UJME 9 (1) 2020: 74-82
UNNES JOURNAL OF MATHEMATICS EDUCATION
https://journal.unnes.ac.id/sju/index.php/ujme/
ISSN: 2252-6927 (print); 2460-5840 (online)

Mathematical Creative Thinking Skills of Eight Grade in Terms of Learning Styles on Learning Model *Means-Ends Analysis* (MEA)

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ARTICLE INFO

Article history:
Received 13 February 2020
Received in revised form 12 March 2020
Accepted 26 March 2020

Keywords:
Creative thinking ability;
Learning style;
Means-Ends Analysis (MEA) Learning

Abstract

This study aims to test whether learning with the *Means-Ends Analysis* (MEA) model achieves learning completeness and knows the description of the ability to think kreatif with the *Means-Ends Analysis* (MEA) model in terms of student leraning styles. Research is a research *mixed methods* model of concurrent triangulation. The population of this research is students of class VIII of SMP Negeri 14 Pekalongan in the academic year 2018/2019, a sample of students of class VIII-F. Research subjects were students of class VIII-F selected with *purposive sampling technique*, selected 4 students from the type of visual and auditory learning styles, and 3 students from the type of kinesthetic learning style. Quantitative data were analyzed using the one-party average test and the one-party proportion test. Whereas qualitative data were analyzed using the Miles adnd Huberman model, namely making verbal data transcripts, data reduction, data analysis, and making conclusions. The result showed that: (1) learning with the *Means-Ends Analysis* (MEA) model achieved mastery learning; and (2) description of creative thinking abilities of students with models of *Means-Ends Analysis* (MEA) in terms of students learning styles that students with visual learning style meet three indicators of creative thinking that fluency *(fluency)*, authenticity *(originality)*, and elaboration *(elaboration)*; students with learning styles of auditory almost all meet the four indicators of creative thinking that fluency *(fluency)*, flexibility *(flexibility)*, authenticity *(originality)*, and elaboration *(elaboration)*; students with kinesthetic learning style meets the four indicators of creative thinking that fluency *(fluency)*, flexibility *(flexibility)*, authenticity *(originality)*, and elaboration *(elaboration)*.

1. Introduction

Education is one of the efforts that can be done by humans to support quality improvement and intellectual change. One of the goals of the management and organization of education in Indonesia is to build a foundation for the development of students potential to become knowledgeable, capable, critical, creative and innovative human beings. This is in line with the learning objectives of mathematics given from elementary school through higher education. According to the contents standards for elementary and secondary education units in mathematics (Minister of education and Culture Regulation Number 21 Year 2016 About content Standards) it is stated that through mathematics learning, students are expected to have logical, analytical, systematic, critical and creative abilities, and have the ability to work same.

Subur (2013) states that creativity is a form of thougt which until now has received less attention in formal education. Based on research from Kadir (2014: 305) shows that students creative thinking abilities to be used in the context of mathematics learning are still lacking. Context is only used at the beginning of learning to draw stuents attention to mathematics learning, but has never been used to develop mathematical concepts and has not been utilizied to improve students creative thinking abilities.

To cite this article:
Octaviana, D. & Kurniasih, A. W. (2020). Mathematical Creative Thinking Skills of Eight Grade in Terms of Learning Styles on Learning Model *Means-Ends Analysis* (MEA). *Unnes Journal of Mathematics Education*, *9*(1), 74-82. doi: 10.15294/ujme.v9i1.38104

Based on the 2011 TIMSS results it can be said that the reasoning abilities of Indonesian students are still relatively low. This means, student still need to be trained in their thinking skills to work on non-routine problems or even problems that are classified as difficult. Therefore a high level of thinking ability is needed, one of which is the ability to think creatively.

Based on the results of a preliminary study conducted on January 19, 2019 to find out the mathematical creative thinking ability of students of class VIII G of SMP Negeri 14 Pekalongan in the academic year 2018/2019 related to the material already taught in the previous chapter, namely getting up flat, it was found that from 29 students as much as 6 students did not reach the fourth indicator of the ability to think creatively, 20 students already fulfills the fluency *(fluency)*, 1 student fulfills the flexibility *(flexibility)*, there is no student who meets aspects of authenticity *(originality)*, and 2 students already fulfills the elaboration *(elaboration)*. Based on this it can be said that there are still many students who do not meet the aspects of flexibility *(flexibility)* and aspects of elaboration *(elaboration)*, and none of them meet the aspects of authenticity *(originality)*.

According to Mulyana (in Kurniasih, 2012), the mathematics learning used and liked by many teachers until now is conventional. Learning begins with the teacher explaining the cocept or principle, then the teacher gives examples of the application of the concept or principle, then students are given a considerable amount of time to practice solving questions related to the concept or principle taken from student worksheets or textbooks for done individually or in groups. Appropriate learning to find out the extent of students creative thinking abilities is *Means-Ends Analysis* (MEA). *Means-Ends Analysis* (MEA) is a learning model that varies between problem solving methods with sytax and presentation of the material using heuristic-based problem solving approaches, namely solving a problem into two or more sub-objectives (Armada, 2012: 3). Meanwhile, the opinion of Sari (2018), the *means-Ends Analysis* (MEA) learning model is carried out using the discussion method so that it can encourage students to work together in learning and be more active in issuing ideas, sugestions, and opinions, so as to increase student participation in the learning process by involving studentsa in the learning process and learning centered on students *(student center)*.

Eysenck as quoted by Umar (2017) states the syntax or steps of learning are (1) presenting material with heuristic-based problem solving approaches, (2) elaboration of problem into more simple sub-problems, (3) arranging sub-problems so that connectivity occurs, and (4) choose a solution strategy. In learning the *Means-Ends Analysis* (MEA) model emphasizes group discussion and students find their own solutions to the problems given. Group discussions that occur in the MEA learning model, will accustom students to be active in learning. Discussion activities can also train students to dare to express their ideas, students begin to practice their thinking skills, one of which is the ability to think creatively to express new ideas in solving a problem.

Learning styles according to Gunawan (2012: 139) are the preferred way of carrying out activities of thinking, processing and understanding information. In addition, Chatib (2014) mentions that children's learning styles are like opening doors. Each item of information that enters through the door wide open, will make it easier for children to understand that information. At the peak of understanding, that information will go into long-term memory and be unforgettable for a lifetime.

DePorter and hernacki in Triwibowo (2017) state that each person has one or a combination of three types of learning styles, namely visual, auditory and kinesetetic learning styles. Knowing the learning styles of each teacher will make it easier for students to determine strategies, methods, and approaches that will be used to help students learn optimally. In line with Sari's research (2014) which states that to develop students creative thinking abilities in a visual learning style that is by using diagrams or pictures that make students more interested so that they can increase student interest in learning. In addition, students with an auditory learning style will further develop their creative thinking abilities if the material presented is accompany by certain repetitions to better provide understanding to the student. And students with kinesthetic learning styles can further develop their creative thinking abilities if the teacher gives assignments in the form of direct practice or in the form of applied projects.

Based on the background description above, it is necessary to have further research on "Mathematical Creative Thinking Skills of Eight Grade in Terms of Learning Styles on Learning Model *Means-Ends Analysis* (MEA)". This research is expected to be an in depth study of student creative thinking abilities in the *Means-Ends Analysis* (MEA) learning model in terms of student learning styles.

2. Methods

This research method used in this study is a combination method *(mixed methods)* design *concurrent triangulation*. The quantitative research design uses the *One-Shot Case Study*. The description of quantitative research designs can be seen in Table 1.

Table 1. *One-Shot case Study* Design Study

Treatment	Measurement
X	*O*

Information:
X : *Means-Ends Analysis* (MEA) learning model
O : Student creative thinking ability test results

The population of this experimental study were all students of class VIII in one junior high school in Pekalongan City. This research uses *purposive sampling technique*. Taken one class, class VIII F. the class will be given *treatment* in the form of mathematics learning with the *Means-Ends Analysis* (MEA) model.

The determination of the subject in this study was based on the results of the Student Learning Style questionnaire and the student creative thinking abilities test. The results of the student learning style questionnaire were categorized into three types, namely the type of visual, auditory, and kinesthetic learning styles. From the result of grouping student learning styles and the results of tests of creative thinking abilities, the types of visual and auditory learning styles are taken 3 research subjects. The selected research subjects were then analysed their creative thinking abilities based on Siswono's research abilities.

The variables used in this study are the independent variables and the dependent variable. The independent variable in this study is student learning style with the *Means-Ends Analysis* (MEA) learning model. The dependent variable in this study is the ability to think creatively. In this study, the data used are primary data, where the data in this study are data on the results of student work on the tests of creative thinking skills and student ;earning style questionnaire data. The data source of this study were students of class VIII in one of the junior high schools in the city of Pekalongan in the academic year 2018/2019. There is one class that is the subject of a creative thinking ability test in terms of learning styles, while the case that will be elaborated in the study is all students of the experimental class with 3-4 subjects being interviewed from each type of learning style formed.

In this study, data collection techniques used include observation, tests, interviews and questionnaires. Observation was carried out by asking the source, the teacher who taught mathematics in the sample class, which will be used for research and preliminary studies. The test used is a test in the form of description. The interview method used in this study is unstructured interviews. Learning style questionnaire in this study, the researcher adopted a questionnaire that was modified by Swinburne University of Technology and was translated into Indonesian by the researcher.

3. Results & Discussion

3.1. Research Data Analysis

The research data is the data of the test of creative thinking ability and analyzed with the normality test, the average test of one party, and the proportion test of one party. Based on the results of data normality test analysis and test values using SPSS 16.0 indicate that the data are normally distributed. Then the matery learning test is conducted with an average test of one party and a proportion test of one party.

Mastery learning in this study is average mastery and classical completeness. The average completeness test is calculated using the one-party (right-hand) average test. Based on the results of calculations that have been done, the value is obtained $t_{hitung} = 4{,}40 \geq t_{tabel} = 1{,}69$. So H_0 rejected, which measn the average test results of students mathematical creative thinking ability in learning the *Means-Ends Analysis* (MEA) model exceeds the KKM. Whereas the classical completeness test is calculated using the proportion test of one party (right hand side). Based on the results of calculations that

have been done, the value obtained $z_{hitung} = 2{,}041 \geq z_{tabel} = 1{,}69$. So H_0 rejected means the average test results of students mathematical creative thinking ability in learning the *Means-Ends Analysis* (MEA) model exceeds the KKM.

Based on the results of the average test analysis it is known that learning with the *Means-Ends Analysis* (MEA) model on the aspects of students creative thinking abilities exceeds the KKM of 73 and is more than or equal to 75% of the number of students getting grades. These result are reinforced by the fact in the class that the average value of the test of creative thinking ability of students is 78,91 and as many as 90,6% or 29 of 32 students get test scores more than or equal to 73. This means that learning is applied to the research class is able to develop aspects of students creative thinking abilities. This is in line with Sari's research (2018) that learning *Means-Ends Analysis* (MEA) achieves mastery learning.

The results are obtained because in learning with the *Means-Ends Analysis* (MEA) model students are required to be active during the learning process. This is in line with the opinion of Susanti (2018) that learning *Means-Ends Analysis* (MEA) can support the learning process of students because the problem is presented in the form of stories used by students with variations in the original form, complex, and contextual learning experiences.

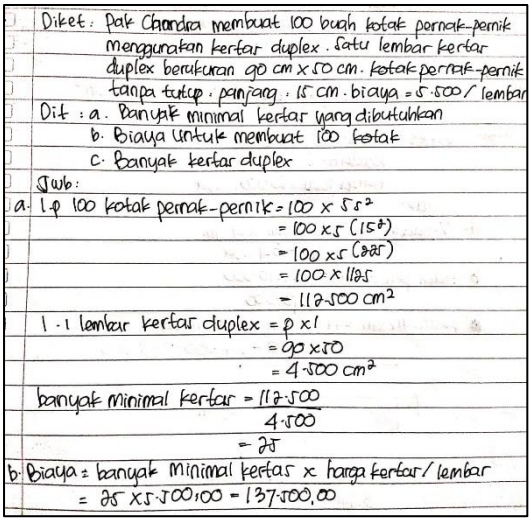

Figure 1. The Result of Test Subjct T-25

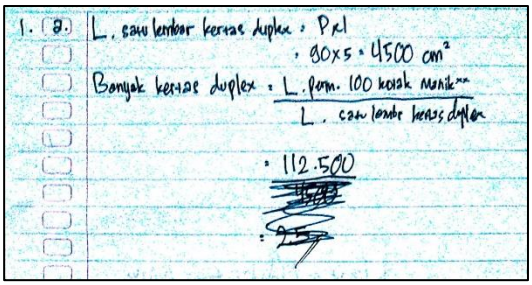

Figure 2. The Result of Test Subject T-24

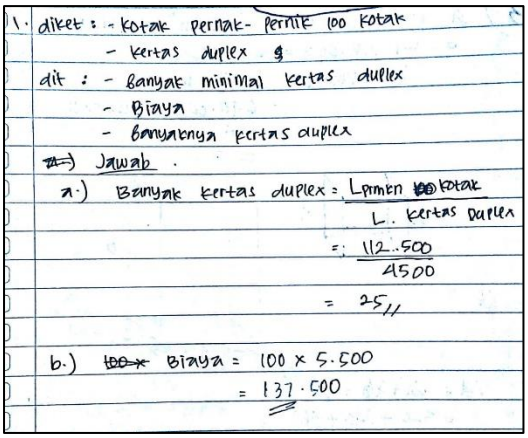

Figure 3. The Result of Test Subject T-15

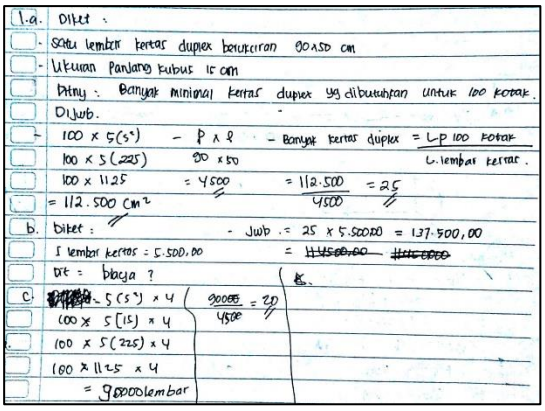

Figure 4. The Result of Test Subject T-21

In addition, in learning *Means-Ends Analysis* (MEA) students learn with a group system where students are required to actively interact with other students through group discussions. This is in line with the theory put forward by Piaget as quoted by Anni & Rifaa'i (2012: 170) that at the time of learning it is necessary to create an atmosphere that allows interaction between learning subjects. With social interaction, children's cognitive development will lead to many views. Therefore the *Means-Ends*

Analysis (MEA) learning model can be implemented in mathematics learning towards students creative thinking abilities.

3.2. Creative Thinking Ability Judging from Student Learning Styles

3.2.1. Product Description Creative Thinking subject Category Visual Learning styles

In this study, interview subjects for mathematical creative thinking ability with visual learning styles are T-25 with a level of creative thinking ability 3, T-24 with a level of creative thinking ability 2, T-15 with a level of creative thinking ability 1, and T-21 with a level of creative thinking ability 0. Following presented the results of tests of mathematical creative thinking ability of subjects T-25, T-24, T-15, and T-21 questions number 1 in picture 1, picture 2, picture 3, and picture 4.

Indicators of fluency *(fluency)* can be met properly by students with visual learning style categories (T-25 and T-15). Students can solve problems smoothly. While students T-24 and T-21 have not been able to solve problems amoothly.

Indicators flexibilit *(flexibility)* can only be met by the students T-4, where the student can solve problems with flexibility. T-24 students use two different methods and the results are the same. As for studnts T-25, T-15, and T-21 only write in one way.

Indicators of authenticity *(originality)* can be fulfilled well by students (T-25 and T-24). Students can solve problems correctly. The answer he wrote was correct according to the answer key. Whereas students of T-15 and T-21 have not been able to provide solutions to problems correctly.

Indicators elaboration *(elaboration)* can be met by the students T-25, T-24, and T-15. Students can solve problems in detail. The answer he wrote was clear. While T-21 students have not been able to solve the problem in detail. Students only write down known and asked questons and answers that are not right.

The following are the conclusions of the subjects creative thinking products with visual learning styles which will be shown in the following table.

Table 2. Product Thinking Creatively Visual Subject

Indicator	T-25	T-24	T-15	T-21
Fluency	√	-	√	-
Flexibility	-	-	-	-
Originality	√	√	-	-
Elaboration	√	√	√	-

By triangulation data is performed, it was found that creative thinking abilities of students based on a visual learning style meet three indicators defined creative thinking smoothness *(fluency)*, authenticity *(originality)*, and elaboration *(elaboration)*. Students with visual learning styles are able to solve problems smoothly and are able to develop answers in detail. In addition students with visual learning styles are able to solve problems in new ways and with their own thoughts. This is in line with Sari's research (2014) which states that to develop students creative thinking abilities in the style of visual learning that is by making learning using digrams or pictures that make students more interested so that they are able to increase student learning intererest.

3.2.2. Product Description Creative Thinking Subjects Category Auditorial Learning Style

In this study, the interview subjects for mathematical creative thinking ability with auditory learning styles are T-18 with the level of creative thinking ability 4, T-07 with the level of creative thinking ability 3, T-17 with the level of creative thinking ability 2, and T-11 with the level of creative thinking ability 1. Following presented the results of tests of mathematical creative thinking ability of subjects T-18, T-07, T-17, and T-11 questions number 1 in picture 5, picture 6, picture 7, and picture 8.

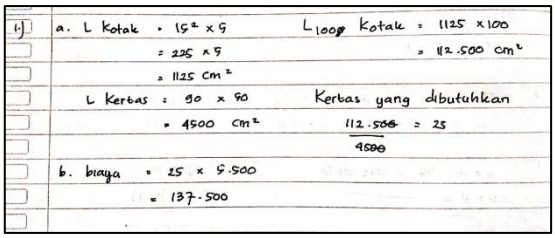

Figure 5. The Result of Test Subject T-18

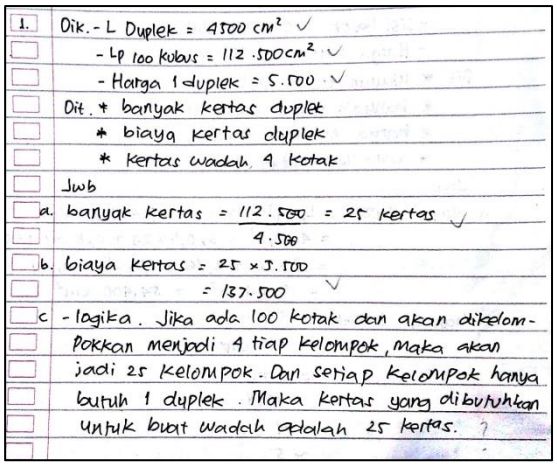

Figure 6. The Result of Test Subject T-07

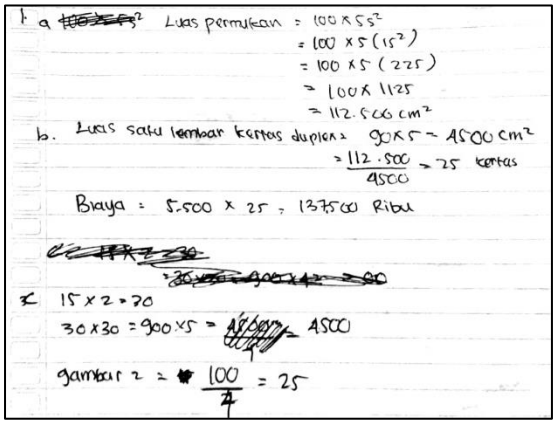

Figure 7. The Result of Test Subject T-17

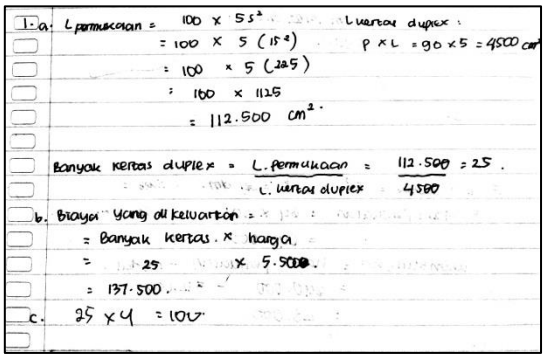

Figure 8. The Result of Test Subject T-11

Indicators of fluency *(fluency)* can be met properly by the auditory student. Student can solve the problems given smoothly. The answer he wrote were true and correct according to the answer key and the steps written coherently.

Indicators flexibility *(flexibility)* can be met by the students T-18 in which the student can solve problems with flexibility. T-18 students use two different methods and the results are the same. As for students T-07, T-17, and T-11 only write in one way.

Indicators of authenticity *(originality)* can be fulfilled well by auditory students (T-18, T-07, and T-17). Students can solve problems correctly. The answer he wrote was correct according to the answer key. While T-11 students have not been able to solve the problem correctly.

The elaboration indicator *(elaboration)* can be fulfilled well by the auditorial students. Stuents can solve problems with detailed and clear steps. Students can understand the problem well so that it can develop the problems given. The answer he wrote was correct and right according to the answer key.

The following are the conclusions of the subjects creative thinking products with auditory learning styles which will be shown in the following table.

Table 3. Product Thinking Creatively Auditory Subject

Indicator	T-18	T-07	T-17	T-11
Fluency	√	√	-	√
Flexibility	√	-	-	-
Originality	√	√	√	-
Elaboration	√	√	√	√

Based on the triangulation of data, almost all the auditory students meet four indicators defined creative thinking amoothness *(fluency)*, flexibility *(flexibility)*, authenticity *(originality)*, and elaboration *(elaboration)*. Auditory students are able to solve problems smoothly and use two different ways. The ideas obtained are the results of their own thoughts. Auditory students are also able to solve problems with detailed and clear steps. This is in line with Saris's research (2014) which states that students with an auditory learning style will further develop their creative thinking abilities if the material presented is accompanied by certain repetitions to better understand the student.

3.3. Product Description Creative Thinking Subjects Categories Kinesthetic Learning Styles

In this study, interview subjects for mathematical creative thinking ability with kinesthetic learning style are T-12 with creative thinking ability level 4, T-09 with creative thinking ability level 3, and T-31 with creative thinking ability level 2. The following presented the results of tests of mathematical creative thinking ability of subects T-12, T09, and T-31 questions number 1 in picture 9, picture 10, and picture 11.

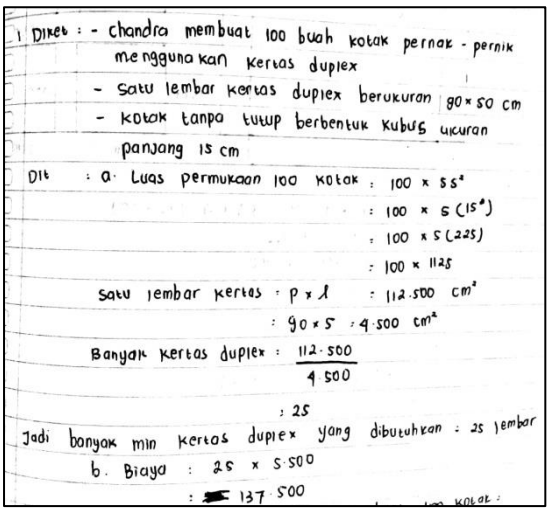

Figure 9. The Result of Test Subject T-12

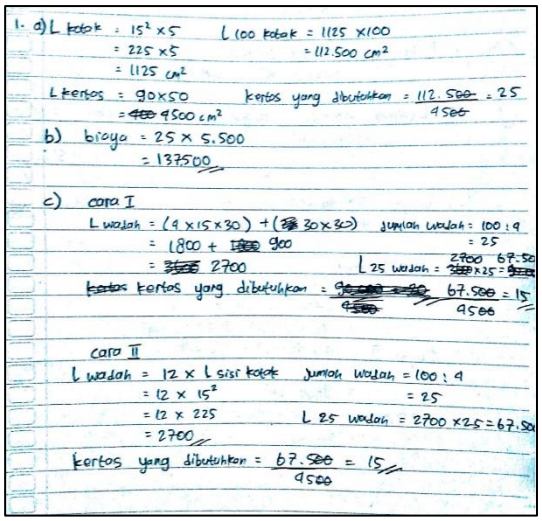

Figure 10. The Result of Test Subject T-09

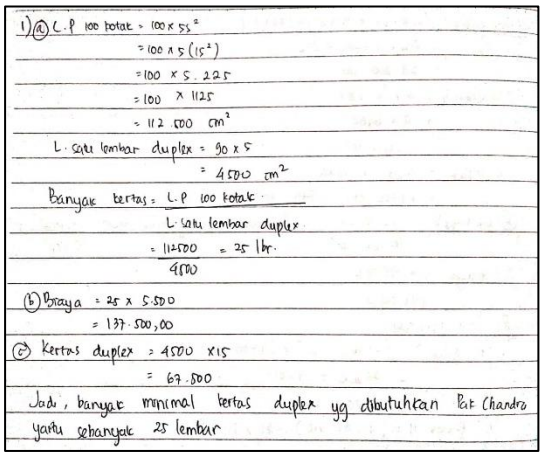

Figure 11. The Result of Test Subject T-31

Indicators of fluency *(fluency)* can be met properly by kinesthetic students. Students are able to work on problems smoothly and the answers given are right in accordance with the answer key. The steps in completing it are also coherent.

Indicators flexibility *(flexibility)* can be met by the student kinesthetic. Students can solve the problems given flexibility. This is indicated by students completing two different ways and have the same results. The answer he wrote was correct and right.

Indicator of authenticity *(originality)* can only be fulfilled well by T-12 kinesthetic students. Students can solve problems correctly. The answer he wrote was correct according to the answer key. While other kinesthetic students (T-09 and T-31) have not been able to solve the problem correctly.

Indicator of elaboration *(elaboration)* can be fulfilled well by kinesthetic students. Students can solve problems with detailed and clear steps. Students can understand the problem well so they can develop the problems given. The answer he wrote was correct to the answer key.

The following are the conclusions of the subjects creative thinking products with kinthetic learning styles which will be shown in the following table.

Table 4. Product Thinking Creatively Kinesthetic Subject

Indicator	T-12	T-09	T-31
Fluency	√	√	√
Flexibility	√	√	-
Originality	√	-	-
Elaboration	√	√	√

Based on the data triangulation, the kinesthetic students to think creatively meet the four indicators set smoothness *(fluency)*, flexibility *(flexibility)*, authenticity *(originality)*, and elaboration *(elaboration)*. Kinesthetic students are able to solve problems smoothly and use two different ways. The ideas obtained are the results of their own thoughts. Kinesthetic students are also able to solve problems with detailed and clear steps. This is in line with research conducted by Sari (2014) stating that students with kinesthetic learning styles can further develop their creative thinking abilities if the teacher gives assignments in the form of direct practice or in the form of applied projects.

4. Conclusion

The conclusions obtained from this study are learning with the *Means-Ends Analysis* (MEA) model to achieve learning completeness, namely the average completeness of the class based on KKM and classical completeness. For the average value of the creative thinking ability test of the research class students was 78,91. As for classical completeness, as many as 90,6% or 29 out of 32 students scored more than or equal to 73. Based on the analysis of creative thinking skills with visual, auditory, and kinesthetic learning style categories, the following conclusions are obtained: (a) students meet three visual indicators of creative thinking applied smoothness *(fluency)*, authenticity *(originality)*, and elaboration *(elaboration)*. Students do not meet the visual indicator of flexibility *(flexibility)* not being able to solve problems using two different ways; (b) students auditory almost all meet the four indicators set creative thinking smoothness *(fluency)*, flexibility *(flexibility)*, authenticity *(originality)*, and elaboration *(elaboration)*; (c) kinesthetic students to thonk creatively meet the four indicators set smoothness *(fluency)*, flexibility *(flexibility)*, authenticity *(originality)*, and elaboration *(elaboration)*.

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