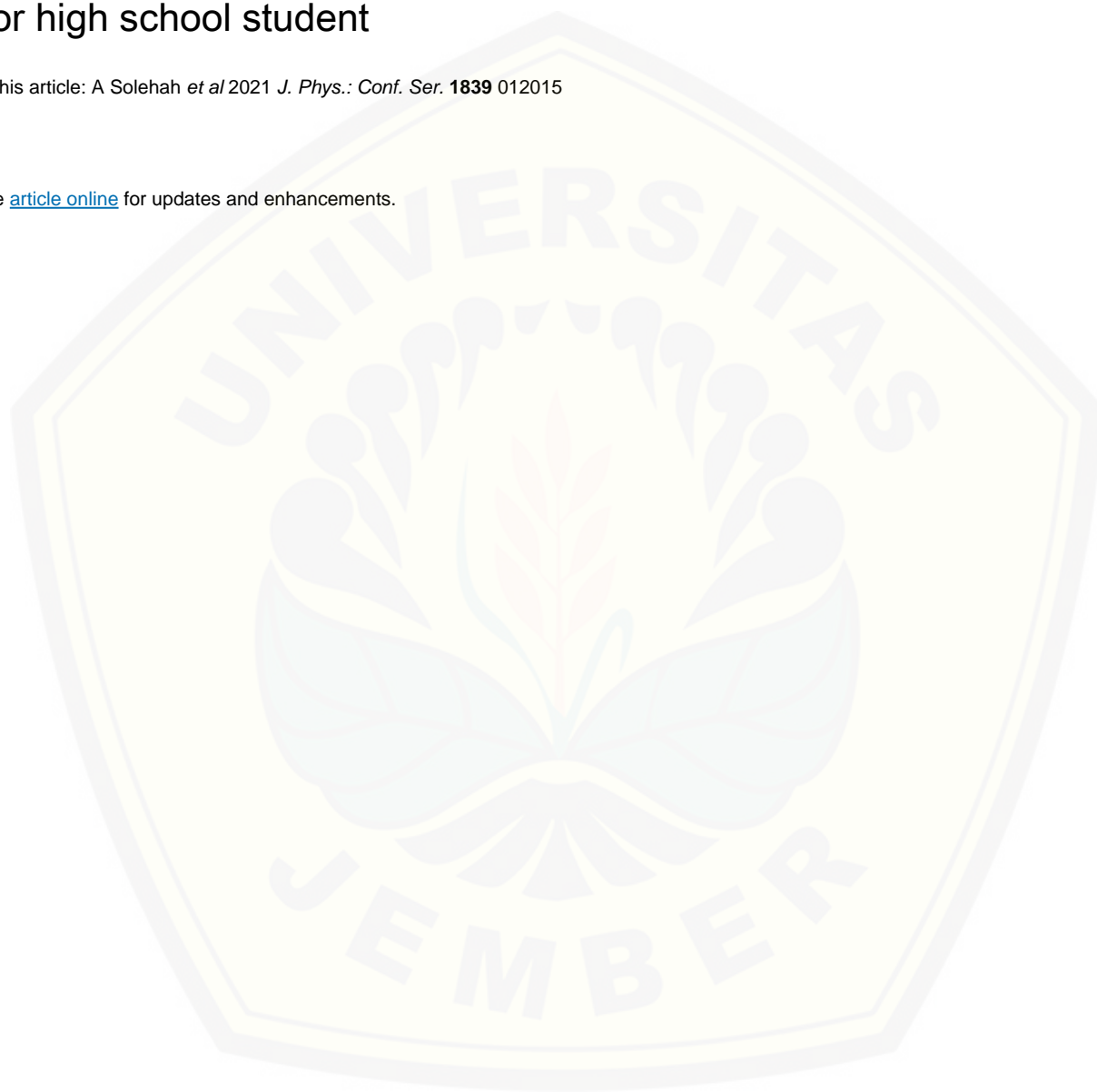


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The development of learning instrument with Contextual Teaching And Learning (CTL) based on Lesson Study for Learning Community (LSLC) on two variable linear equations and its effect on creative thinking of junior high school student

A Solehah¹, D S Pambudi¹, Hobri¹, B I Ummah¹

¹Department of Mathematics Education, University of Jember, Indonesia

E-mail: didikpambudi.fkip@unej.ac.id, arifatus.solehah@gmail.com

This study aims to develop learning instrument with *contextual teaching and learning* (CTL) based on *lesson study for learning community* (LSLC) on the two-variable linear equation material for grade VIII students of Junior High School/ MTs and its effect on students' creative thinking. The method used is mix methods with a combination model of *sequential exploratory design* with the Thiagarajan development model through four stages, those are *define, design, develop, and disseminate*. In experimental research using a *quasi experimental design*, namely *pretest posttest non equivalent control group design*. The subjects of this study were students of MTs Bustanul Ulum Panti, class VIIIA as the experimental class and class VIIIB as the control class. Students' creative thinking abilities were measured using tests of creative thinking abilities. The assumption test for normality and homogeneity of variance is carried out before the data is analyzed. This research generates learning instrument that meet the criteria of practical validity, and effective, also the significance value (t-tailed) of 0,000 ($p < 0,05$) which indicates the application of learning has a significant effect on students' creative thinking abilities.

1. Introduction

Education has a very important role in the development of students' thinking skill. The quality of human resources is an important factor in responding to the challenges of the globalization era. At this time the Indonesian nation is faced with external challenges in the form of the presence of the Industrial Revolution 4.0 which is based on a *cyber-physical system*, supported by advances in technology, information base, knowledge, innovation, and networks marking the emergence of the creative century [1]. One of the important efforts in realizing quality human beings is by optimizing the role of education. According to [2] asserts that national education functions to develop capabilities and shape the character and civilization of a nation with dignity in order to educate the nation's life, aims to develop the potential of students to become noble, healthy, knowledgeable, capable, creative, independent, and becomes democratic citizens and responsible. Unfortunately the condition of education in Indonesia has not shown satisfactory results, one of the indicators is based on the 2015 PISA (*Program for International Students Assessment*) score data at the level of literacy which includes three aspects, which are reading, math skills, and science skills, ranked 62th out of 72 countries of OECD (*Organization for Economic Cooperation and Development*) member[1].



The Indonesian government continues to strive to improve and develop the quality of education with one of the ways by through improving the educational curriculum. The current curriculum is the 2013 curriculum, where learning can develop creative thinking processes that produce deep creativity and student-centered learning. This statement is strengthened by the Ministry of Education and Culture which states that the 2013 curriculum is able to encourage students to find out, use various sources for learning, observation, ask questions, argue, communicate their knowledge, and think creatively so as to produce creative answers and multi-dimensional truths [3]. It is hoped that the 2013 curriculum can be implemented comprehensively in mathematics, as well as other subjects, which are taught in Junior High Schools / Madrasah Tsanawiyah.

In the 21st century, student need to have an understanding of the basic concepts of mathematics, they must be able to translate new situations or problems they face, make these problems workable mathematically, identify and use relevant mathematical knowledge to solve problems, then evaluate solutions in the language of the problem context. In the 21st century, literacy is about reading to learn, the capacity and motivation to learn to identify, understand, interpret, create and communicate knowledge, using written materials that are related to a variety of situations in changing contexts. 21st century skills are 4C skills, including creativity, critical thinking, communication, and collaboration.

The highest success in learning is when the learning process of students is able to foster their creative abilities. Creativity is the ability to imagine and organize innovations in mapping problems and answers, or expressing knowledge [4]. According to [5] creativity is the ability to solve problems and create new products and to provide new questions. Furthermore, [6] described creativity as an imaginative process with original and valuable results. So it can be concluded that creativity is the result of creative thinking which can be shown by the emergence of new ideas or concepts, not just producing something useful. So, the creativity of students can be improved by finding problems and finding new solutions.

Creative thinking can be fostered through designing a lesson that emphasizes exploring student abilities. As according to [7] which states that creative thinking is the result of thinking that allows students to apply their imagination to generate ideas, questions and hypotheses, experiment, and to evaluate their own ideas and ideas from their friends. Because basically, each student has different creative potentials in solving problems, so that students are given the opportunity to solve it in their own way. Referring to [8] 's opinion, the unique relevant factors in creative thinking are: (1) *fluency*, which is to generate lots of ideas; (2) *flexibility*, which is to produce many variations of completion ideas or answers to a question; (3) *novelty*, namely providing unique responses (unusual / rare); (4) *elaboration*, namely developing or enriching ideas, describing ideas, and adding or detailing an idea for the information that has been generated.

Mathematics learning needs to be developed and designed in such a way that it has the potential to develop students' creative thinking abilities. The development of creative thinking skills can be done through learning mathematics which can be used to foster students' awareness as a science related to everyday life and able to facilitate students in understanding the material, one of which is by using a contextual approach. The contextual approach model or *Contextual Teaching and Learning* (CTL) being able to understand the meaning of knowledge and skills can lead to mastery and skills [9]. According to [10] using the *Contextual Teaching and Learning* (CTL) approach, teachers are expected to be able to link learning material with the real world of students to encourage students to make connections between their knowledge and its application in everyday life which involves seven main components, which are: (1) *constructivism*, (2) *inquiry*, (3) *questioning*, (4) *learning community*, (5) *modeling*, (6) *reflection*, and (7) *authentic assessment* [11].

The learning tool needed in managing the teaching and learning process can be in the form of lesson plans, teacher books, student books, worksheets, learning outcomes tests (THB) [12]. In this study, the learning outcome test (THB) was replaced by the name Creative Thinking Ability Test, because researchers would see the level of creative thinking of students.

Lesson Study for Learning Community (LSLC) is a *lesson study* that has undergone changes based on a *collaborative and learning community*. In LSLC student and teacher must learn from each other (*collaborative learning*), groups of students who care for each other and are sensitive to the environment so that no one is neglected (*caring community*) also giving *jumping task* [13] which is done by finding solutions in solving problems using creative thinking skills owned by each student. Collaborative learning is seen as an approach that allows teachers and students to learn from each other, give each other, care for one another, accept each other so that no student is isolated in the group [14]. Thus, in this study, LKS used the *Contextual Teaching and Learning* (CTL) learning approach based on the *Lesson Study for Learning Community* (LSLC) which aims to improve students' creative thinking skills in solving problems in a two-variable linear equation system. Relevant research that supports is research from [15] physics learning based on contextual problems to improve students' creative thinking skills in liquid topics, based on the results of this study it can be concluded that the contextual learning model can improve creative thinking skills. Research from [16] the aim of this study is to discuss the philosophical underpinnings of LSLC, with particular emphasis on its social justice nature, particularly in reference to criticisms against neoliberal reform agendas. According to research [17] findings inform our understanding of the teacher's role in providing engaging and worthwhile mathematics for all students with contextualized tasks.

2. Method

This study uses a combination research method or *mixed methods* (combination methods of *Sequential Exploratory Design*). This research is a research that combines two pre-existing forms of research, which is *research and development* and experimental research, namely in the early stages of research using qualitative methods and the next stage using quantitative methods [18]. The chosen device development model is the Thiagarajan, Semmel & Semmel (4-D / Four D Model) model which consists of four stages, which are *define, design, develop, and disseminate*[19].

These learning instrument are lesson plans and worksheets. The instrument used was a creative thinking ability test, student activity sheets, learning tool implementation sheets, interview guideline sheets, and student response questionnaires. Tools and instruments can be used if they meet the valid criteria validated by expert validators. For the quantitative method using experimental design in which used is a quasi-experimental research (*Quasi Experimental Design*), namely the *pretest-posttest non-equivalent control group design* using two classes, which are one experimental class and one control class [20]. The population in this study were 8th grade students of MTs Bustanul Ulum Panti Jember in 2020/2021 as many as four classes. The sample of this study consisted of two classes taken randomly, the class selection was using the *cluster random sampling* method, which are class VIII A as the experimental class and class VIII B as the control class. In the experimental class, they were treated using a lesson study for learning community (LSLC) contextual teaching and learning (CTL) approach, while the control class used the *Contextual Teaching and Learning* (CTL) learning tool which is commonly applied in schools [21].

Table 1. Experimental Research Design

Experimental class	O_1	X_1	O_2
Control class	O_3	X_2	O_4

Note:

O_1 & O_2 : pre test

O_3 & O_4 : post test

X_1 : learning using group contextual teaching and learning

X_2 : learning using group conventional method

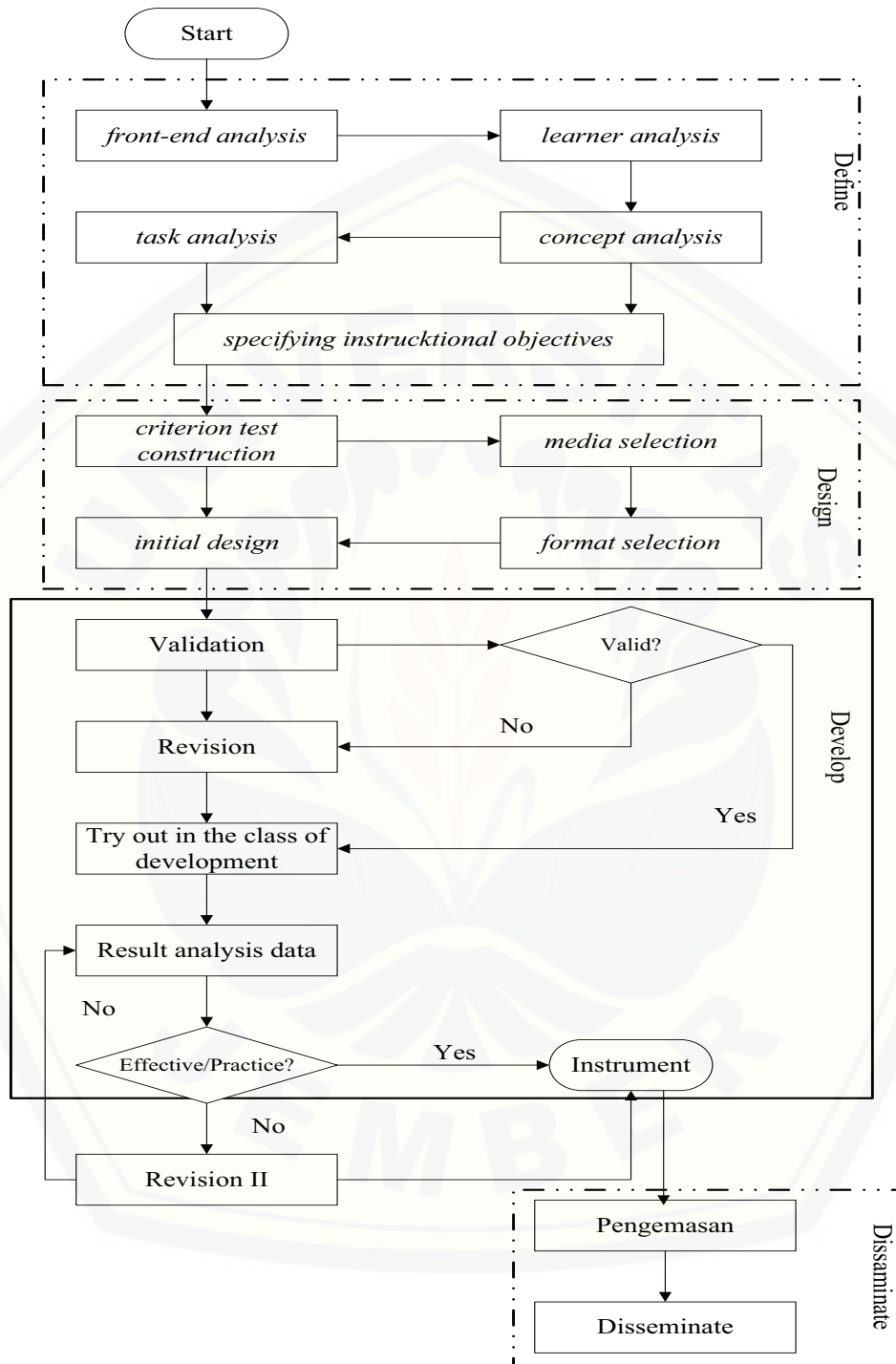


Figure 1. Flowchart of development research

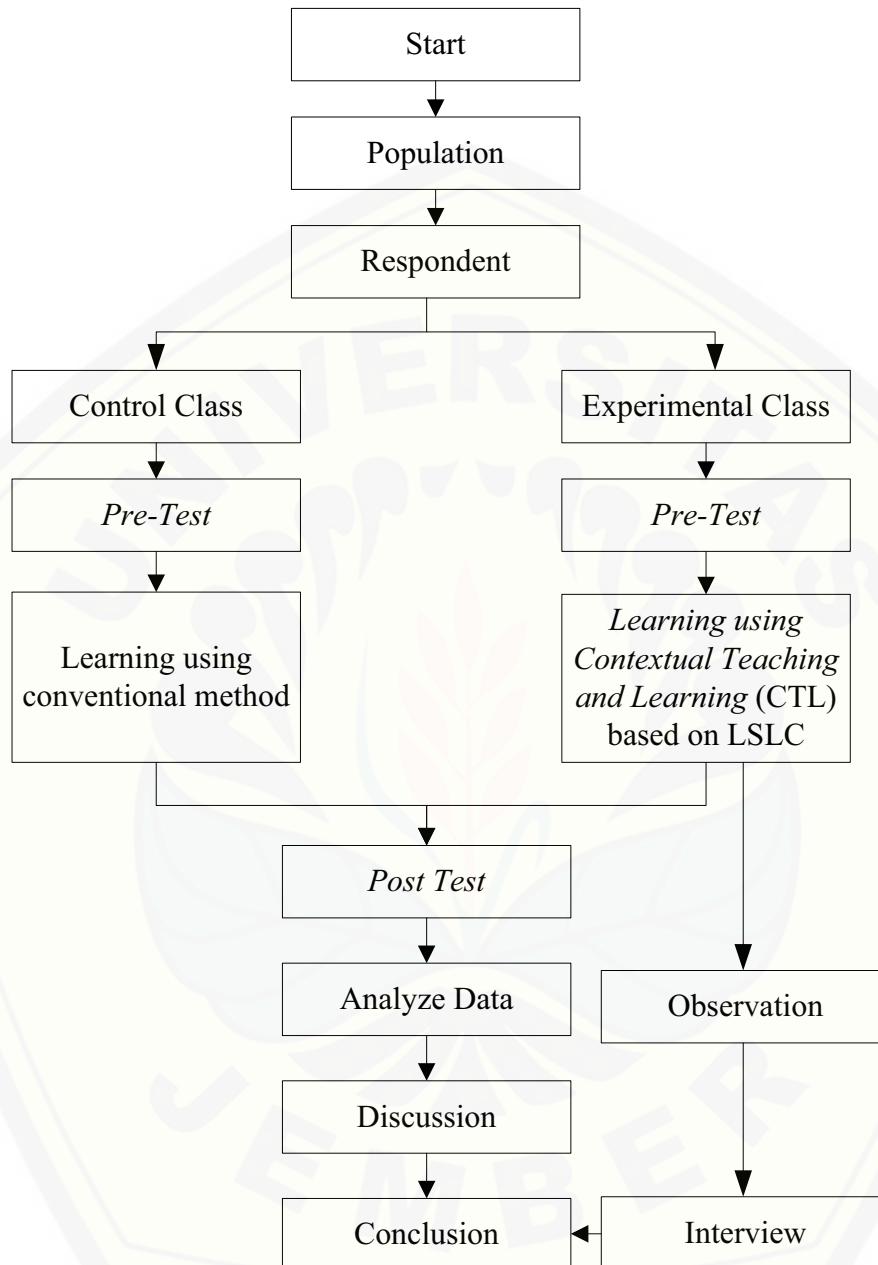


Figure 2. Flowchart experimental research

This study involved one independent variable and one dependent variable. The independent variable tested in this study was the learning tool with the contextual teaching and learning approach based on lesson study for learning community, while the dependent variable used as the object of this study was the students' creative thinking ability. The data analysis technique uses the *t-test*, if the data were normally distributed and homogeneous. The *t-test* used is the *independent sample t-test*. If the data is not normally distributed or

not homogeneous, then a non-parametric test is used, which is the *Mann-Whitney* test. The research hypothesis is as follows:

H_0 : There is no effect of learning tool with a contextual teaching and learning approach based on lesson study for learning community on students' creative thinking abilities.

H_1 : There is an effect of learning tool with a contextual teaching and learning approach based on lesson study for learning community on students' creative thinking abilities.

With the test criteria, if the significance value > 0.05 , then H_0 is accepted, whereas if the significance value < 0.05 , then H_0 is rejected [22].

3. Results dan Discussions

Development research obtained valid, practical and effective results. The validity of learning instrument of lesson plan, worksheets, and creative thinking ability test questions obtained the following results. The lesson plan validation results from the validator 1 was 93.33%, the validator 2 was 95.83%, and validator 3 was 95.83%. Based on the results of the three validators, the average result of lesson plan validation is 94.99%, so the percentage results are declared very valid. The results of the worksheets validation from validator 1 was 75%, validator 2 was 93.75%, and validator 3 was 88.28%. Based on the results of the three validators, an average of 85.67% is obtained, so the percentage results are stated to be very valid. The results of the validation of the creative thinking ability test questions of validator 1 was 88.23%, validator 2 was 91.76%, and validator 3 was 89.41%. Based on the results of the three validators, the average results of the validation of the creative thinking ability test questions were 89.8%, so the percentage results were declared very valid. From the results of the validation of the learning device experts, it was stated valid and usable.

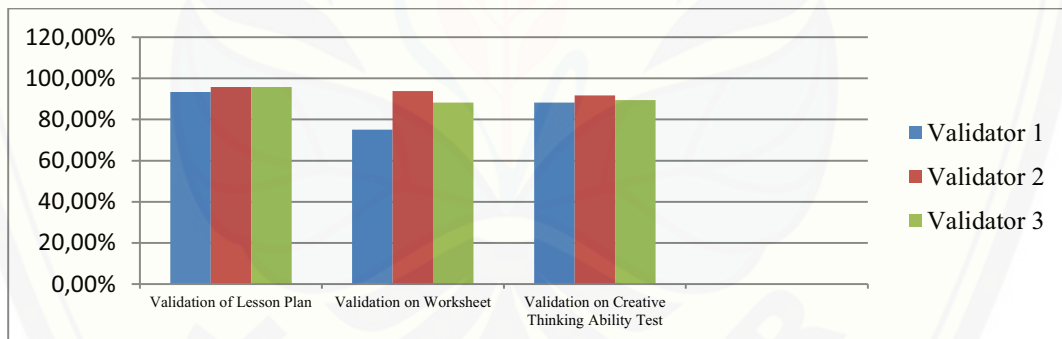


Figure 3. Learning Instrument Validation Results

After obtaining valid results, we are tried out in a development class or large group of 40 students. Based on the results of observations of the implementation of learning tools, the average result is 91%, meaning that the learning tools are very practical to use. The use of these learning tools can change the attitudes of students to be more active in the teaching and learning process, as evidenced by the learning activities of students, the average result of the effectiveness of learning tools is 89.99%, so that the percentage results indicate the level of student activity is very good. Supported by the data generated from the student's response of 83.17%, meaning that almost all students have an interest in the use of this learning tool, so that the completeness of student learning outcomes is obtained by a percentage of 82.35%. So it can be concluded that the resulting learning tool has met the criteria of validity, practicality, and effectiveness or is suitable for use.

In experimental research using learning tools that have been declared valid, practical, and effective. There are four meetings, the first meeting gives a pretest. The pre-test was conducted to measure students' creative thinking abilities before carrying out learning activities, the pretest was carried out in the

experimental class and the control class. In the second and third meetings, students studied collaboratively with their own group and also with other groups. One group consists of four students, but there are also five students in one group. In groups, students discuss with each other, ask each other questions, and care for each other in the group. The teacher, as a facilitator, provides guidance to each group that needs it. The following is a picture of students' activities asking each other and answering each other in groups (picture taken from one of the groups as a sample).

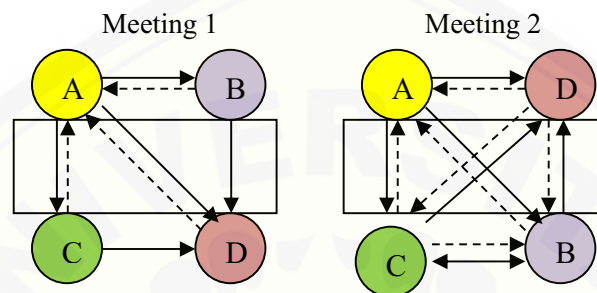


Figure 4. Activities of experimental class group discussion

Note:

- : students answer / explain
- : students ask

The discussion activity went well. At the first meeting, student A explained to the group members. Students B and C help explain student D. Student D does not understand the material, therefore student D is not active in group discussions. Finally, at the second meeting, they switched positions, where student D sat next to student A who understood the material and was active in discussions. Then, student D understood the material and the discussion went well. The situation above shows the collaboration of students in groups and building feelings of caring for one another.

While in the control class using a conventional learning model, where the teacher has a role as a learning center in guiding and providing training to students. Group discussion that took place in the control class.

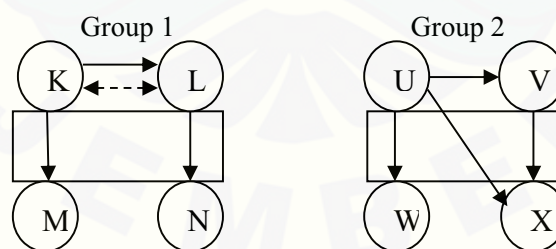


Figure 5. Diskusi Kelompok kelas Kontrol

Note:

- : students answer / explain
- : students ask

In Group 1, group discussions only happened to students K and L. Students M and N did not understand the material, and did not ask their friends who has understood. The same condition occurs in

Group 2, student U who understands the material and explains the answers to all members, but members only copy the answers from student U without asking and do not care about each other. So that the purpose of making a group is only to get the highest score, regardless of whether the group members understand the materials or not. In stark contrast to the discussion in the experimental class, there was no exchange of seats.

On the second meeting was also attended by five teachers from all subjects at MTs Bustanul Ulum. The *open class* activity is one of the lesson study for learning community activities which is followed by a reflection from the observation of student activity. Reflection is carried out to see how students learn and observe the teacher teaching and mastery of the material provided. Therefore, the teachers attend an *open class* that the main purpose of teaching and learning contextual teaching and learning (CTL) based on lesson study for learning community (LSLC) is to gain meaningful knowledge, think creatively, argue, discuss, make decisions, and solve problems in groups, and this learning will have a significant impact on students' creative thinking abilities.

The fourth meeting or the last meeting gives a post-test. The post-test was conducted to measure students' creative thinking skills after carrying out learning activities, the post-test was also carried out in the experimental class and the control class.

The research data obtained from the average results of the pre-test in the experimental class and the control class were 35.84 and 29.50, respectively.

One-Sample Kolmogorov-Smirnov Test

		Unstandardized Residual
N		64
Normal Parameters ^{a,b}	Mean	.0000000
	Std. Deviation	.42254481
Most Extreme Differences	Absolute	.147
	Positive	.136
	Negative	-.147
Test Statistic		.147
Asymp. Sig. (2-tailed)		.002 ^c

a. Test distribution is Normal.
 b. Calculated from data.
 c. Lilliefors Significance Correction.

Figure 6. Normality test for pre-test by SPSS

Test of Homogeneity of Variances

Nilai			
Levene Statistic	df1	df2	Sig.
3.180	1	62	.079

Figure 7. Homogeneity test for pre-test by SPSS

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Nilai	Equal variances assumed	3.180	.079	5.118	62	.000	6.344	1.240	3.866	8.822
	Equal variances not assumed			5.118	50.581	.000	6.344	1.240	3.855	8.833

Figure 8. T-test for pre-test by SPSS

After being treated with learning of *contextual teaching and learning* (CTL) based on lesson study for learning community (LSLC) in the experimental class, the post-test average result was 44.81. While in the control class that was treated using learning tools of *contextual teaching and learning* (CTL) that are commonly applied in schools, the average result was 39.25. This shows a significant difference between the

experimental class and the control class. The results of the pre-test and post-test were analyzed using the SPSS.

One-Sample Kolmogorov-Smirnov Test

		Unstandardized Residual
N		64
Normal Parameters ^{a,b}	Mean	.0000000
	Std. Deviation	3.66206421
Most Extreme Differences	Absolute	.081
	Positive	.054
	Negative	-.081
Test Statistic		.081
Asymp. Sig. (2-tailed)		.200 ^{c,d}

a. Test distribution is Normal.
 b. Calculated from data.
 c. Lilliefors Significance Correction.
 d. This is a lower bound of the true significance.

Figure 9. Normality test for post-test by SPSS

Test of Homogeneity of Variances

Nilai

Levene Statistic	df1	df2	Sig.
1.680	1	62	.200

Figure 10. Homogeneity test for post-test by SPSS

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Nilai	Equal variances assumed	1.680	.200	6.027	62	.000	5.563	.923	3.718	7.407
	Equal variances not assumed			6.027	60.414	.000	5.563	.923	3.717	7.408

Figure 11. T-test for post-test by SPSS

The results of the analysis show that contextual teaching and learning (CTL) based on lesson study for learning community (LSLC) affects students' creative thinking abilities. There is an increase in the average score of students' creative thinking abilities in every aspect of the experimental class. However, there was also an increase in the average in the control class but not greater than that in the experimental class.

Table 2. Comparison of pre-test and post-test average

Class	Pre-test average	Post-test average
Experimental Class	35.84	44.81
Control Class	29.50	39.25

In this study, the students' answers were analyzed using creative thinking skills in solving problems. To measure students' creative thinking skills by fulfilling the 4 indicators of student creative thinking, which are *fluency*, *flexibility*, *elaboration*, and *novelty*. *Fluency* is fulfilled if students can solve problems correctly and provide more than one idea or statement related to a relevant mathematical concept or situation, as well as problem solving and complete and also clear disclosure. *Flexibility* is fulfilled if students can provide many answers, using various strategies in solving problems but in the calculation process and the results are correct. *Novelty* is fulfilled if students can provide answers using their own way, the calculation process and the results are correct. *Elaboration* is fulfilled if students can provide correct answers and explain in detail.

The results of the data analysis on students' creative thinking abilities in each aspect of *fluency* were classified as moderate with an average score of 68.03 out of 40 students, so it could be said that the way students completing answers / ideas correctly and giving more than one statement to the problems given was pretty smooth. The students' creative thinking ability on the *flexibility* aspect is classified as low with an average score of 51.07 out of 40 students, so it can be said that the way students use various strategies is still low. In addition, the ability of students to think creatively in the *elaboration* aspect is low with an average score of 55.28 out of 40 students, so it can be said that the way students solve problems is still lacking in detail and is still classified as low. Furthermore, in the *novelty* aspect it is classified as very low with an average score of 2.35 out of 40 students, so it can be said that the way students solve problems in a unique/ new way is still lacking, because students are still accustomed to using the same method as conveyed by the teacher.

The results of the research on the analysis of students' creative thinking abilities at MTs Bustanul Ulum showed that as many as 5% of students had a high level of creative thinking skills, 22.5% indicated that students were at a moderate level of creative thinking skills, 60% indicated that students were at a low level of creative thinking skills, and 37.5% indicated that students were at a very low level of creative thinking skills.

Given = mathematical model
 $2x + 5y = 144,000$
 $3x + 4y = 174,000$

Asked = How many reams of paper and how many packs of board markers did Mr. Agung buy IDR 250,000

Answer = $2x + 5y = 144,000$
 $3x + 4y = 174,000$

$$\begin{array}{r} \times 3 \\ \times 2 \\ \hline 6x + 15y = 432,000 \\ 6x + 8y = 348,000 \\ \hline 7y = 84,000 \\ y = 12,000 \end{array}$$

$2x + 5y = 144,000$
 $2x + 5(12,000) = 144,000$
 $2x + 60,000 = 144,000$
 $2x = 144,000 - 60,000$
 $2x = 84,000$
 $x = 42,000$

The set completion = $\{42,000, 12,000\}$

Possibility 1
 $2x + 5y = 144,000$
 $2(0) + 5(12,000) = 60,000$
 The rest of the money = $250,000 - 60,000 = 190,000$

So Mr Agung only bought 5 packs of board markers

Possibility 2
 $2x + 4y = 144,000$
 $2(42,000) + 2(12,000) = 108,000$
 The rest of the money = $250,000 - 108,000 = 142,000$

So Mr Agung only bought 2 reams of paper P4 and 2 packs of boardmarker

Figure 12. Results of Answers to High Level Students' Creative Thinking

Based on the results of hypothesis testing with testing criteria $t_{table} = 1.69389$ with t_{test} value = 6.027 so that $t_{table} < t_{test}$ is obtained, then H_0 is rejected and H_1 is accepted, thus indicating that the development of learning tools with LSLC-based CTL affects students' creative thinking abilities. Then the relationship between CTL and LSLC is obtained to show the influence on students' creative thinking abilities as shown in Figure 15.

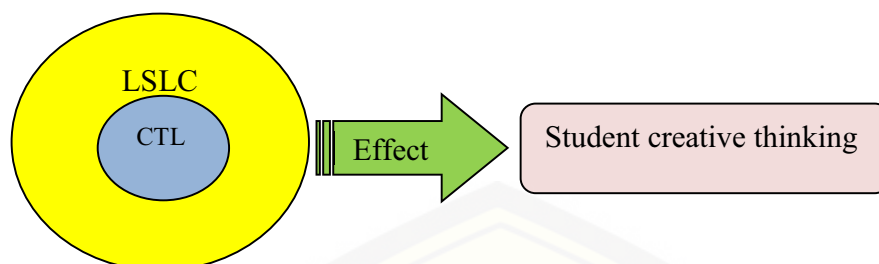


Figure 13. The relationship between CTL and students' creative thinking skills

4. Conclusion

Based on the results of the discussion, the conclusions of the research results are lesson plans, student worksheets and creative thinking skills test questions. The results of the validity test of the expert's assessment, validation of lesson plans, validation of worksheets, validation of test questions for creative thinking skills, validation of learning device implementation sheets, validation of student activity sheets, validation of interview guidelines, and validation of student response questionnaires can be concluded that have met the valid criteria and are used. The results of the practicality test based on the results of the practicality analysis of the learning tools from the results of the implementation of the learning tools and the results of the interviews with the assessment model teacher, it can be concluded that the resulting teaching materials have met the practical criteria for use. The results of the effectiveness test based on the results of the analysis of the effectiveness of learning tools from the results of student activity assessments, student learning outcomes from the creative thinking ability test questions, student responses, and the results of interviews with students above, it can be concluded that the resulting learning tools have met the criteria for being effective for use. So the results of research on the development of mathematics learning tools using *contextual teaching and learning* (CTL) based on *lesson study for learning community* (LSLC) on the material of two-variable linear equation systems for 8th grade students of Junior High School / MTs from the results of the validity, practicality, and effectiveness test shows that learning tools have met these three criteria. And has a significant influence on students' creative thinking skills. Further research can be done by combining the focus of creative thinking and critical thinking in solving problems using online-based learning media.

Open problem

Determine the development of learning instrument based on Lesson Study for Learning Community on the other topics of mathematics like matrix, sosial arithmetic, and linier equation.

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