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The Effect of REACT Learning Strategy Assisted Structured Worksheet on Mathematical Problem-Solving Ability

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Abstrak

Penelitian ini bertujuan untuk mengetahui pengaruh penerapan strategi pembelajaran REACT berbantuan LKPD terstruktur terhadap kemampuan pemecahan masalah matematis. Penelitian ini menggunakan metode kuasi eksperimen dengan desain penelitian *posttest-only control group*. Pengambilan sampel dilakukan secara *purposive sampling* dan *cluster random sampling*. Siswa kelas X7 dan kelas X9 digunakan sebagai sampel pada penelitian ini. Instrumen penelitian terdiri dari empat soal uraian materi program linear yang sudah teruji valid dan reliabel. Hasil pengujian hipotesis dengan uji-*t* pada taraf signifikansi 5% menunjukkan bahwa terdapat pengaruh penerapan strategi pembelajaran REACT berbantuan LKPD terstruktur terhadap kemampuan pemecahan masalah matematis siswa.

Kata kunci: Kemampuan Matematis, LKPD Terstruktur, Pemecahan Masalah, Program Linear, Strategi REACT.

Abstract

This research aims to determine the effect of the REACT learning strategy assisted by structured student worksheets on mathematical problem-solving ability. This study design employs a quasi-experiment with a posttest-only control group design. The sampling technique was carried out using purposive sampling and cluster random sampling. Students from classes X7 and X9 at SMA Negeri 3 Karawang were used for the research samples. The instrument in this research consisted of four description questions on linear program material that had been tested for validity and reliability. The results of hypothesis testing with an independent sample test (*t*-test) at the 5% significance level show that there is an effect of the implementation of the REACT learning strategy assisted by structured student worksheet on mathematical problem-solving ability.

Keywords: Linear Program, Mathematical Ability, Problem-Solving, REACT Strategy, Structured Student Worksheet.

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INTRODUCTION

Problems become fundamental in both mathematics and daily life. Problems in mathematics are interpreted as non-routine problems that require procedures and careful thought to solve (Siagian et al., 2019). Mathematics has an important role as it enables students to develop problem-solving abilities and become familiar with the process of finding solutions (Sihite & Pangaribuan, 2023). Thus, students' ability in learning mathematics is expected to be a provision in solving problems.

National Council of Teachers of Mathematics (NCTM) (2000) states that problem-solving ability is one of the five essential standards for mathematical competency that students must acquire. Mathematical problem-solving ability refers to the ability of students to solve non-routine or contextual problems that require procedures to solve (Surya & Putri, 2017). Students need to have great ability to solve mathematical problems (Ulandari et al., 2019). Students can use mathematical principles to solve routine and non-routine problems and apply the principles to real-world problems by developing mathematical problem-solving abilities (Simamora et al., 2018)

The urgency of mathematical problem-solving abilities is contradicted by a fact that this ability is relatively low in Indonesian students. The results of Damayanti and Kartini (2022) research show that students mathematical problem-solving abilities are low, especially in interpreting the results of problem-solving. According to Yayuk et al. (2020), students are still struggling with non-routine problems because they have not succeeded in finding problem-solving strategies. In addition, the results of preliminary research conducted on 10-th grade students at senior high school show that their mathematical problem-solving abilities are still low. Students can only solve problems that are the same as the textbook or as the teacher taught. Moreover, the biggest problem is that students cannot solve even just understanding contextual problems when presented with narrative problems.

Based on the problem of students' inability to solve mathematical problems, a learning strategy is needed that might fix the problem. Improving the ability of students to solve mathematical problems can be accomplished by active learning (Widada et al., 2019). According to Hasanah et al. (2019), students who actively participate in instructional process can increase their mathematical problem-solving abilities. Additionally, the implementation of effective learning is needed in the learning process so that students can easily find and solve math problems through discussion activities (Ulandari et al., 2019). One of things that is thought to be useful for improving mathematical problem-solving abilities is using the REACT learning strategy.

The REACT (Relating, Experiencing, Applying, Cooperating, and Transferring) learning strategy is contextual learning, which is at the core of the principle of constructivism (Akbulut & Hill, 2020). In the principle of constructivism, students construct new knowledge and experiences based on their prior knowledge (Juwita et al., 2023). According to Crawford (2001), REACT learning strategy consist of: (1) relating (connecting learning materials with student experience or daily life problem), (2) experiencing (investigating and gathering data),

(3) applying (apply mathematical concepts to contextual problems), (4) cooperating (group discussions), and (5) transferring (transferring knowledge to a new context).

REACT learning strategy provides opportunities for students to construct their new ideas and knowledge use their experiences and beliefs (Cahyani et al., 2021). REACT learning strategy emphasizes providing information that is related to students' daily experiences, so students can easily understand the material because it is relevant to their daily lives (Hasanah et al., 2019).

The REACT learning strategy can be supported by structured students' worksheets as a learning media that can encourage student activity in the learning process. Student worksheets consist of learning guidance of a material which is then adapted to learning activities including investigation, problem-solving, and drawing conclusion (Prayuti et al., 2023). Structured student worksheet is designed to guide students in a learning process with little teacher guidance (Murlin et al., 2022). Structured student worksheet is equipped with supporting information and materials that facilitate students in problem-solving (Safitri et al., 2019). Structured student worksheets help students answer questions with direction and give students the opportunity to find solutions (Susmawati et al., 2021).

There has been some research related to REACT learning strategies assisted by structured students' worksheets on mathematical problem-solving ability. Hasanah et al. (2019) research with the results that REACT learning strategy supported educational games media effectively against mathematical problem-solving ability. Hasanah et al. (2019) research also recommended carrying out advanced research on the implementation of REACT learning strategy to mathematical problem-solving ability through media assistance other than educational game. According to Safitri et al. (2019), there is an effect of learning Probing Promting assisted structured students' worksheets on the mathematical problem-solving ability. Furthermore, research by Agustin and Fuad (2022) showed that a student worksheet based on REACT learning strategy had a positive impact on student learning outcomes.

Research related to REACT learning strategy and structured student worksheet has a lot of positive impact on mathematical problem-solving ability. However, no research has been found that combines REACT learning strategy, structured student worksheet as assisted media, and mathematical problem-solving ability, especially in the Merdeka curriculum. Therefore, research is conducted to find out whether there is an effect of the REACT learning strategy assisted student worksheet on students mathematical problem-solving abilities.

METHOD

This study utilized a quantitative approach with a quasi-experiment method. The use of the quasi-experiment method is because the researcher did not create a new class as a control group. In the quasi-experiment method, there is a control group, but it does not fully control the external variables that affect the conduct of the experiment (Sugiyono, 2013). Two variables in this research are: the dependent variable is students' mathematical problem-solving ability, and the independent variables are REACT learning strategy assisted structured student worksheet and expository learning strategy. A posttest-only control group design was used in the study, as shown in the Table 1. Khotimah et al. (2019).

Table 1. Research design

Class	Treatment	Posttest
Experiment (E)	X_1	Y
Control (K)	–	Y

Information:

X_1 : REACT learning strategy assisted structured student worksheet.

– : Expository learning strategy

Y : posttest mathematical problem-solving ability

The sampling technique used is two stage sampling. The first stage was carried out by purposive sampling to select classes with Merdeka curriculum learning, so that all 10-th grade students at senior high school in the 2023-2024 school year were selected as the target population. Then, the precondition test of analysis data of the final assessment result of 10-th grade students was tested for normality with Lilliefors, homogeneity with Bartlett, equality of means tests with one-way ANOVA, and post-hoc equality of means tests with Scheffe's test to see the initial condition of the class. Classes that are normally distributed, homogeneous, and have average similarity will then be carried out cluster random sampling to select two classes as research samples.

Data was collected from posttest mathematical problem-solving ability students' experimental and control classes. The research instrument consisted of four essay tests of mathematical problem-solving ability on linear program material. Essay tests are used to avoid bias in measurement results because there is no guessing system, so that the test results can better represent the true students' actual abilities (Lestari & Yudhanegara, 2017). The indicators of mathematical problem-solving ability used in this study are the result of

synthesizing the results of several experts such as Polya (1973) and previous research indicators such as Damayanti and Kartini (2022). Indicators of mathematical problem-solving ability test instrument are: 1) identifying the problem; 2) develop a plan; 3) solve the problem according to the plan; 4) interpreting solutions of the problem.

For the test instrument, validity and reliability tests were used. The validity test used are content, construct, and empirical validity. Content and construct validity are carried out to test the suitability of the instrument, with linear program material indicators and indicators of mathematical problem-solving ability. The instrument will be measured suitability and consulted with experts (Sugiyono, 2016). Then, empirical validity testing was carried out by testing the instrument on non-sample classes that had studied linear program material. Empirical validity testing was carried out by calculating the item correlation coefficient (r_{xy}) using the Pearson Product Moment correlation coefficient (Sugiyono, 2016). Alpha Cronbach formula is used in the reliability test. The Alpha Cronbach formula is used when the test instrument is a description question with scoring using a Likert scale (Sundayana, 2016). Before the instrument is tested to sample, instrument considered valid and reliable.

The posttest data will be analyzed using an independent sample test (*t*-test) as a hypothesis test. Before the hypothesis test is carried out, a precondition test of data analysis will be carried out, namely the normality test with Shapiro Wilk and the homogeneity test with Lavene. After data analysis, the effect size test will be conducted using Cohen's Effect Size to measure the effect of REACT learning strategy assisted by structured student worksheets on students' mathematical problem-solving abilities.

Posttest data is normally distributed and homogeneous if the results of normality testing with the Shapiro-Wilk test and homogeneity testing with the Lavene test obtained a significance value greater than the significance level of 5%. Then data analysis is carried out to obtain conclusions from the hypothesis tested. From the results of the calculation with the t-test, if the significance value is less than the significance level of 5%, then there is an effect of REACT learning strategy assisted structured worksheets on mathematical problem-solving ability.

RESULTS

Data were collected from the posttest results of mathematical problem-solving ability of experimental and control class students. Data was carried out to test assumptions of normality and homogeneity as a precondition of parametric test of the research hypothesis.

The following are results of normality test using Shapiro Wilk test through SPSS software on significance level 0.05.

Table 2. Output Normality Test

Class	Shapiro Wilk		
	Statistic	df	Sig.
Experiment	.950	35	.116
Control	.943	36	.064

From the Table 2 of Shapiro Wilk output results, sig. value of experimental class is 0.116 and control class is 0.064 that means sig. value > 0.05. It can be concluded that data was normally distributed. The homogeneity test of posttest data was carried out with Levene's test through SPSS software with the following result.

Table 3. Output Homogeneity Test

		Levene Statitsic	df1	df2	Sig.
Posttest Results	Based on Mean	.620	1	69	.434
	Based on Median	.755	1	69	.388

Based on the Table 3, sig. Based on Mean is 0.434 which greater than significance level of 0.05. Thus, it can be concluded that posttest data experimental class and control class have homogeneity variance.

Independent sample test (t-test) was used to find out how the independent variable affected the dependent variable. Hypothesis test is carried out after the assumption test is fulfilled and aims to show the hypothesis is accepted or rejected. In this research, hypothesis test use t-test through SPSS software on significance level of 0.05. The result is presented as follows.

Table 4. Output Hypothesis Test

		t-test for Equality of Means		
		T	df	Sig. (2-tailed)
Posttest Result	Equal variances assumed	2.683	69	.009
	Equal variances not assumed	2.688	68.375	.009

Based on the Table 4, sig. (2 tailed) is 0.009. If the sig. value (2-tailed) is less than the significance level of 0.05, then H0 is rejected. The results show that the sig. value less than the significance level (0.009 < 0.05), so it can be concluded that H0 is rejected. This indicates that the experimental class posttest score and the control class differ significantly on linear program material.

The Hypothesis test shows that implementation of REACT learning strategy assisted structured student worksheet has an effect on students' mathematical problem-solving ability at SMA Negeri 3 Karawang. Furthermore, the effect size test will be carried out using the Cohen's Effect Size test. The result obtained Cohen's value of 0.637 which means that the effect of the REACT learning strategy assisted by structured student worksheet on students' mathematical problem-solving ability is 72,6% and included in the medium category.

DISCUSSION

Research results show that the implementation of REACT learning strategy assisted structured student worksheets affects students mathematical problem-solving ability. The finding in this research is in line with previous research findings of Widada et al. (2019) and Cahyani et al. (2021). Results of Widada et al. (2019) research show that mathematical problem-solving ability of students taught with REACT strategy was higher than students taught with traditional learning. Also, according to Cahyani et al. (2021), implementation of REACT strategy can improve student mathematical problem-solving and receive positive responses from students.

The implementation process of learning with the REACT strategy is a cycle of activity. According to Crawford (2001), the five stages of REACT strategy include relating, experiencing, applying, cooperating, and transferring. Relating, students given contextual problem and connecting that problem to material that will be learned. Relating stage supported students' ability to solve problems because it is connected to real contexts while exploring students' prior knowledge related to the material will be learned (Wijaya et al., 2019). Experiencing, students will collect information to get new knowledge by doing activities on structured student worksheet. Experiencing stage directs students to find new concepts that will be learned, so students understand the point of problems and devise a plan to solve the problem (Cahyani et al., 2021).

There are several reasons why REACT learning strategy has an impact on student mathematical problem-solving ability. REACT learning strategy enables students to gain their own knowledge by searching information and completing activities on structured student

worksheets. Learning process with REACT strategy emphasizes the activity of students who construct their own knowledge, so that they can deepen their understanding (Cahyani et al., 2021). The active involvement of students in learning has a positive impact on their learning motivates, including in solving mathematical problems (Hasanah et al., 2019).

The next stages of REACT learning strategy are the main stages of solving the problem. Applying, students use the information that they get to solve the problem. Along with cooperating stage, students solve the problem in groups. Through group learning, students discuss their opinions to solve problems together, so that it is good for improving mathematical problem-solving ability (Crawford, 2001). Last stage is transferring, students and teacher, both together will conclude solution of the problem and students given other problem as evaluation. When the teacher devises a varied problem, students' understanding of the learning will be improved because students are usually curious about new context (Crawford, 2001).

The implementation of REACT strategy is also supported by using structured students' worksheets as a media assistance. Student worksheets used are in the form of worksheets that are organized based on problem-solving activities and contain little information, so that students are more directed to gain their knowledge independently. Structured student's worksheet helps students answer problems in a directed way and provides opportunities for students to understand problems, especially in devising and finding solutions of the problem (Safitri et al., 2019). Problems in the student worksheet in the form of written or narrative problems, so that students are familiar with mathematical statements and can transform sentences into mathematical form. Since mathematical statements cannot be learned by rote, students must comprehend and be familiar with them to use the mathematical statements to solve problems in their daily lives (Kharis et al., 2021).

CONCLUSION

Based the result of the research, it can be concluded that there is a positive effect of the implementation of REACT learning strategy assisted by structured student worksheet on mathematical problem-solving ability of high school student at SMA Negeri 3 Karawang on linear program subject. This is showed from the average results of the mathematical problem-solving ability test in experimental class students with REACT learning strategy assisted by structured student worksheet higher than control class students with expository learning strategy. The implementation of REACT learning strategy assisted by structured student

worksheet has an effect of 72,6% which is included in medium category on students mathematical problem-solving ability.

Some recommendation for additional study, including the following: 1) This research can be continued to other research methods such as design research or class action research. 2) REACT learning strategy can be implemented in further research with different media assistance or learning materials on mathematical problem-solving ability. 3) Structured student's worksheet based REACT learning strategy on linear program material can be developed in further research with research and development as the research method. The conclusion must address the research objectives or questions that have been posed. The conclusion is the result of abstracting the article's content with answers to the research objectives or questions, not by taking sentences from the research findings or discussion in their entirety. This section describes the conclusion descriptively, not in numbering or bullet form. If numbering and bullet points are required, they should still be in the form of a descriptive paragraph.

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