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Comparison of the Effectiveness Between the Open Ended, ELPSA, and Problem Solving Approaches, With the STAD Type Cooperative Model In Learning Sistem Persamaan Linear Dua Variabel (SPLDV) Material

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A B S T RAK

Penelitian ini bertujuan untuk membandingkan efektivitas pendekatan open ended, ELPSA, dan problem solving dengan model kooperatif tipe STAD dalam pembelajaran materi Sistem Persamaan Linear Dua Variabel (SPLDV) di kelas VIII SMP Negeri 2 Sungguminasa. Penelitian ini menggunakan pendekatan kuantitatif dengan desain quasi eksperimen berupa nonequivalent pretest-posttest comparison group design. Populasi penelitian adalah seluruh siswa kelas VIII yang terdiri dari 11 kelas. Sampel diambil menggunakan teknik double random sampling cluster sehingga diperoleh tiga kelas eksperimen yang seluruh siswanya menjadi subjek penelitian. Instrumen yang digunakan meliputi: (1) lembar observasi pelaksanaan pembelajaran, (2) tes hasil belajar matematika, (3) bahan ajar, (4) lembar observasi siswa, dan (5) angket respons siswa. Data dianalisis menggunakan statistik deskriptif dan inferensial. Hasil analisis deskriptif menunjukkan bahwa ketiga pendekatan (open ended, ELPSA, dan problem solving) efektif dalam pembelajaran SPLDV. Urutan efektivitas dari yang tertinggi adalah pendekatan ELPSA, diikuti open ended, dan problem solving, jika dibandingkan dengan model STAD. Namun, hasil uji ANOVA satu arah pada taraf signifikansi 5% menunjukkan bahwa tidak terdapat perbedaan yang signifikan dalam hasil belajar, aktivitas siswa, maupun respons siswa antar pendekatan yang diterapkan. Dengan demikian, secara inferensial tidak terdapat perbedaan yang signifikan dalam efektivitas pendekatan open ended, ELPSA, dan problem solving dibandingkan dengan model kooperatif tipe STAD dalam pembelajaran SPLDV.

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A B S T R A C T

This research aims to determine the effectiveness comparison between the open ended, ELPSA, and problem solving approach, with the STAD type cooperative model in learning SPLDV material in class VIII of SMP Negeri 2 Sungguminasa. This type of research is quantitative research. The design of this study is a quasi experimental design in the form of nonequivalent pretest-posttest comparison group design. The population in this study were all students of class VIII of SMP Negeri 2 Sungguminasa consisting of 11 classes and the sample was determined using the double random sampling cluster technique, 3 classes of experiments will be selected, all students in the three classes are the samples in this study. The instruments in this study were (1) observation sheet of learning implementation, (2) mathematics achievement test, (3) teaching material, (4) student observation sheet, and (5) student response questionnaire. Data analysis techniques used in this study are descriptive statistical analysis and inferential statistical analysis. Descriptive analysis results show that: (1) the application of the open ended approach is effective in learning SPLDV material; (2) application of the ELPSA approach is effective in learning SPLDV material; (3) the application of an effective problem solving approach in learning SPLDV material; (4) the results of the comparative effectiveness respectively are the ELPSA approach, the open ended approach, and the problem solving approach, with the STAD type cooperative model. One way ANOVA test results at 95% confidence level showed that: (1) there were no significant differences in the learning outcomes of SPLDV students, (2) there were no significant differences in student activity, and (3) there were no differences in students' responses significantly. Thus, inferential there is no significant difference from the application of the open ended approach, ELPSA, and problem solving, with the STAD type cooperative model in learning SPLDV material in class VIII of SMP Negeri 2 Sungguminasa.

Keywords:
comparison, effectiveness, open ended approach, elpsa approach, problem solving approach

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1. INTRODUCTION

The achievement of educational objectives is one of them is influenced by the success of the teaching and learning process. In a copy of the attachment to Regulation of the Minister of Education and Civil Affairs of the Republic of Indonesia Number 22 (2016: 1), on The Standard of Primary and Secondary Education Process explained that: "The learning process in each unit of primary and secondary education must be interactive, inspiring, fun, challenging, and motivate learners to actively participate, as well as provide sufficient space for initiative, creativity, and independence in accordance with talents, interests and physical and psychological development of learners. Therefore, each education unit conducts learning planning, implementation of the learning process as well as assessment of the process to improve the efficiency and effectiveness of the achievement of graduates" competencies.

The sistem persamaan linear dua variabel material has several activities in its learning, including: creating a persamaan linear dua variabel (PLDV), modeling problems from two-variable linear equations, modeling problems from a sistem persamaan linear dua variabel (SPLDV), and writing down problem solving related to the sistem persamaan linear dua variabel related to everyday life. However, although SPLDV is closely related to daily life there are still many students who have difficulty in the learning process.

Sundary et. al (2022), stated that some of the problems faced by students in studying SPLDV include students difficult to remember a condition sufficient for an object to be used in terms that represent the concept, students are less able to group objects as examples of a concept of an object that is not an example, and students are less able to do discovery activities about modeling the story and not thorough in counting an. This was also revealed by Andhani (2016), who revealed that if the problem is given in the form of a story problem, then the learner will have difficulty in making a mathematical model of the problem. In addition, students also have difficulty understanding symbols and signs, as well as errors in choosing and using settlement procedures.

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Based on the results of initial observations made by the author on August 13, 2019 at the Gowa District National Education Office, the authors obtained data recapitulating the average score of the National Examination of junior high school math subjects in Sungguminasa the last three years, which is presented in table 1 below,

Table 1. Recapitulation of National Exam Mathematics Score of SMP Negeri in Sungguminasa

School Names	Years Lessons			Average
	2016/2017	2017/2018	2018/2019	
SMP Negeri 1 Sungguminasa	39,60	40,45	43,16	41,07
SMP Negeri 2 Sungguminasa	39,21	31,37	36,82	35,80
SMP Negeri 3 Sungguminasa	38,17	29,92	39,71	35,93
SMP Negeri 4 Sungguminasa	35,78	32,81	38,94	35,84

(Source: National Education Office Gowa)

Based on table 1 obtained data on the average score of the National Examination of mathematics subjects in the last three years of SMP Negeri in Sungguminasa, which shows that SMP Negeri 2 Sungguminasa obtained the lowest average score from the other three public junior high schools. So, researchers are interested in conducting research at SMP Negeri 2 Sungguminasa.

Observation on August 15, 2019 through Mrs. Widya, S.Pd. and Mrs. Mardiana, S.Pd. as teachers of mathematics class VIII subjects at SMP Negeri 2 Sungguminasa was informed that the average score of mathematics learning achievement of grade VIII students in the daily exam of SPLDV material in the 2018/2019 school year was 46.71 with a standard deviation of 12.49 from the ideal score of 100. While the average score of mathematics learning achievement in the daily exam material SPLDV school year 2018/2019 amounted to 51.83 with a standard deviation of 19.74 from the ideal score of 100. Even though there is an improvement in the learning achievement of students, but the results are still not able to meet the Minimum Completion Criteria (KKM) of mathematics subjects set by the school for grade VIII which is 79.

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Other information obtained by researchers related to learning, especially SPLDV material, that students of grade VIII at SMP Negeri 2 Sungguminasa are less able to do discovery activities about the concept of SPLDV from the situation presented by the teacher, in addition students are more focused on memorizing concepts and formulas without being balanced with the understanding of the concept of SPLDV itself, in other words if the problem given in the form of a story question then the learner will have difficulty in converting the question into several equations in order to obtain the solution. Learners do not understand that in every variable in the equation has meaning. Thus, when students are faced with a varied problem they will have difficulty in solving it. This is why the results of learning mathematics, especially the material of the sistem persamaan linear dua variabel of learners are not optimal.

Ananda et. al. (2023) stated the main foundation of active, innovative, creative, effective and fun learning is constructivism. So in this study the author is interested in using learning models and approaches based on constructivism. Arafah et. al. (2023) stated that the implementation of constructivism in learning in general applies broadly cooperative learning with the basis of thinking, that students will be easier to find and understand difficult concepts if they discuss the problem with their friends in small groups.

Cahyaningrum & Utomo (2022), stated that the Student Team Achievment Division (STAD) cooperative model is one type of cooperative that emphasizes the activities and interactions of students to help each other in mastering the subject matter in order to achieve maximum learning achievement. Because the ability of learners in understanding the subject matter is diverse so that several approaches are needed in mathematics learning, especially SPLDV materials that can facilitate the ability of learners, the approach in question is an open ended approach, an experiences language pictures symbols application (ELPSA) approach, and a problem solving approach, which will be combined with a cooperative model of STAD type.

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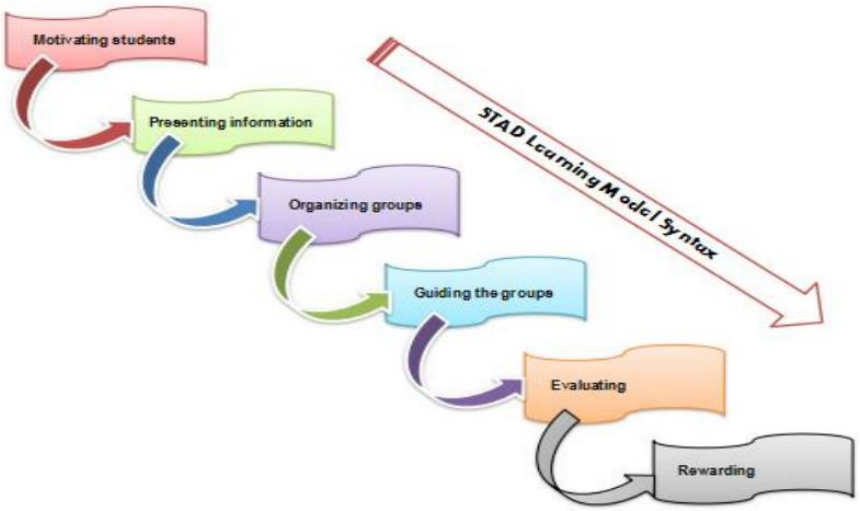

Figure 1. The syntax of the cooperative learning model of STAD type

Source: (Suastika et. al., 2021: 1665)

Afifah &Agoestanto (2020), with the open type questions educators have the opportunity to help learners in understanding and elaborating the mathematical ideas of learners as far and deeply as possible. Thus, this approach solves the problem and also brings up new problems. Faishol et. al. (2016) states that most curriculum and education approaches ignore open views in math classes and do not apply open problems and avoid giving students the opportunity to engage in these types of problems independently for long periods of time. Whereas experience with open problems gives students the opportunity to express their conceptual understanding (Tambunan, 2019).

The development of the ELPSA framework originated with Leibeck's idea (Lowrie et al, 2018) which examined how a child studied mathematics. Lowrie & Patahuddin (2015), One of the learning frameworks based on constructivism is ELPSA which contains five components, namely experiences, language, pictures, symbols, and applications. This framework views learning as an active process by which learners construct their own way of understanding a new mathematical knowledge through individual thought processes and social interactions with others.

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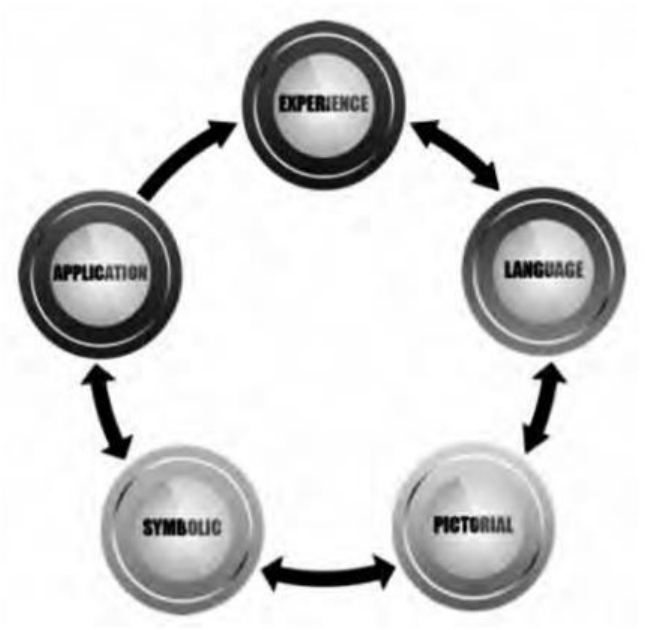

Figure 2. The five components of the ELPSA cycle

Source: (Lowrie et. al., 2018: 29)

Polya defines problem solving as an attempt to find a way out of a difficulty in order to achieve a goal that is not so immediately attainable. Khatimah & Sugiman, et al. (2019), define the problem solving approach as one approach that requires teachers to help learners learn to solve problems through hands-on learning experiences. Hands-on learning experience means learners interact directly with the problems provided by the teacher.

Based on the background, the following questions in this study that will be answered through a series of research processes are as follows: (1) Is the application of an open ended approach with a cooperative model of type STAD effective in learning SPLDV materials reviewed from the results of learning mathematics, activity and response of students of grade VIII SMP Negeri 2 Sungguminasa?, (2) Is the application of ELPSA approach with cooperative model type STAD effective in SPLDV material learning is reviewed from the results of learning mathematics, activity and response of students of grade VIII SMP Negeri 2 Sungguminasa?, (3) Is the application of problem solving approach with cooperative model type STAD effective in learning SPLDV materials reviewed from the results of learning mathematics, activity and response of students of grade VIII SMP Negeri 2 Sungguminasa?

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(4) Is there any difference in the effectiveness of the application of open ended approach, ELPSA, and problem solving, with a cooperative model of STAD type in SPLDV material learning reviewed from the results of learning mathematics, activity and response of students of grade VIII SMP Negeri 2 Sungguminasa?

Operationally, to measure indicators of effectiveness and comparative results of the effectiveness of the three treatments, it must first be known how the implementation of learning through the application of open ended approach, ELPSA, and problem solving, with cooperative model type STAD.

2. RESEARCH METODS

This type of research is Quantitative Research that compares the effectiveness of the application of open ended approach, ELPSA and problem solving, with a cooperative model of STAD type in students of grade VIII SMP Negeri 2 Sungguminasa. Because there is treatment or treatment, so this research is classified into Experimental Methods. Sugiyono (2016), stated that experimental methods can be interpreted as research methods used to find the influence of certain treatments on others in controlled conditions. Researchers used experiments because they wanted to manipulate variables by comparing three classes. The design in this research is quasi experimental, which is in the form of nonequivalent pretest-posttest comparison group design means that three classes of experiments will be selected, each of which will be given one treatment with an open ended approach, ELPSA, and problem solving, with a cooperative model type STAD.

Table 2. Nonequivalent Pretest-Posttest Comparison Group Design

Experiment Classes	*Pretest*	*Treatments*	*Posttest*
I	O_1	*Open Ended* (T_1)	O_2
II	O_3	ELPSA (T_2)	O_4
III	O_5	*Problem Solving* (T_3)	O_6

The population in the study was all students of grade VIII SMP Negeri 2 Sungguminasa Gowa district at the beginning of the 2019/2020 school year consisting of 11

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classes. The research sample consists of 3 classes using Problem Posing, Open Ended Problem, ELPSA, and Problem Solving. Based on random results selected 3 experimental classes namely class VIII7, VIII9, and VIII10. All students in grade VIII7, VIII9, and VIII10 were sampled in this study.

The instruments in this study are (1) observation sheet of learning implementation, (2) mathematics learning achievement test, (3) teaching materials, (4) observation sheet of student activity, and (5) student response questionnaire.

The data analysis techniques used in this study are descriptive statistical analysis and inferential statistical analysis. Descriptive statistics are used to describe the results of students' mathematics learning, the ability of teachers to manage learning, student activities during the mathematical learning process, and how students respond to mathematics learning, based on learning with the application of open ended approaches, ELPSA, and problem solving. Inferential statistics used to test research hypotheses.

3. RESULT AND DISCUSSION

Descriptive analysis of the results of mathematics study of students of grade VIII10 SMP Negeri 2 Sungguminasa after the application of open ended approach of cooperative model type STAD showed the average posttest value of students more than (KKM=79) which is 83.43 with classical completion reached 88.57%. The average score of increasing the value of learners for the open ended approach of the STAD type cooperative model was 0.74. Furthermore, the average activity score of learners was 3.37. The average response score of the students was 3.33. Inferential analysis with one sample t-test on study results and gain showed that p-value = 0.001 < α = 0.05, thus H0 was rejected and H1 accepted, thus the open ended approach with STAD type cooperative model has met all the effectiveness criteria.

Descriptive analysis of the results of mathematics study of students of grade VIII7 SMP Negeri 2 Sungguminasa after the application of ELPSA approach of cooperative model type STAD showed the average posttest value of students more than (KKM=79) which is

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84.88 with classical completion reached 91.43%. The average score of the increase in student scores for the ELPSA approach of the STAD-type cooperative model was 0.77. Furthermore, the average score of student activity was 3.39. The average response score of the students was 3.34. Inferential analysis with one sample t-test on study results and gain showed that p-value = 0.001 < α = 0.05, thus H0 was rejected and H1 accepted, thus ELPSA approach with cooperative model type STAD has met all effectiveness criteria.

Descriptive analysis of the results of mathematics study of students of grade VIII9 SMP Negeri 2 Sungguminasa after the application of problem solving approach of cooperative model type STAD shows the average posttest value of students more than (KKM=79) which is 82.51 with classical completion reached 88.57%. The average score of the increase in the value of learners for the problem solving approach of the STAD type cooperative model was 0.73. Furthermore, the average activity score of learners was 3.38. The average response score of the students was 3.30. Inferential analysis with one sample t-test on study results and gain showed that p- value = 0.001 < α = 0.05, thus H0 was rejected and H1 accepted, thus the problem solving approach with STAD type cooperative model has met all the effective criteria.

Table 3. Comparison Of Descriptive Effectiveness Indicators

Implementation of Approaches	Experimental Classes	Holistic Learning Outcomes	Average Activity Score	Average Respons Score	Average
Open Ended	VIII-10	2,80	3,37	3,33	3,16
ELPSA	VIII-7	2,86	3,39	3,34	3,19
Problem Solving	VIII-9	2,77	3,38	3,30	3,15

Based on the table above, it can be concluded that if reviewed from the average score of the indicators of effectiveness, then descriptively learning through the application of ELPSA approach with STAD type cooperative model is more effective than open ended approach, and problem solving with cooperative model type STAD. While learning through

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an open ended approach with a cooperative model type STAD is more effective than problem solving approach with cooperative model type STAD.

The following are the results of recapitulation of inferential statistical analysis on the effectiveness indicators of the application of open ended approach, ELPSA, and problem solving with cooperative model type STAD in mathematics learning SPLDV material class VIII at SMP Negeri 2 Sungguminasa.

Tabel 4. Summary of Inferential Analysis Results with ANOVA Test

No	Approaches	SPSS Test Results on Effectiveness Indicators			
		$\bar{x}_{posttest}$	$\bar{x}_{gain}$	Activity	Respons
1	*Open ended*				
2	ELPSA	0,176	0,180	0,947	0,633
3	*Problem Solving*				

From the table above can be seen that the test results anova posttest after the application of the open ended approach, ELPSA and problem solving obtained p-value = 0.176 > α = 0.05, then H0 : μ1 = μ2 = μ3 received and H1 : at least one of the μ that is not the same rejected, in other words for a confidence level of 95% there is no difference in the average posttest score of learners after being taught with an open ended approach, ELPSA and problem solving with cooperative model type STAD in mathematics learning in grade VIII SMP Negeri 2 Sungguminasa. Anova gain test results application of open ended approach, ELPSA and problem solving obtained value p = 0.180 > α = 0.05, then H0 : μ_g1 = μ_g2 = μ_g3 accepted and H1: there is at least one of the μ_g that is not the same rejected, in other words for a confidence level of 95% there is no difference in the average score of gain of students after being taught with an open ended approach, ELPSA and problem solving with cooperative model type STAD in mathematics learning in grade VIII SMP Negeri 2 Sungguminasa.

Anova test results of student activity from the application of open ended approach, ELPSA and problem solving obtained p-value = 0.947 because the value p = 0.947 > α = 0.05,

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then H0 : μ_M1 = μ_M2 = μ_M3 received and H1: at least one of the μ_M is not equally rejected, in other words for the confidence level of 95% there is no difference in the average score of student activity after being taught with an open ended approach, ELPSA and problem solving with cooperative model type STAD in mathematics learning in grade VIII at SMP Negeri 2 Sungguminasa.

Anova test results of learners' response to the application of an open ended approach, ELPSA and problem solving obtained p-value = 0.633 because the value p = 0.633 > α = 0.05, then H0 : μ_M1 = μ_M2 = μ_M3 received and H1: at least one of the μ_M that is not the same rejected, in other words for a confidence level of 95% there is no difference in the average score of the learner's response after being taught with an open ended approach, ELPSA and problem solving with cooperative model type STAD in mathematics learning in grade VIII at SMP Negeri 2 Sungguminasa.

The application of open ended approach with cooperative model type STAD is effective in learning SPLDV material because it has met three indicators of effectiveness that have been set. The results of descriptive statistical analysis show (a) the average score of SPLDV material learning achievement of 83.43 with a standard deviation of 4.88 from an ideal score of 100, (b) the average score of increase (gain) of learning outcomes of 0.74 (being in the high category), (c) the average score of student activity of 3.37 with a standard deviation of 0.13 from the ideal score of 4.00 (being in the active category), (d) the average score of the learner's response of 3.33 with a standard deviation of 0.10 from the ideal score of 4.00 (in the positive category), (e) the classical completion percentage of 88.57% > 85% means descriptively fulfilling the criteria of effectiveness. While the result of inferential statistical analysis shows (a) learning achievements, t test results show p-value = 0.001 < α = 0.05 thus H0 is rejected, meaning SPLDV material learning achievement is greater than 79, (b) N-gain score, t test result shows p- value = 0.001 < α = 0.05 thus H0 is rejected, meaning SPLDV

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material learning achievement is greater than 0.30. (c) classical completion, proportion test results show p-value = 0.001 < α = 0.05 thus H0 is rejected, meaning that the achievement of learning SPLDV material of learners who reach KKM more than 85%. This is in line with the results of research Kaharuddin (2017), and Nurlidia (2015), which stated that the application of open ended setting cooperative approach is effective in mathematics learning.

The implementation of ELPSA approach with STAD type cooperative model is effective in SPLDV material learning because it has met three indicators of effectiveness that have been set. The results of descriptive statistical analysis show (a) the average score of SPLDV material learning achievement of 84.88 with a standard deviation of

5.82 from an ideal score of 100, (b) the average score of increase (gain) of learning outcomes of 0.77 (being in the high category), (c) the average score of student activity of 3.40 with a standard deviation of 0.13 from the ideal score of 4.00 (being in the active category), (d) the average score of the learner's response of 3.34 with a standard deviation of 0.10 from the ideal score of 4.00 (in the positive category), (e) the percentage of classical completion is 91.43% > 85% means descriptively meets the crematorium of effectiveness. While the results of inferential statistical analysis show (a) learning achievements, t test results show p-value = 0.001 < α = 0.05 thus H0 is rejected, meaning SPLDV material learning achievement is greater than 79, (b) N-gain score, t test result shows p-value = 0.001< α = 0.05 thus H0 is rejected, meaning SPLDV material learning achievement is greater than 0.30. (c) classical completion, proportion test results show p-value = 0.001 < α = 0.05 thus H0 is rejected, meaning that the achievement of learning SPLDV material of learners who reach KKM more than 85%. This is in line with the results of Kaharuddin's research (2017), which stated that the application of ELPSA approach to cooperative settings is effective in mathematics learning.

The application of problem solving approach with cooperative model type STAD is effective in learning SPLDV material because it has met three indicators of effectiveness that have been set. The results of descriptive statistical analysis show (a) the average score of

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SPLDV material learning achievement of 82.51 with a standard deviation of 5.22 from the ideal score of 100, (b) the average score of increase (gain) of learning outcomes of 0.73 (being in the high category), (c) the average score of student activity of 3.38 with a standard deviation of 0.26 from the ideal score of 4.00 (being in the active category), (d) the average score of the learner's response of 3.30 with a standard deviation of 0.95 from the ideal score of 4.00 (in the positive category), (e) the classical completion percentage of 88.57% > 85% means descriptively fulfilling the criteria of effectiveness. While the results of inferential statistical analysis show (a) learning achievements, t test results show p-value = 0.001 < α = 0.05 thus H_0 is rejected, meaning SPLDV material learning achievement is greater than 79, (b) N-gain score, t test result shows p- value = 0.001 < α = 0.05 thus H_0 is rejected, meaning SPLDV material learning achievement is greater than 0.30. (c)

4. CONCLUSIONS

The conclusions that are taken based on the results of research and discussion are as follows

1. The application of open ended approach with cooperative model type STAD effective in learning SPLDV materials in students of grade VIII SMP Negeri 2 Sungguminasa reviewed from the results of learning, activities, and responses of students.
2. The application of ELPSA approach with STAD-type cooperative model is effective in the learning of SPLDV materials in students of grade VIII SMP Negeri 2 Sungguminasa reviewed from the results of learning, activities, and responses of participants.
3. The application of problem solving approach with cooperative model type STAD effective in learning SPLDV materials in students of grade VIII SMP Negeri 2 Sungguminasa reviewed from the results of learning, activities, and responses of students.

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4. There is no difference in effectiveness between open ended approach, ELPSA, and problem solving, with cooperative model type STAD in differential, but descriptively there are differences in effectiveness both from the results of learning, activities and responses of learners, the order of effectiveness of approach based on descriptive analysis is, ELPSA approach, open ended approach, and problem solving approach, with cooperative model type STAD in SPLDV material learning in class VIII SMP State 2 Sungguminasa.

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