Vygotsky: Jurnal Pendidikan Matematika dan Matematika
5 (1) February 2023, pp. 55 - 64
E-ISSN: 2656-5846 P-ISSN: 2656-2286
Journal Page is available to
https://jurnalpendidikan.unisla.ac.id/index.php/VoJ

Analysis of Student's Creative Thinking Ability on Arithmetic Sequences in the Lesson Study Framework

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ARTICLE INFO

Article History

Received	:	29 Nov 2022
Revised	:	24 Dec 2022
Accepted	:	11 Feb 2023
Available Online	:	15 Feb 2023

Keywords:
Creative Thinking Ability
Arithmetic Sequence
Lesson Study

Please cite this article APA style as:
Prafianti, R. A., Novitasari, N., Albab, M. U., & Novi, D. (2023). Analysis of Student's Creative Thinking Ability on Arithmetic Sequences in the Lesson Study Framework. *Vygotsky: Jurnal Pendidikan Matematika dan Matematika*, 5(1), pp. 55-64.

ABSTRACT

This research aims to determine the creative thinking ability of students in arranging and solving contextual problems on arithmetic sequence. This research is a descriptive quantitative study through a Lesson Study framework with a subject of 18 students of the Mathematics Education study program at the Islamic University of Lamongan. The instruments in this study include attitude assessment sheets used to measure student activity in participating in learning and Student Worksheets used to measure students' creative thinking ability in arranging and solving contextual problems on arithmetic sequences. The results of the analysis show that the average score of student activities during learning is 85.13% while the average score of students' creative thinking ability is 71.875% in the Enough category.

1. Introduction

The development of science and technology today requires the world of education to produce superior human resources and have global competence. Therefore, it takes a generation that has the skills and creative thinking ability. This creative thinking ability can be developed through mathematics. Widia said that mathematics is taught with the aim of forming students into individuals who are able to think creatively in solving contextual problems and as a provision for life in the era of globalization (Widia, Syahrir, & Sarnita, 2020).

Contextual problems are problems that are in accordance with what is experienced by students, according to what is in real life and close to students (Rizki, 2018). Contextual problems teach students to construct certain problems,

E-ISSN: 2656-5846
P-ISSN: 2656-2286

see a problem that is still global and then use real ways to present new situations and solutions to these cases. Contextual problems here do not refer to reality but to something that can be imagined by students. The real world is the real world that is conveyed to students through the application of mathematics (Edo & Tasik, 2019). Through learning mathematics students will get used to solve contextual problems. By getting used to solve contextual problems, students' creative thinking ability can increase.

Creative thinking abilities are abilities that provide new ideas by way of thinking and realizing imagination and providing opportunities for students according to fluency, flexibility, originality, and elaboration (Wahyuni & Kurniawan, 2018). Creative thinking abilities can train students to issue ideas and express themselves in the learning process. Creative thinking abilities have four indicators, namely fluency, flexibility, originality, and elaboration (Putra, Akhdiyat, Setiany, & Andiarani, 2018). In the fluency indicator, students are expected to be able to come up with many ideas and answers in solving problems. In the flexibility indicator, students are expected to be able to produce varied answers. In the originality indicator, students are expected to be able to produce unique answers and be able to think in ways that are not the same as in general. In the elaboration indicator, students are expected to be able to develop an idea by adding or detailing an idea.

One of the causes of the low creative thinking ability of students is allegedly because the learning process tends to be more preoccupied with thinking about how to make all materials immediately given to students (Wasiran & Andinasari, 2019). This method tends not to involve students in learning so that it cannot form creative and independent students. Sutrimo said that the meaning of mathematics lessons related to everyday life is still not fully integrated in the learning process (Sutrimo, Kamid, & Saharudin, 2019). One of the reasons is because the teacher or lecturer pursues the target of teaching materials, so that the creative thinking ability will be difficult to achieve.

The quality of learning can be seen from students' understanding by looking at the results and processes during learning activities. Currently, the application of the learning process is still mostly teacher centered, even though the ideal concept of the current learning process should be student centered active learning (Ayu & Supriadi, 2021). In analyzing students' creative thinking ability in arranging contextual problems, it can be done in various ways, one effective way is by applying Lesson Study For Learning Community so that students are able to arrange contextual problems into solving steps by collaborating with their friends.

Lesson Study for Learning Community is a form of Lesson Study using collaborative learning and the concept of Learning Community. The Lesson Study for Learning Community in question includes plan, do, and see based on collaborative learning which is implemented in an open class manner to create a Learning Community which is expected to be able to strengthen the character values that students must possess (Mustadi, 2018). Lesson Study is a scientific activity for teachers or lecturers who try to develop their theories to develop and share good practices (Saiful, Hobri, & Tohir, 2020). In Lesson Study, lecturers collaborate to study the content and instructional instructions and then discuss them. While the Learning Community is the result of Lesson Study, to increase student learning activities so that they can work together in the form of collaboration and collegiality (Asih, Hobri, & Oktavianingtyas, 2020). Learning

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P-ISSN: 2656-2286

Community is one of the important aspects that must exist in every classroom (Marhamah, Mustafa, & Melvina, 2017). Active teachers will strive to create an effective learning community in learning. The learning community that exists in a class is very influential on student involvement in the learning process, so that it can achieve the learning objectives that have been designed.

Lesson Study is a educator professional development model through learning assessment activities carried out by a group of educators, both teachers and lecturers, in a collaborative and sustainable manner to improve the quality of learning (Rini, 2021). While the Learning Community in its implementation uses a collaborative model, where previous learning has been designed so that each student has the same learning rights. So, it can be concluded that the characteristics of Lesson Study for Learning Community are collaborative learning, a community that cares for each other, and assignments to improve creative thinking ability.

As for one of the material in mathematics which is loaded with the application of contextual problems and the creative thinking ability is the material of arithmetic sequences. Arithmetic sequence material can represent a measurement of the level of student creativity because there are heterogeneous solutions in solving problems in this material (Rambe & Afri, 2020). Arithmetic sequence material is one of the most interesting materials among students because this material can be directly applied to everyday life and is also widely used in statistics. Arithmetic sequence material is also usually used in academic potential tests. Based on the description above, the purpose of this research was to determine students' creative thinking abilities in arranging and solving contextual problems in arithmetic sequence within the Lesson Study framework.

2. Method

This type of research is descriptive quantitative. The subjects of this research were 3rd semester students of the Mathematics Education Study Program, Faculty of Teaching and Education, Lamongan Islamic University. This study uses the Lesson Study procedure which consists of plan, do, and see (Hiçyılmaz & Aykan, 2020). PLAN was carried out before the research activities took place by involving four lecturers from the Mathematics Education Study Program to get input and suggestions regarding designing the lesson design, Worksheets, learning media, and assessment instruments. The second stage, namely DO or implementation, was carried out on Monday, September 26, 2022, involving four lecturers from the Mathematics Education Study Program as observers. The Observers are in charge of observing how the student learning process is, observing interactions between students and students and observing interactions between students and worksheets. The final stage of Lesson Study is SEE or evaluation, at this stage an evaluation of the learning that has been carried out will be carried out. The observer conveys the results of his observations regarding student activities while participating in learning and observations of the implementation of learning designs carried out by model lecturers.

The instruments used in this research were attitude assessment sheets filled in by each observer and worksheets to measure students' creative thinking abilities. Worksheets are given to students at the do or implementation stage. Students are asked to compile and solve contextual problems related to arithmetic sequences. Furthermore, to determine the level of creative thinking ability, an analysis of student answers was carried out. Analysis of student answers was carried out for

E-ISSN: 2656-5846
P-ISSN: 2656-2286

each indicator of creative thinking ability such as fluency, flexibility, elaboration, and originality. Each indicator will be given a score of 0, 1, 2, 3, and 4 according to the following Table 1 assessment guidelines.

Tabel 1 Assessment Guidelines for Creative Thinking Ability

Indicator	Response	Score
Fluency	Do not answer or provide ideas that are not relevant to the problem	0
	Giving an idea that is not relevant to solving the problem	1
	Gives a relevant idea but the answer is still wrong	2
	Gives relevant idea more than one but the answers are still wrong	3
	Provide relevant idea more than one with correct and clear solution	4
Flexibility	Not answering or providing an answer in one way or more but all wrong.	0
	Gives answer in one way with the wrong answer	1
	Gives answer in one way with the correct calculation process and results	2
	Gives answers in more than one way (various) but the answers are wrong because there is an error in the calculation process.	3
	Gives answers in more than one way (various), the calculation process and the results are correct	4
Elaboration	Did not answer or gave the wrong answer	0
	There was an error in the answer and no details were provided	1
	There is an error in the answer but it is accompanied by less detail	2
	There is an error in the answer but it is accompanied by detailed answer	3
	Gives correct and detailed answers	4
Originality	Did not provide an answer or gave the wrong answer	0
	Gives an answer in its own way but can't be understood	1
	Gives answers in their own way with the correct calculation process but not finished	2
	Gives answers in their own way but the results are wrong. There is an error in the calculation process	3
	Gives answers in their own way with the correct calculation process and results.	4

Developed from (Suciati, 2021)

After knowing the total score obtained by each group through Table 1, then to determine the level of creative thinking ability, the researcher compared the total score obtained by each group with the maximum score of creative thinking ability. Mathematically it can be written as follows.

$$CTAL = \frac{S_{fl}+S_{fx}+S_{el}+S_{or}}{S_{maks}} \times 100\% \quad (1)$$

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Description:

CTAL	=	Creative Thinking Ability Level
S_{fl}	=	Score for the fluency indicator
S_{fx}	=	Score for the flexibity indicator
S_{el}	=	Score for the elaboration indicator
S_{or}	=	Score for the originality indicator
S_{maks}	=	Maximum score for each indicator

The achievement of students' creative thinking abilities is calculated in the following categories.

Tabel 2. Creative Thinking Ability Level Category

Intervals (%)	Creative Thinking Ability Level Category
86 -100	Very Creative
76 – 85	Creative
60 – 75	Quite Creative
55- 59	Less Creative
< 54	Not Creative

(Budi & Izzati, 2021)

Indicators of success in this research are the percentage of student activity in participating in learning at least 80% and the level of students' creative thinking ability is in the High category ($76 \leq CTAL \geq 85$).

3. Results and Discussion

Based on the observation related to student activities in learning, the results were presented in Table 3.

Table 3. The Observation Results of the Student Activities

Observed Aspects	Observation result		
	Observer I	Observer II	Observer III
Actively participate in group discussions	22	22	20
Able to find the concept of completion	20	18	20
Skilled in communicating the results of the discussion	22	20	20
Total score	64	60	60
Max Score		**72**	
Average Score		**61,3**	
Percentage		**85,13%**	

Based on the observer's observations, the average student activity during the learning process was 85.13%. Meanwhile, scores of students' creative thinking abilities were shown in Table 4 below.

Tabel 4 Data on Acquired Scores for Creative Thinking Ability Test

Indicators of Creative	Group						Total Score
	I	II	III	IV	V	VI	

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Thinking Ability							
Fluency	1	2	2	1	2	2	10
Flexibity	4	4	4	2	3	3	20
Elaboration	4	3	3	2	4	3	19
Originality	4	3	3	2	4	4	20
Total	13	12	12	7	13	12	69
Scor CTAL	81,25%	75%	75%	43,75%	81,25%	75%	
Result Category CTAL	High	Medium	Medium	Very Low	High	Medium	
Average Score	71,875%						

From Table 4 it was found that the creative thinking abilities of groups I and III in arranging and solving contextual problems of arithmetic sequences were better than the other groups, namely 81.25% (High). The contextual problem of arithmetic sequences composed by group I was not relevant to the problem of arithmetic sequences as shown in Figure 1, but the problem solving done by group I is appropriate using the concept of arithmetic sequences as shown in Figure 2. Among other groups, only group I gave answers in more than one ways accompanied by the correct calculation process and results. In Figure 2, it could be seen that group I gave answers in more than one way. The first way is to use the induction method, namely detailing each term, starting from the 1st term, 2nd term, 3rd term, and so on until you find a pattern and then draw a general conclusion, namely the formula for the nth term. The second method was a proof of the first method to ensure that the formula for the nth term obtained was correct.

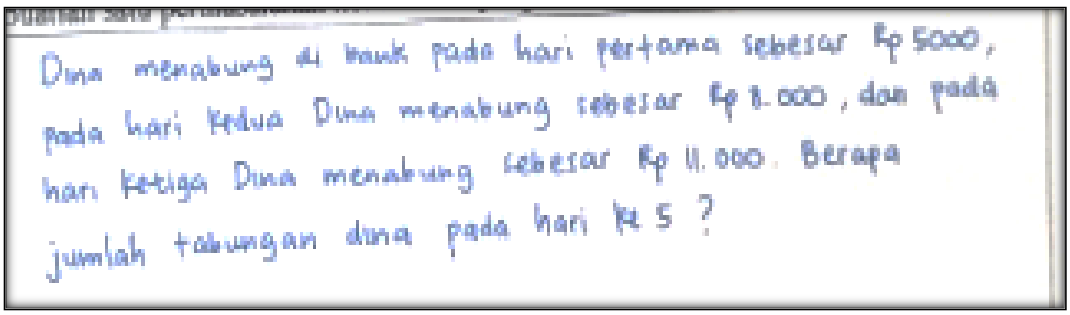
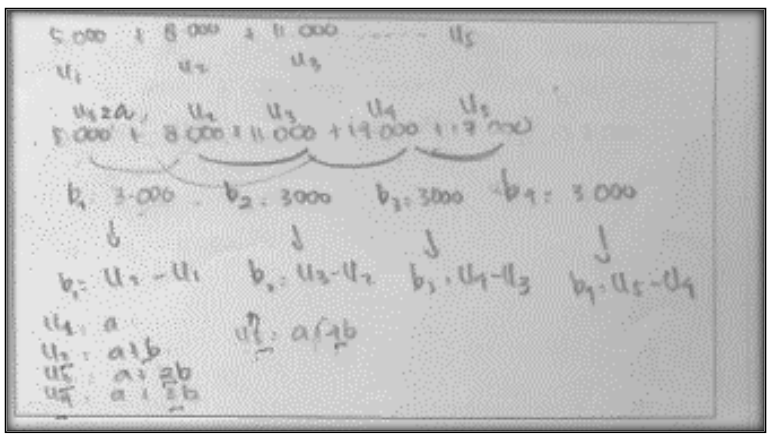


Figure 1. Contextual Problems of Group I Arithmetic Sequences



E-ISSN: 2656-5846
P-ISSN: 2656-2286

Figure 2. Group I Answers

The group with the lowest score was group IV with a score of 43.75% (Very Low). Group IV provides contextual problem ideas that were more relevant for comparison material not for arithmetic sequence material as shown in Figure 3. There are some problems developing students' creativity in learning mathematics, including: 1) limited study time, 2) different abilities of children, 3) students do not understand the material prerequisites, and 4) low reasoning abilities and abilities student mathematics (Wirnoto & Ratnaningsih, 2022).

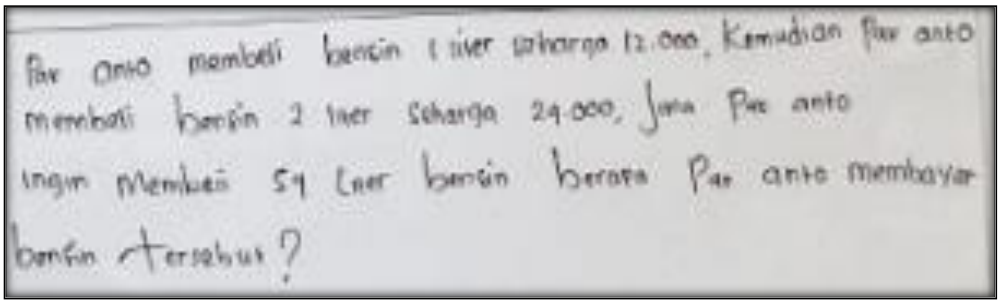


Figure 3. Contextual Problems of Group IV

Group VI got a score of 75% in the Enough category, because in solving the problem there were still errors in the answers accompanied by less detailed details as shown in Figure 4 below.

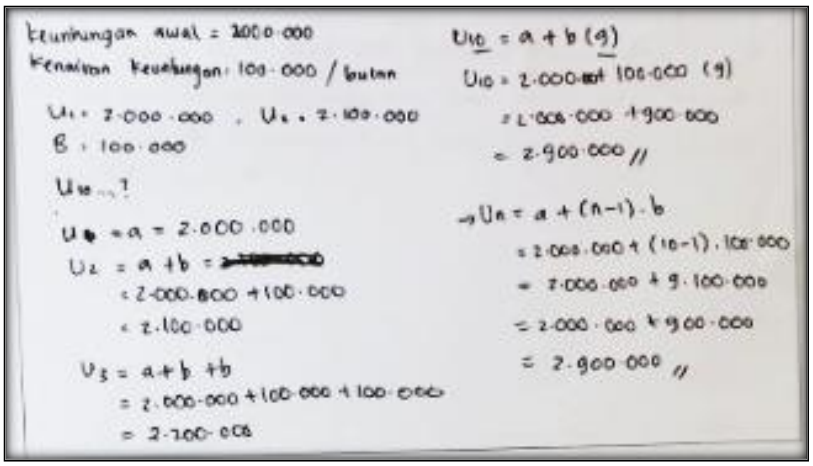


Figure 4. Group VI Answers

Group VI gave less detailed answers, after explaining U_1, U_2, U_3, they immediately switched to U_{10} without explaining the pattern. Viewed based on the indicators of creative thinking ability in Table 4, the percentages for each indicator were obtained as presented in following table.

Table 5 Mean Score of Each Indicator of Creative Thinking Ability

Indicators of Creative Thinking Ability	Percentage (%)
Fluency	41,7%
Flexibity	83,3%
Elaboration	79,17%
Originality	83,3%

E-ISSN: 2656-5846
P-ISSN: 2656-2286

Table 5 shows the indicators of fluency of 41.7%, flexibility of thinking of 83.3%, elaboration of 79.17%, and originality of 83.3%. The following is a comparison of each indicator of students' creative thinking abilities.

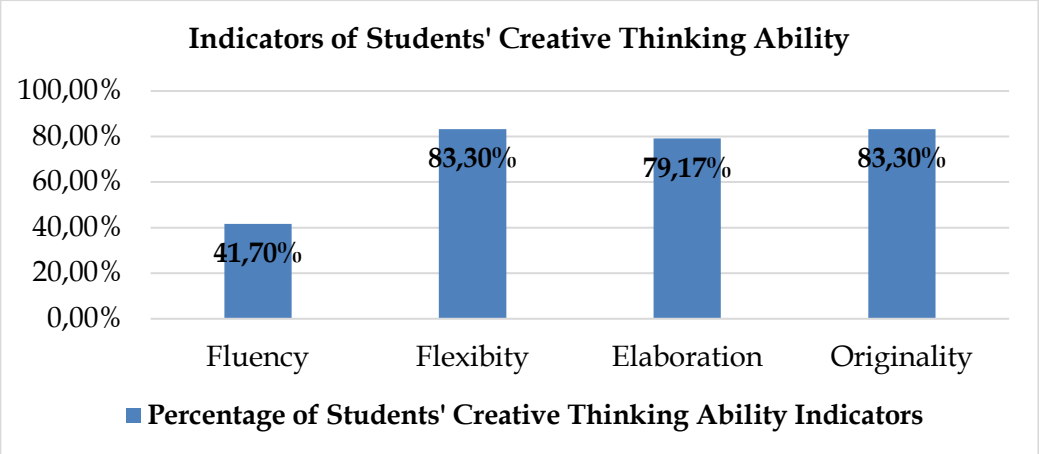


Figure 5. Indicators of Students' Creative Thinking Ability

Figure 5 shows that of the four indicators of the creative thinking ability, the highest percentage was obtained by the flexibity indicator and the originality indicator at 83.3%, the next order is the elaboration indicator at 79.17%, and the last order is the fluency indicator at the lowest 41.70%.

4. Conclusions

Based on the result and discussion, it can be concluded that the student activity score was above the set indicator, namely 85.13%, while the student's creative thinking ability score was still below the set indicator, namely 71.875%. Therefore, students' creative thinking abilities still need to be improved. The results of the reflection (SEE) conducted by the observer showed that there were still a number of students who had not carried out group discussions optimally (they looked passive). The highest indicator of creative thinking ability was fluency (32.14%) while the lowest indicator waxs flexibility and originality (21.43%). Students need to be frequently trained in constructing contextual problems and solving contextual problems so that students as future mathematics teachers can not only solve contextual problems but can also construct contextual problems.

Author Contributions

First author as a lecturer model, compiles instruments and article manuscripts. Second author and third author as observers and analyzes data. Fourth author took documentation of learning videos and pictures.

Acknowledgment

The author would like to thank the Department of Mathematics Education Universitas Islam Lamongan for supporting this research activity so that this research can be completed.

Declaration of Competing Interest

The author declares that there is no conflict of interest in this research.

E-ISSN: *2656-5846*
P-ISSN: *2656-2286*

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