Exploration of the Influence of Learning ELPSA (Experiences, Language, Pictures, Symbols, and Applications) on the Understanding of Mathematical Concepts

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ABSTRACT

The ability of students to understand the concept of learning varies, it is very necessary to know the level of understanding of students' concepts in learning mathematics, so that it becomes a rationale in determining the appropriate learning approach. This study aims to determine the effect learning approach of the ELPSA eighth grade students of SMP Negeri 6 Makassar. The type of research used is experimental research. The design of this research is the One-Group Pretest-Posttest Design. The population in this study were students of class VIII SMP Negeri 6 Makassar in the 2019/2020 academic year and the research sample was determined by the Cluster Random Sampling technique. The instrument in this study was an essay test on understanding mathematical concepts. The data analysis used was descriptive and inferential. The descriptive research results show that there is an increase in understanding of the mathematical concept after the application of the ELPSA learning approach; the score of concept understanding after the application of the ELPSA learning approach met the completeness criteria, namely more than 80; and completeness of students' conceptual understanding after being applied classical ELPSA learning approach is 97% complete. The inferential hypothesis testing results show that the application of the ELPSA learning approach affects the understanding of mathematical concepts in class VIII students of SMP Negeri 6 Makassar.

Keywords: ELPSA Approach; Mathematical Concept Understanding

INTRODUCTION

The development of science and technology which is increasing rapidly has implications for changes in the world of education. The world of education is closely related to students as learners who are the main subjects in education. According to (Umar, et all, 2020) students must be equipped with knowledge, skills, and attitudes that allow them to be independent so that they can make useful contributions to the development of the nation and state. According to Law no. 20 of 2003 that: "Education is a conscious and planned effort to create an atmosphere of learning and the learning process so that students actively develop their potential to have religious spiritual activities, self-control, personality, intelligence, noble character, and skills for themselves, the community, the nation, and country". Education has a very important role in the development of the Indonesian people as a whole. Therefore education needs to be developed from various sciences because quality education can improve the quality of a nation. Education is an important part of the national development process that helps increase a country's economic growth. Education is also an investment in developing human resources in increasing skills and abilities as a supporting factor for human efforts to navigate life. One of the knowledge in education that can develop human thinking is mathematical knowledge. According to (Syahrir & As'ari, 2019) Mathematics is universal

knowledge that underlies the development of modern technology, has an important role in various disciplines, and develops human thinking. Meanwhile, according to (Kaharuddin & Hajeniati, 2020; Zetriuslita, Wahyudin, & Dahlan, 2018) by studying mathematics, students are expected to think logically, analytically, critically, and creatively and are expected to be able to solve all the problems faced, both problems related to lessons. mathematics, as well as those related to everyday life. The 2013 curriculum demands that the learning process of mathematics is directed at learning to find mathematical concepts, learning from real problems by the principles of constructivism learning using a scientific approach (*scientific approach*) where students gain learning experiences through the 6M process (observing, asking, exploring or trying, reasoning or concluding, communicating or networking, and creating or making creative work). In line with one of the general objectives of learning mathematics at level Primary and secondary education according to (Arifin & Aprisal, 2020), namely: understanding mathematical concepts, explaining the relationship between concepts, and applying concepts or algorithms in a flexible, accurate, efficient, and precise way to solve problems.

By the demands of the curriculum, the objectives of learning mathematics, and the facts that occur in school, after the learning process students are expected to understand mathematical concepts so that they can use their abilities in dealing with mathematical problems. According to (Kartika, 2018) in mathematics education, understanding mathematical concepts is an important basis for thinking in solving math problems and real-life problems. So it can be said that understanding the concept is the most important part of learning. This is as stated by (Herawaty, Widada, Nugroho, & Anggoro, 2019; Magfirah et al., 2019; Sadikin & Kaharuddin, 2019) that mathematics subjects emphasize concepts, meaning that in studying mathematics students must understand mathematical concepts first to be able to solve problems and be able to apply the learning in the real world. By understanding a concept students can know, explain, describe, compare, differentiate, classify, give examples and not examples, conclude and re-express an object in its language by being aware of the processes it goes through (Pasnak et al., 2016; Young & Shtulman, 2020). To observe mathematical concepts, students need to read and interpret information, express their thoughts orally and in writing, listen to others, and think critically about ideas and have the ability to solve problems, both problems in mathematics lessons and problems in everyday life. day.

To improve students' ability to understand mathematical concepts, they must be supported by an appropriate learning approach. One learning approach that can improve conceptual understanding is the ELPSA learning approach which contains five components, namely *Experiences, Language, Pictures, Symbols,* and *Applications*. According to

(Kaharuddin, 2013) that the ELPSA *framework* makes an individual develop meaningful mathematical concepts. Meanwhile, according to (Wulandari, 2017), it shows that the component *application* in ELPSA is a learning activity that seeks to understand the significance of the learning process by applying new knowledge in solving problems in a meaningful context. Furthermore, according to (Syahdan, 2017) learning the ELPSA approach (*Experiences, Language, Pictures, Symbols,* and *Applications*) intends to provide free-thinking space for students to seek concepts and problem-solving related to the material taught by teachers at school. Then according to (Lowrie & Patahuddin, 2015) mathematics aims to make students understand mathematical concepts and their relation to everyday life, have the skills to develop knowledge about natural processes around them, be able to apply various mathematical concepts to explain natural phenomena, and be able to use technology. simple to solve problems found in everyday life.

METHODS

This research is experimental research conducted at SMP Negeri 6 Makassar. This research aims to determine the effect of the ELPSA learning approach (*Experiences, Language, Pictures, Symbols,* and *Applications*) on the understanding of mathematics concepts in grade VIII students of SMP Negeri 6 Makassar. The research design used was the *One-Group Pretest-Posttest Design.*

Table 1. Research Design

Group	*Pretest*	*Treatment*	*Posttest*
E	O_1	T	O_2

Source: (Kasiram, 2010)

The population in this study were all class VIII students of SMP Negeri 6 Makassar for the 2019/2020 academic year and then one class was selected as the research sample, namely class VIII who were given treatment using the ELPSA learning approach with the technique *Cluster Random Sampling.* The reason the researcher chose class VIII as the research sample was because class VIII was a transition period from class VII to class IX and class VIII was a period of students who were always curious and wanted to try new things, during which students had to be given skills and understanding of material concepts to move up to class IX.

The instrument used in this study was the learning implementation observation sheet which aims to determine how well the ELPSA learning approach is implemented and the mathematics concept understanding test refers to the basic competencies and indicators of understanding mathematical concepts which aim to measure students' conceptual understanding skills after the application of the ELPSA learning approach. The indicators of learning outcomes in understanding mathematical concepts in this study are a) The average score for the *posttest is*

at least in the high category (x > 80); b) The minimum normalized gain average is in the medium category (g > 0.3); c) classical completeness of more than 80%; d) The percentage of understanding the concept is at least 80%

The data collection technique in this research is the observation sheet of the implementation of the ELPSA learning approach and the test of understanding the concept of mathematics which is given after the application of the ELPSA learning approach to the eighth-grade students of SMP Negeri 6 Makassar.

The analysis technique in this research is using descriptive statistics and inferential statistics. The descriptive statistical analysis aims to determine the understanding of the material by describing the characteristics of the distribution of students' achievement of mathematics understanding through the ELPSA learning approach. Meanwhile, inferential statistics aims to generalize which includes estimation (estimation) and hypothesis testing based on data obtained from scores on *pretest* and *posttest* understanding the concept.

The data obtained from the results of the *pretest* and *posttest* were analyzed to determine the increase in students' mathematical understanding abilities. The amount of increase before and after the application of the learning approach used the normalized gain formula.

The formula to determine the increase in learning outcomes is as follows:

$$g = \frac{S_{pos} - S_{pre}}{S_{Maks} - S_{pre}}$$

Information:

g $\quad$ = *Gainternormalisasi*

Spre $\quad$ = Skor *pretest*

Spos $\quad$ = Skor *posttest*

Smaks $\quad$ = Skor Maksimum

For normalized gain classification can be seen in the following table.

Table 2. Normalized Gain Classification

Gain	Classification
g ≤ 0,3	Low
0,3 < g < 0,7	Medium
g ≥ 0,7	High

Source: (Kaharuddin, 2018)

Criteria used to determine the category of student learning outcomes in this study are presented in the form of a frequency distribution as follows.

Table 3. Classification of Concept Understanding Level

student learning outcomes	classification
$0 \leq x \leq 60$	Very Low
$60 < x \leq 80$	Low
$80 < x \leq 90$	High
$90 < x \leq 100$	Very High

Source: (Puspitasari & Ratu, 2019)

The criteria for a student is said to be complete if the score of concept understanding and problem-solving is more than 80. Meanwhile, classical completeness is achieved when more than 80% of students in the class are complete. To find out the percentage of each indicator of understanding the concept of mathematics, the following formula is used:

$$percentage = \frac{\text{the score for each indicator}}{\text{The ideal score of each indicator}} \times 100\%$$

After that, the calculation of the percentage of the ability to understand the concept as a whole is carried out using the following formula:

$$percentage = \frac{\text{the total score for each indicator}}{\text{The total ideal score of each indicator}} \times 100\%$$

Furthermore, the percentage of students' concept understanding ability is categorized as several levels of understanding using the modified score interpretation criteria by the author.

Table 4. Interpretation Criteria Score Percentage of Concept Understanding

No.	Percentage	Level of Understanding
1	$0\% \leq x < 60\%$	Very Low
2	$60\% \leq x < 80\%$	Low
3	$80\% \leq x < 90\%$	High
4	$90\% \leq x \leq 100\%$	Very High

Source: (Ng, Ting, Lam, & Liu, 2020)

The criteria for assessing the understanding of mathematical concepts are as follows.

Table 5. Conceptual Understanding Scoring Guidelines

Indicator	Information		Score
Restate concept	a.	Answer is blank	0
	b.	Cannot restate the concept	1
	c.	Can restate concept but still many mistakes	2
	d.	Can restate concept but not quite right	
	e.	Be able to restate concepts exactly	3
			4
Provide examples and non-examples of concepts	a.	Answer is blank	0
	b.	Cannot provide examples and non-examples of a concept	1
	c.	Can provide examples and non-examples of a concept but there are still many mistakes	2
	d.	Can provide examples and non-examples of a concept but are not precise	3
	e.	Can provide examples and non-examples of a concept appropriately	4
Classify objects	a.	Answer is blank	0

according to certain properties according to the concept	b. Unable to classify objects according to the concept	1
	c. Can name the properties according to the concept but there are still many mistakes	2
	d. Can mention the properties according to the concept but not quite right	3
	e. Can name the properties according to the concept very precisely	4
Presenting concepts in various forms of mathematical representation	a. Answer is blank	0
	b. Cannot present a concept in various forms of mathematical representation	1
	c. Can present a concept in the form of a mathematical representation but there are still many mistakes	2
	d. Can present a concept in the form of a mathematical representation, but not quite right	3
	e. Can present a concept in various forms of mathematical representation appropriately	4

Source: (Kartika, 2018)

RESULT AND DISCUSSION

Based on the learning implementation plan (RPP) developed by the researcher by considering the objectives of learning and the steps of the ELPSA learning approach applied to grade VIII students of SMP Negeri 6 Makassar. The lesson plan is made 6 meetings based on the number of sub material. The first meeting discussed the material of two-variable linear equations and two-variable system of linear equations, the second discussed the matter of solving a two-variable system of linear equations using the graph method, the third discussed the matter of solving a two-variable system of linear equations with the substitution method, the fourth discussed the matter of solving a system of two linear equations variables with the elimination method, the fifth discusses the material of solving a system of linear two-variable equations with the mixed method (elimination-substitution), and the sixth discusses the material of making mathematical models and their solutions related to contextual problems.

The format of the Learning Implementation Plan (RPP) is adjusted to the 2013 Curriculum format used in SMP Negeri 6 Makassar. Learning Implementation Plan (RPP) is designed by the learning steps ELPSA approach, namely:

No	Teacher	Students
Phase 1: Deliver the purpose of learning and motivate students		
1.	Preparing students to learn and pray together	Prepare to study and pray together led by one of the students
2.	Inform students about the material to be studied, namely the SPLDV concept material (*Experience*)	Listening to / paying attention to the teacher's explanation (*Experience*)
3.	Communicating the learning objectives that will be achieved by each student.	Listening to the learning objectives conveyed by the teacher
4.	Exploring students' initial knowledge by asking questions related to the SPLDV concept (*Language, Pictorial, Symbol*)	Raising hands to answer questions (*Language, Pictorial, Symbol*)
Core Activity		
No	Teacher	Students

	Phase 2: Presenting information to students	
5.	Explaining/providing information as an initial introduction to the SPLDV (*Experience*)	concept material Paying attention to the teacher's explanation of the SPLDV (concept material *experience*)
6.	Provide opportunities for students to ask questions about the material that has been delivered if anything is not clear (*Language, Picture,* and *Symbol*)	Ask about the material to the teacher if anything is not clear (*Language, Picture,* and *Symbol*)
	Phase 3: Organizing students in study groups	
7.	Organizing students into cooperative groups consisting of 4-6 students heterogeneously	Forming groups based on teacher directions
8.	Distribute worksheets to students in each group, as well as direct students to complete the worksheets together	Read/observe the problems presented in the worksheet
	Phase 4: Guiding group work and study	
9.	Guide students to discuss problems in the worksheet with their group friends. (*Language, Picture, Symbol,* and *Application)*	Discussing worksheets with group friends. (*Language, Picture, Symbol,* and *Application*)
10	Monitor the course of group discussions and guide the group if anyone is having difficulties (*Language*)	Ask the teacher if there are difficulties. (*Language*)
	Phase 5: Evaluation	
11	Ask several groups to present their work in turn and ask other groups to review their responses. (*Language, Picture, Symbol,* and *Application)*	Presenting the results of their group discussions or working on problems on the board. (*Language, Picture, Symbol,* and *Application)*
12	Give quizzes to be done independently. (*Language, Picture, Symbol,* and *Application)*	Doing quizzes individually. (*Language, Picture, Symbol,* and *Application)*
	Phase 6: Giving awards	
13	teacher rewards each group with things that can arouse students' enthusiasm and motivation to learn, including praise, applause, or certain items.	Get an award according to the average score achievement of the group
	Final Activity	
14	Guide students to conclude the material that has been studied (*Language, Pictorial, Symbol, Application)*	Conclude the material that has been studied (*Language, Pictorial, Symbol, Application)*
15	Deliver the title of the sub material will be studied at the next meeting	Listening to / paying attention to the explanation from the teacher
16	Giving homework to students	Following the teacher's instructions
17	Closing the lesson	Praying before going home

The results of the analysis show that the implementation of learning with the application of the ELPSA learning approach at the first meeting is 3.37 in the very well implemented category, the second meeting has obtained an average of 3.58 is in the very well executed category, the third meeting has obtained an average of 3, 68 were in the very well executed category, the fourth meeting has obtained an average of 3.63 was in the very well executed category, the fifth meeting has obtained an average of 3.63 was in the very well executed category, and the sixth meeting was obtained on average an average of 3.68 is in the very well performed category. Based on this description, it can be concluded that in the learning process by applying the ELPSA learning approach the teacher's ability to manage learning for 6 meetings was carried out very well.

Furthermore, the learning outcomes of students' understanding of mathematical concepts after applying the ELPSA learning approach to class VIII students of SMP Negeri 6 Makassar.

Table 6. Recapitulation of Student Concept Understanding Learning Outcomes
Class VIII.9 SMP Negeri 6 Makassar

Statistik	Pretest_PK	Posttest_PK
Sample	33	33
Mean	40.9697	91.3333
Med	40.0000	92.0000
Mod	25.00[a]	95.00
Deviation Standart	11.88614	5.59948
Variance	141.280	31.354
Skewness	0.223	-0.318
Ranges	35.00	20.00
Max	25.00	80.00
Min	60.00	100.00

Based on the table above, it can be seen that the mean *posttest* understanding of students' concepts is 91.33. This shows that in general, the scores *posttest* are in the very high category, thus there is an increase in the mean value of students from *pretest* to *posttest* (from very low to very high categories). The median score of the *posttest* students was 92.00 indicating that there were about 50% of the students who obtained the highest score of 92.00 or the lowest score of 92.00. The mode score of 95.00 indicates that the *post-test* understanding of the concept of students with the greatest frequency is 95.00. Based on the slope coefficient of -0.31 and paying attention to the mean, median and mode values, it can be said that in general the results of the *posttest* students' understanding of the concept are above the average with a very high category.

Table 7. Classification of Normalized Gain Understanding Student Concepts

Class VIII.9 SMP Negeri 6 Makassar

Gain	Classification	Student	Percentace(%)
g ≥ 0,7	Tinggi	32	97
0,3 < g < 0,7	Sedang	1	3
g ≤ 0,3	Rendah	0	0
Jumlah		33	100

From the table, it can be seen that 32 students are in the high category with a percentage of 97% and 1 student is in the medium category with a percentage of 3%. None of the students scored in the low category. This indicates that the students' conceptual understanding increases after the ELPSA learning approaches are applied in class VIII.9 SMP Negeri 6 Makassar is in the high category with a percentage of 97%. Based on the description above, it can be concluded that descriptively the increase in students' understanding of concepts after implementing the

ELPSA learning approach the material of the two-variable linear equation system in class VIII.9 SMP Negeri 6 Makassar is in the high category with a percentage of 97%.

Table 8. Percentage of Student Concept Understanding scores per indicator

No.	Indicators	Percentage (%)	Classification
1	Restate concept.	93.43	Very High
2	Provide examples and non-concept examples.	92,93	Very High
3	Classify objects according to certain properties.	91,08	Very High
4	Presenting concepts in various forms of mathematical representation.	89,20	High
	Mean	91,66	Very High

Based on the table, the data analysis that has been done shows that the score of students who can restate a concept well reaches 93.43% in the category Very high, the score of students who can provide examples and non-examples of the concept well reaches 92.93% with the category. Very high, the score of students who can classify objects according to certain properties according to the concept well reaches 91.08% with the category Very high, and the score of students who can present concepts in various forms of mathematical representation reaches 89.20% with category High. So it can be concluded that descriptively the students' ability to understand mathematical concepts in the material of the two-variable linear equation system for class VIII.9 SMP Negeri 6 Makassar is categorized as very high with the overall percentage of each indicator of concept understanding reaching 91.66%.

Based on the research results it has been described that the results of students' understanding of mathematical concepts after applying the ELPSA learning approach are increasing. The increase in students' understanding of mathematical concepts is the effect of the application of the ELPSA learning approach. So, in this discussion, the effect of the components of the ELPSA learning approach on each indicator of conceptual understanding is described. The ELPSA approach which includes *experiences, language, pictures, symbols, and application* affects every indicator of concept understanding, namely:

a) *Experiences* (E)

Experiences are learning activities that explain or bring up previous experiences that students have and relate them to new knowledge and experiences or information that will be obtained or learned. At this stage, students can restate a simple concept based on experience and knowledge that has been studied or experienced contextually, namely: being able to name the object, model, or shape of the object related to the subject matter of the two-variable linear equation system. However, at this stage, it is still weak in terms of students' ability to provide

examples and not examples of a concept, classify objects according to certain properties, and present concepts in various forms of mathematical representations.

According to (Arifin & Aprisal, 2020; Baharun, 2018) experiences include how students have used mathematics so far, what concepts they know, how they can obtain information, and how mathematics has been experienced by students both inside and outside the classroom. Knowledge is awakened when students try to organize their experiences according to their cognitive structures.

b) *Language* (L)

Language (language development) is a learning activity that actively develops certain mathematical languages so that the learners interpret them. It is important for teachers to model correct language and students need to be encouraged to use clear language in describing their understanding to the teacher and their peers. At this stage students can restate a concept and mention examples and not examples of a concept, namely: when the teacher delivers or explains the material and mentions parables or examples in clear language and is easily understood by students, therefore students can restate a concept and citing examples and not examples of two-variable linear equation systems in their language using clear language in describing their understanding to the teacher and their peers.

According to (Herawaty et al., 2019) language is used to encourage understanding. In mathematics, the language of mathematics can be general or specific and is needed to present mathematical ideas. It can happen that students do not understand a mathematical concept not because the concept is too difficult for them but because the teacher who presents it uses words or sentences that the students cannot understand.

c) *Pictures* (P)

Pictures (image representations) are learning activities that provide experiences about mathematical concepts in the form of pictures. At this stage, students can restate a concept, be able to provide examples and non-examples, be able to classify objects according to certain properties and be able to present concepts in various forms of mathematical representations of two-variable linear equation systems based on pictures, graphs, diagrams, tables, and so forth.

According to (Baron, 2019) that visualization is important in mathematical thinking that can be realized in the form of shadow*(image)*image on the paper or the display of technology. Image representation (component "P" of ELPSA) can be used to stimulate students to think mathematically, namely what kind of image or visualization is more effective in helping

students understand mathematics which can be a stepping stone for students to arrive at the "S" component of ELPSA.

d) *Symbols* (S)

Symbols (symbol representation) are learning activities that can change or make the transition from image representation to symbol representation. Mathematical concepts contain many symbols, either formulas or abstract statements. At this stage, students can restate a concept, be able to provide examples and non-examples, be able to classify objects according to certain properties, and be able to present concepts in various forms of mathematical representations of two-variable linear equation systems based on symbols which are transitions from image representations.

According to (Wulandari, 2017; Young & Shtulman, 2020) asserts that symbols in ELPSA are a more general experience and are the result of generalizations. A series of symbols in mathematics can take the form of a mathematical model. Symbols in mathematics can deliver students' knowledge to find solutions and apply formulas in solving math problems.

e) *Application* (I)

Application (application of knowledge) is a learning activity that seeks to understand the significance of the learning process by applying new knowledge in solving problems in a meaningful context. At this stage, students can restate a concept, be able to provide examples and non-examples, be able to classify objects according to certain properties, and be able to present concepts in various forms of mathematical representations of two-variable linear equation systems based on knowledge obtained from all components or steps. -the learning steps of the ELPSA approach, namely, *experiences, language, pictures, symbols, and application.*

According to (Lowrie & Jorgensen, 2011) that the application stage describes how the knowledge and understanding of concepts that have been obtained can be applied in various situations. Thus, in the application component students use the ability to understand concepts in solving a problem.

In general, it can be said that the application of the ELPSA learning approach is an active process in which students build their ways and understand things through independent processes and interact socially with other students, and can construct their ways of understanding things through individual thought processes and social interactions. In ELPSA learning, students learn more systematically and are oriented towards finding concepts from their knowledge experience and can involve students' activeness directly in constructing their

knowledge in the process of understanding mathematical concepts, as well as providing free space for students to think about concepts and solving related problems. with the material taught by the teacher at school.

CONCLUSION

This study concludes that the application of the ELPSA learning approach can improve the understanding of the concept of the material of the two-variable linear equation system in class VIII students of SMP Negeri 6 Makassar. ELPSA learning which includes experiences, language, pictures, symbols, and application affects every indicator of concept understanding, namely indicator I (93.43%) students can restate a concept in the experiences and language stages, indicator II (92.93%) able to provide examples and non-examples in a concept at the language and pictures stage, indicator III (91.08%) students can classify objects according to certain characteristics according to the concept at the pictures and symbols stage, indicator IV (89,20%) students can present the concept in various forms of mathematical representation at the symbols and application stages.

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