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How to Design Student Worksheet Based ELPSA Model to Improve Understanding of Mathematics Concepts?

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ABSTRACT

Understanding of mathematics concept is the most important resolution in learning where students not only memorize the material but can understand and apply it in their daily lives. The ELPSA learning model can improve students' understanding of concepts through learning experiences, developing communication, presenting images in the form of visualizations, symbolizing in general terms, and as the application of the knowledge that has been obtained (application). This study aims to produce a product in the form of an ELPSA-based Student Worksheet that meets the criteria of being valid, practical, effective and has the potential to improve students' conceptual understanding. The method of this research is a 4D development model which is modified into 3D (Define, Design, and Develop). data collection instruments consist of observations, questionnaires and tests. This research produces valid, practical and effective student worksheets that can improve students' understanding of mathematical concepts. The results of this study indicate that the student worksheets are valid with good criteria. The student response questionnaire are 85.6% so it can be concluded that the student worksheets used are practical and can be used in learning. The effectiveness of obtaining a posttest average value of 87.06 with a percentage of 92.5% of students declared complete in learning. Student worksheets are said to be effective if student learning outcomes are declared complete. Mastery learning classically is said to be effective if it has reached 75% of the total number of students. Finally, student worksheets can improve students' understanding of mathematical concepts seen from the pretest and posttest questions that have been given. Student worksheets that have been applied can be a contribution for teachers to improve students' mathematical understanding in learning.

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A. INTRODUCTION

Activities to increase knowledge, improve skills, self-quality and students' mindsets are the goals of learning (Bardach & Klassen, 2020). Mathematics lessons are part of students' knowledge to have the ability to understand concepts, reasoning, and apply concepts or algorithms in a flexible, accurate, efficient, and precise way in problem solving (Bakry & Bin Bakar, 2015; Simamora et al., 2018). The implementation of mathematics learning in the classroom can be carried out properly if it is supported by facilities, media and learning resources that are in accordance with the needs of students. One of the learning resources that can be developed is student worksheets. Student worksheets designed according to the needs of students can provide opportunities to develop their creativity (Hariyanto et al., 2021).

MTs AL-Munawwaroh is a school where students live in dormitories, and the teachers can design learning without using technology. Learning carried out at MTs AL-Munawwaroh still uses textbooks from publishers which makes learning less interesting and effective. Student worksheets should be designed as attractive as possible and arranged systematically in order to help students be more active in learning both independently and in groups (Kontorovich, 2018; Marks & Fraley, 2013).

Student worksheets are designed to help students integrate concepts, understanding, and implement learning materials creatively according to their own thinking (Turyanto et al., 2019). Student worksheets are prepared according to student abilities and can support learning in the classroom. Student worksheets prepared with the ELPSA model can improve students' conceptual understanding through learning experiences, developing communication, presenting images in the form of visualizations, symbolizing in general terms (symbols), and as the application of knowledge that has been obtained (application) (Wijaya, 2014).

The ELPSA model student worksheet can help students to understand the learning material well. This can be seen from how students explain again using their own language, are able to distinguish examples, present concepts, and apply them in solving problems and are able to make the learning process active (Arifin, 2015; Gasco et al., 2014). An active learning process using the ELPSA framework will provide more effective results for the achievement of improving learning outcomes, achievements, and understanding students' concepts in achieving learning goals (Boels et al., 2019; Fajar et al., 2019; Supiyati & Sanapiah, 2017).

Based on data from the Education Assessment Center of the Ministry of Education and Culture, the average score for the math UNBK for the last three years for the MTs level in Merauke district is in 2017 = 50.36, in 2018 = 41.16 and in 2019 = 42.24, while for the distribution of values from Puspendik at the lowest value interval is n 55 (Puspendik, n.d.). These data indicate that the average mathematics score of MTs students in Merauke district is still low. The low mathematics average value of students also occurs at MTs Al-Munawwaroh, based on Puspendik data (2019), the average math score at MTs Al-Munawwaroh for the last three years is in 2017 = 51.12, in 2018 = 43.49 and year 2019 = 50.19 which includes material on numbers, algebra, geometry and measurement, as well as statistics and probability.

The four materials, the average UNBK score for students is the lowest, namely in geometry and measurement materials (flat shape and spatial shape). This can be seen from data (2019) for the last three years which continues to experience a decline in geometry and measurement material every year, namely in 2017 = 48, 57, 2018 = 41, 40, and 2019 = 37.80. The data is strengthened by the results of interviews with mathematics teachers, that there are still many students whose scores are below the Minimum Completeness Criteria (KKM) with an average daily test score of 65 students while the provision for the KKM score is 69. One of the causes for the incomplete math scores is due to the lack of understanding of students in understanding mathematical concepts given by the teacher, especially on geometry and measurement material. This is in line with the results of interviews with students that they have difficulty understanding geometry material due to lack of feedback between teachers and students during the learning process, less creative in managing learning in the classroom and less interactive teaching materials.

Understanding the concept is the most important goal in learning. The ability to understand mathematical concepts shows that the learning materials taught to students are not only memorised, but also to understand the concepts of subject matter so that they can be applied in life. Therefore, students must have a good basic understanding of concepts in learning mathematics so that students can understand and understand the subject matter given (Fajar et al., 2019). Students are said to be able to understand the subject matter if they can connect concepts with each other, because every mathematical concept is interrelated and can be used in solving problems ranging from simple to more complex problems (Citra, S. Y., Mustamin & Kadir, 2018). Building an understanding of concepts in every math learning activity will help increase the knowledge possessed by students to a higher stage (Fajar et al., 2019).

From research conducted by Aulia, (2020) understanding of concepts can be improved through constructivism-based learning tools so that students have the ability to find, understand, and use the information or knowledge being studied. Understanding Concept is the main focus in learning mathematics, in this study, constructivism-based student worksheets were able to improve students' conceptual understanding. This study aims to understand the concept of learning tools that use a constructivist approach so that researchers want to develop learning tools using the ELPSA model. Wikasari, A., I Made & I Gusti (2020) conducted experimental research to improve students' understanding of mathematical concepts by using the ELPSA learning model. From his research,

It is known that the understanding of students' mathematical concepts who are taught using the ELPSA learning model is higher than the conventional learning model that is usually done. The ELPSA model can have a positive influence on students' understanding of concepts so that it is feasible to be developed. Research conducted by (Arifin, 2015) using the ELPSA model with the help of geoboard props on rectangular flat shapes shows that the ELPSA model is very efficient for use in schools. In this study, it only focuses on the activities and learning outcomes of students, so there has not been an increase in the understanding of the students' concepts under study. In this case, the researcher wants to develop student worksheets to improve understanding of mathematical concepts. In a study conducted by (Supiyati & Sanapiah, 2017) which aimed to improve mathematical literacy through the ELPSA (Experience, Language, Picture, Symbol, and Application) learning model, the use of the ELPSA model was considered very effective. Puprose of this research has not shown developing students' conceptual understanding for further research because it only focuses on increasing mathematical literacy. Thus, a teaching material using the ELPSA model is needed which can improve students' understanding of concepts. Therefore, researchers are interested in developing the ELPSA model of student worksheets in improving students' understanding of mathematical concepts

B. METHODS

The method of this research are R&D (Research and Development) development model using a 4D model (Define, Design, Develop, Disseminate). The researcher used the stages of the Student Worksheet development research model developed by Thiagarajan, namely the 4D research model, but this researcher was carried out until the develop stage. The development carried out in 3D stages, namely (Define, Design, Develop) on the student worksheet, was

carried out in several stages which were adapted to the 4D development research model (Sutarti, 2017), namely first define. This definition stage is used to set learning boundaries. In the define stage, the researcher makes observations to schools to determine the limits of development starting from curriculum analysis, student character analysis, to material analysis. Material analysis was conducted to find out and analyze the basic competencies, core competencies, and indicators used in MTs Al-Munawwaroh.

Character Analysis of Students is carried out to see the age, background and cognitive abilities of students. Analysis of the material used in the student worksheets to be developed must be in accordance with the syllabus used at MTs Al-Munawwaroh. The learning materials contained in the Student Worksheets are also formulated based on the results of curriculum analysis and student character analysis and must be adapted to the Student Worksheets that will be developed, namely the ELPSA Student Worksheet model. The second stage was design, the aims to prepare the initial product development. At this stage, the researcher begins to design the initial product according to the results of the previous analysis, starting from the cover of the Student Worksheet, learning materials, assessment, preparing pretest-posttest, to strengthening the framework as a reference in development before being tested on target users.

The third stage is develop. This stage is carried out to produce a revised development product based on input from experts. At this stage, the researcher will validate the Student Worksheet product. After the product is declared valid, then the next step the product will be tested to students. The data resulting from the Student Worksheet assessment will be analyzed for validity and practicality to obtain a quality product assessment. If the quality has met the assessment standards, then the development product can be piloted to a wider target audience. If the product does not meet the assessment standards, the product being tested will be revised again and prepare a new product. The following describes the research flow chart, as shown in Figure 1.

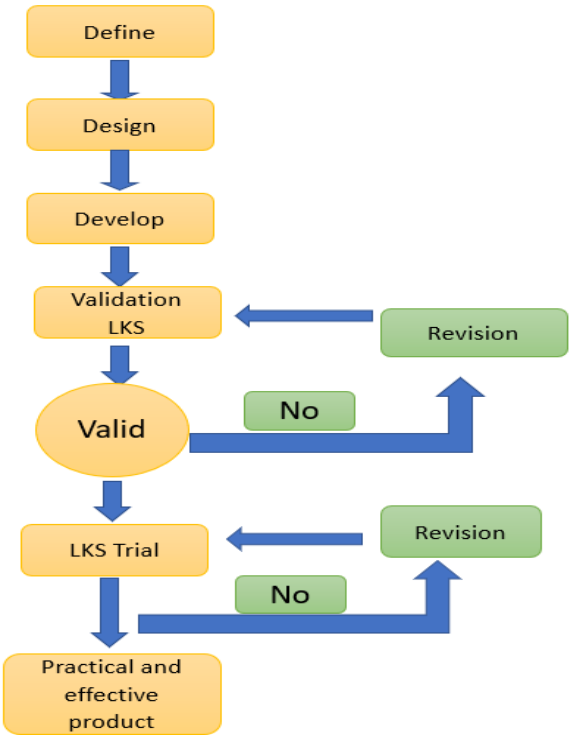

Figure 1. Research Flowchart

Data Collection Instruments was a tool used by researchers to collect research data. The instruments that researchers use are: Student and Teacher Response Questionnaire and validation sheet. The use of the questionnaire aims to obtain data on the opinions of students and teachers after using the student worksheets to measure the practicality aspect by giving written questions to students and teachers. Validation sheets are used to measure the validity of student worksheets, lesson plans, as well as pre-test and post-test which are reviewed from the aspects of the feasibility of content, presentation, and language.

Data collection technique in this study was observation and test. Observations are used to define learning problems in MTs Al-Munawwaroh, starting from curriculum analysis, character analysis of students, to material analysis. The pre-test and post-test sheets were used to measure the increase in students' conceptual understanding as a comparison of the results of increasing student learning before and after using the product. Pre-test and post-test sheets are given to students before and after using the student worksheets.

Data Analysis Techniques of this study is validity analysis, practical analysis and Effectiveness analysis. Validity was obtained from the results of the assessment of 4 validators, namely 2 lecturers and 2 mathematics teachers. The Student Worksheet is said to be valid if the validation results are declared feasible to be tested in the field by the four validators through a statement on the validation sheet. Practicality Student worksheets are determined from the results of the teacher and student response questionnaire assessments which are analyzed by classifying statement points according to the part seen from the results of the student response questionnaires.

The learning device "ELPSA model student worksheet" is said to be practical if the percentage value obtained was ≥80. The effectiveness of student worksheets is assessed from student learning outcomes. Learning outcomes are measured based on the achievement of cognitive learning objectives on the results of students' answers when working on the pre-test and post-test given. Student worksheets are said to be effective if student learning outcomes have been declared complete. Mastery learning classically is said to be effective if it has reached 75% of the total number of students. This study aims to design a valid, practical, and effective ELPSA model Student Worksheet.

C. RESULT AND DISCUSSION

1. Result

Research and development carried out is the ELPSA Student Worksheet. The research model used by the researcher is the model developed by Thiagarajan, namely the 4D research model, but the researcher only does it until the develop stage, which means that it reaches the 3D stage. The results of these stages are described as follows

a. Define

Based on the results of observations made by researchers, it is known that the curriculum used at MTs Al-Munawwarah is the curriculum, the core competencies in this study are KI 3 and KI 4, namely; KI 3: Understand and apply factual, conceptual, procedural, and metacognitive knowledge at simple technical and specific levels based on their curiosity about science, technology, art, culture with human, national, and state insights related to visible phenomena and events; KI 4: Demonstrate creative, productive, critical,

independent, collaborative, and communicative reasoning, processing, and presenting skills, in the concrete and abstract realms in accordance with those learned in school and other sources that are the same from a theoretical point of view.

This analysis was conducted to see the age, character, and cognitive abilities of the seventh grade students of MTs Al-Munawwaroh as research subjects. Based on the results of the analysis, it was found that the average age of students in class VII MTs Al-Munawwaroh is 13 years with the character of students who are still less active in working in groups and are individualistic, indifferent, and lack self-confidence. Based on cognitive abilities, some students still have difficulty understanding the subject matter so that it becomes one of the causes of incomplete math scores as expected.

The material used in the student worksheet developed was formulated based on the results of the previous analysis on the lowest UNBK scores of MTs Al-Munawwaroh students in the last three years, namely on geometry and measurement material (flat shape and space), and in accordance with the syllabus. Used at MTs Al-Munawwaroh. Therefore, the material used by the researcher is triangle material because one of the basic concepts of geometry and measurement is a triangle whose application is used in similarity materials, Pythagorean theorem, trigonometry and others so that mastery of triangle material needs to be mastered by students as the basis for the following materials.

b. Design

The selection of media and formats is adjusted to the learning objectives to be achieved. The learning objectives in this study are that after participating in a series of learning activities, students are expected to be able to recognize and understand triangles, find types of triangles, solve problems related to triangles, determine the perimeter and area of triangles, and solve contextual problems related to triangles so that the media used by the researcher, namely the Student Worksheet, while the format of the Student Worksheet is adjusted to the learning model used, namely the ELPSA model component.

The researcher began to design the initial product according to the results of the previous analysis, starting from the design of the Learning Implementation Plan, student worksheets, pre-test post-test sheets to teacher and student response questionnaires. The identity structure contained in the lesson plans includes: name of school, subject, class, semester, subject matter, time allocation, core competence, basic competence, indicators of competency achievement, learning objectives, character education, learning materials, learning models and media, learning resources, as well as the steps of learning activities. Based on the previous design that had been prepared, the researchers made lesson plans for two meetings. The design of learning materials as shown in Table 2.

Table 2. Learning Material

Meeting	Learning Material
1	Definition of Triangle
	Types and properties of triangles
2	Perimeter and area of triangle
	Special lines on triangles

Learning activities are grouped into three activities, namely: preliminary activities, core activities, and closing activities. Preliminary activities include: orientation, apperception (experience), and motivation. While the core learning activities follow the stages of the ELPSA model, namely language, picture, symbol and application, and in the closing activity students are asked to conclude the learning material that has been studied.

The cover page is composed of the title of the student worksheet, the background of the student worksheet, the name of the author, the learning material, the name of the group, class, agency, semester, and learning model. The purpose of compiling a table of contents is to assist readers in obtaining the expected reading content, so that the table of contents is designed with the contents of the content title and page numbers. The introduction to the ELPSA Model Student Worksheet is intended so that students are more familiar with the product of the Student Worksheet that will be implemented during the learning process. The learning activity materials are designed and adapted to the components of the ELPSA model student worksheet. The use of the questionnaire aims to obtain data on the opinions of students and teachers after using the student worksheets to measure practicality aspects through the provision of written statements for students and teachers. The researcher designed a student response questionnaire with 20 statements that were filled out after the students used the developed student worksheet, while the teacher assessment questionnaire gave 14 statements. The pre-test and post-test sheets were used to measure the increase in students' conceptual understanding as a comparison of the results of increasing student learning before and after using the product. Pre-test sheets are given to students before using the Student Worksheets and post-test sheets are given after students use the Student Worksheets.

c. Develop

The product of the student worksheet that has been developed in the form of draft 1 will be validated first by four validators, namely two mathematics education lecturers and two mathematics teachers. The validated draft is called draft 2. The 2nd draft was tested on students on a limited scale. After the students did a trial using draft 2, the researcher gave a student response questionnaire for the practicality assessment. The results of the trial draft 2 were further developed and obtained the following development results.

Learning Implementation Plan (RPP) developed using RPP research systematics that contain school identity, subjects, core competencies, basic competencies, indicators, character education, learning materials, models and learning media, learning resources, learning activities (preliminary activities, core activities, and closing activities), question grids, and rating rubrics. RPP developed previously received a revision of the validator. Here are the results of the revision of the RPP of the validator

2. Discussion

The ELPSA Student Worksheet is designed for class VII MTs Al-Munawwaroh in two meetings. The research model for the development of this student worksheet uses research developed by Thiagarajan, namely the 4D model, but the researcher only does it until the develop stage, which means that it reaches the 3D step (define, design, develop). At the define

stage, it is known that the curriculum used at MTs Al- Munawwaroh is the K13 curriculum, while the core competencies used are KI 3 and KI 4.

The average age of students in class VII MTs Al- Munawwaroh is 13 years with characters who are still less active in working in groups and are individualistic, indifferent, and lack self-confidence. Based on the cognitive abilities of students, there are still many who have difficulty understanding the subject matter so that it becomes one of the causes of not completing the mathematics scores as expected. The material used by researchers in this study is triangle material because one of the basic concepts of geometry and measurement is a triangle whose application is used in similarity materials, Pythagorean theorem, trigonometry and others so that mastery of triangle material needs to be mastered by students as the basis for these materials. The next step is so that at the design stage, the researcher designs a learning device in the form of a Student Worksheet, while for the format of the Student Worksheet it is adjusted to the learning model used, namely the ELPSA model component. Researchers began to design the initial product according to the results of the previous analysis, starting from the design of lesson plans, student worksheets, pretest-posttest sheets to teacher and student response questionnaires. At the develop stage, the previously developed product was validated by 4 validators, namely 2 lecturers of mathematics education at Universitas Musamus and 2 mathematics teachers at MTs Al-Munawwaroh Merauke.

During the validation process, the researcher revised three times for each validator. After the student worksheets are declared suitable for use, the student worksheets are ready to be tested to see the practicality and effectiveness of the products developed. Furthermore, the researchers tested the student worksheets on the seventh grade students of MTs Al-Munawwaroh. The percentage results of the overall student response questionnaire are 85.6% so it can be concluded that the student worksheets used are practical and can be used in learning, this is in accordance with Santi & Rusgianto (2016) which says that the learning tools of student worksheets said to be practical if the percentage value obtained.

Students' learning mastery can be seen from the use of the posttest whose value is above the KKM with the KKM value and the percentage of completeness is 92.5%. The understanding of students' concepts has also increased, this can be seen when applying the material that has been obtained, namely by looking at the answers to the students' pretest-posttest, practicing questions or presenting the material that has been studied. A total of 37 out of 40 students have completed their studies with an average score of 87.06.

The following are the answers of students in restating a concept, classifying objects according to certain properties according to the concept, giving examples and not examples of a concept, presenting concepts in various forms of mathematical representation, and developing necessary or sufficient conditions of a concept on pretest-posttest questions, as shown in Figure 2.

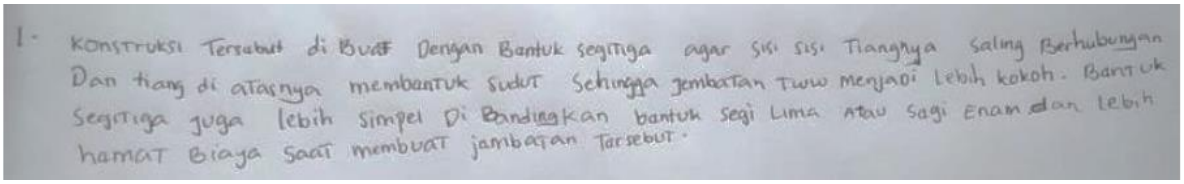
1. Konstruksi tersebut di buat dengan bentuk segitiga agar sisi sisi tiangnya saling berhubungan dan tiang di atasnya membentuk sudut sehingga jembatan tsuu menjadi lebih kokoh. Bentuk segitiga juga lebih simpel di bandingkan bentuk segi lima atau sagi enam dan lebih hamat biaya saat membuat jambatan tersebut.

Figure 2. Restatement of a Concept

Based on Figure 2 above, the answers given by students have been able to restate a concept based on their own understanding, as shown in Figure 3.

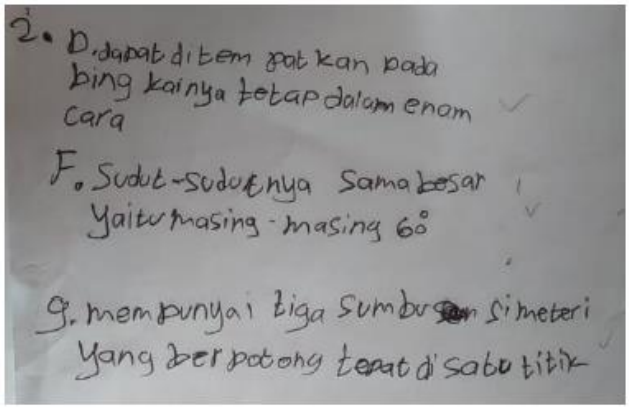

Figure 3. Grouping Objects According to Their Properties

Based on Figure 3, students can group objects according to their properties and can distinguish which ones are isosceles triangles and which ones are not, as shown in Figure 4.

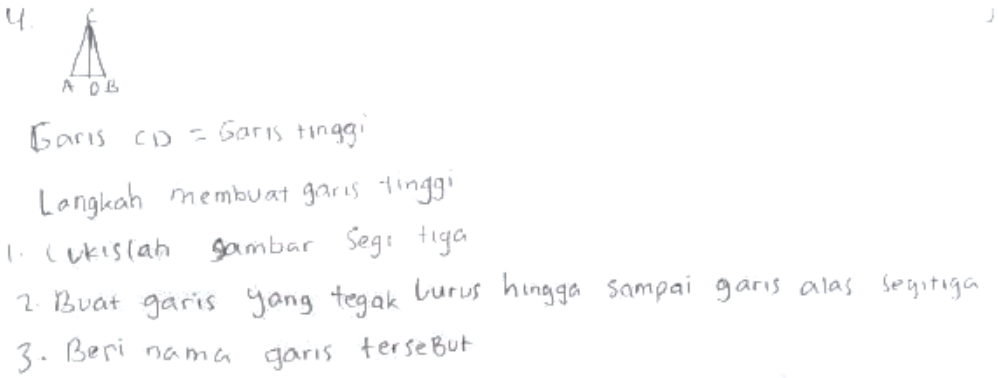

Figure 4. Giving an example and not an example of a concept

Based on Figure 4, students can provide examples and not examples through answers to question number 4. As shown in Figure 5.

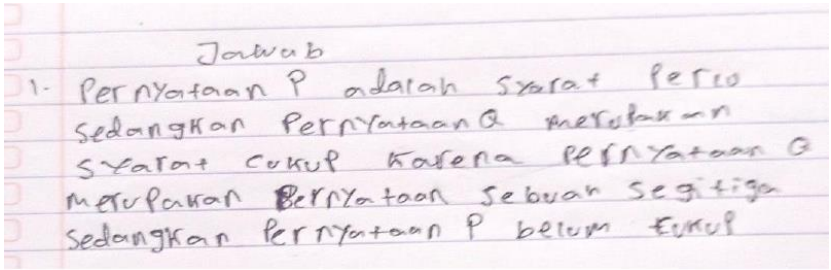

Figure 5. Developing Necessary or Sufficient Conditions for a Concept

Based on the Figure 5, students have answered the questions by fulfilling the necessary and sufficient requirements of a concept. The results of the effectiveness of obtaining a posttest

average value of 87.06 with a percentage of 92.5% of students declared complete in learning. Student worksheets are said to be effective if student learning outcomes are declared complete. Mastery learning classically is said to be effective if it has reached 75% of the total number of students. In line with research conducted by (Minarni et al., 2016) which showed student learning outcomes increased from initial learning completeness by 51% increasing to 86%. All aspects of student activity have increased after using the student worksheets, both visual, listening, drawing, writing, mental, and emotional activities. This is also in accordance with research conducted by (Hanum, 2009) which got an average percentage of 76.875% and was categorized as high.

The results of this study are also in line with the results of research conducted by Supiyati & Sanapiah (2017) who obtained the results of the student's concept understanding test showing that 82% of students' scores had reached and exceeded the KKM, which means that ELPSA-framed learning was effectively used in schools. Research conducted by (Septiana et al., 2021) in an article entitled "Development of Cooperative Model Mathematics Learning Devices with a Combination of ELPSA and Scientific Approaches". The results of the trial of the learning device showed that 29 out of 35 students or 82.85% met individual mastery which indicated that classical mastery was achieved. From the results of this study, it can be concluded that the learning tools developed have met the valid, practical, and effective requirements.

D. CONCLUSION AND SUGGESTIONS

The product developed is in the form of an ELPSA model student worksheet whose learning steps follow 5 stages of the ELPSA model component, namely experience, language, picture, symbol, and application and have met valid, practical, and effective aspects. The product validation was revised three times by the four experts which were subsequently declared valid and suitable for use in learning. The percentage results of the overall student response questionnaire are 85.6% so it can be concluded that the student worksheets used are practical and can be used in learning. The results of the effectiveness of obtaining a posttest average value of 87.06 with a percentage of 92.5% of students declared complete in learning. Student worksheets are said to be effective if student learning outcomes are declared complete. Mastery learning classically is said to be effective if it has reached 75% of the total number of students. The ELPSA model can be said to be valid, practical, and effectively used in triangle learning. Students' understanding of the triangle concept has increased after students use the ELPSA model student worksheet, namely 37 of 40 students have completed learning with a mastery percentage of 92.5%.

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