The Effect of Applying The Problem-Posing Learning Model with The Virtual Enriched on Mathematics Learning Outcomes

Saraswanti Sri Hastanti[1], Maufur[2], Muntoha Nasucha[3]
{ Saraswatisrihastanti@gmail.com[1]}

Postgraduate Program, Pedagogy Study Program, Universitas Pancasakti Tegal, Indonesia

Abstract. The learning model greatly affects the learning outcomes of students, students will be more interested if they are actively involved in learning. This involvement will build the knowledge and skills of the learners that they constructed themselves so that the results of the material studied will be imprinted longer in memory. However, there are still many teachers who use conventional methods in learning so that students are not interested in learning, plus learning that is carried out remotely or online, which teachers dominate, makes students nervous and not interested in learning. The purpose of this study is to decrypt the influence of problem-posing learning models with enriched virtual strategies on mathematics learning outcomes. This research uses a quantitative approach to experimentation methods with a pretest-posttest design research design. The research samples were students of XI SMK N 1 Adiwerna, SMK N 1 Bumijawa and SMK N 1 Duuhturi, with many samples being 216 learners. The instrument in this study used a test of 30 questions consisting of 25 multiple-choice questions and 5 essay questions. Hypothesis testing using a paired sample t-test. Based on the paired test results, the t-test sample shows the sig value. (2-tailed) of 0.000 < 0.05., then Ha is accepted and H0 is rejected, meaning that there is an influence of the application of the problem-posing learning model with virtual enriched strategies on mathematics learning outcomes.

Keywords: Enriched Virtual Strategy**,** Learning Outcome, Problem Based Learning

MALAPY 2022, May 28, Tegal, Indonesia

DOI 10.4108/eai.28-5-2022.2320374

1. Introduction

The quality of a nation's human resources (HR) is determined by the quality of education provided. Education is the basis for the progress of a nation, the better the quality of education, the better the human resources born from the educational process.

To realize quality education, it is necessary to have educational interaction between teachers and students through the learning process to achieve learning objectives. Learning objectives are a picture that students must own as a result of learning outcomes thataremeasured and observed [1]. According to [2] emphasized that the learning objectives are a detailed formulation of what must be mastered by students after they pass the learning activities concerned successfully. The purpose of teaching and learning activities between teachers and students is so that students can understand the knowledge and skills material taught by teachers so as to obtain good learning outcomes in certain subjects. To get optimal learning outcomes, attraction is needed so that students are willing to learn. One of the ways that learners are interested in learning is a learning model that attracts learners.

Learners are more interested in doing than remembering. Then the material that learners independently unearth through a learner-centered learning model is longer remembered than conventional teacher-centered learning. Students actively discussing, collaborating with other students in digging for information and criticizing the learning problems faced will be more enthusiastic in learning because they feel challenged to find the information they need. The existence of interest in learning will affect the outcomes obtained because students who are interested in learning will learn without being forced so that problems or questions related to the material will be solved easily. The increase in learning outcomes due to the involvement of students in learning has been proven by previous research [3].

One student-centered learning model that actively involves students in learning is the problem posing learning model. In this problem posing learning, students will be guided so that they can be involved actively in learning such as communicating and collaborating with other students and being able to think critically, creatively and innovatively in solving problems related to the material being studied.

Problem posing learning is student-centered learning that can involve students actively in learning. In this lesson, the teacher serves as a motivator and facilitator only. This learner-centered learning makes learners actively involved in learning. With the learning of problem posing, student learning activity will increase student learning activity, in line with research from [4] in a journal entitled Problem-posing research in mathematics education: Some unanswered questions. Another research is a journal from [4] entitled Increasing Activeness and Cooperation through the 4C Approach and Problem Posing in History Learning in Class X IPS 2 SMAN 8 Surakarta, the result is an increase in the percentage of activeness and cooperation of students from the pre-cycle stage to cycle II. The increase has exceeded the specified target of 75%. This study concludes that the 4C approach and the Problem Posing learning model can increase activeness and cooperation in class X social studies 2 students of SMA N 8 Surakarta.

The involvement of students in exploring and understanding learning materials makes students better understand the material being taught so that cognitive abilities in the form of knowledge will automatically rise along with better understanding of students. The application of this problem posing learning model, in addition to being able to increase the learning activity of students, will also improve student learning outcomes. This is supported by research in a journal entitled The Influence of Problem Posing Learning Models on Student Learning Outcomes in Thematic Learning [5] with the results of research that there is an influence of the application of problem posing learning models on student learning outcomes in thematic learning. The results showed that the use of problem posing learning models had an effect on student learning outcomes and could improve student learning outcomes.

Another problem that is being faced by the world of education is the emergence of the Covid-19 pandemic, all regions in the world including Indonesia are feeling the impact of the corona virus 19 which came to Indonesia from Wuhan, China since early 2020. The impact of Covid-19 is felt in all sectors of life such as the economic and education sectors. Teaching and learning activities that are usually carried out face-to-face cannot be carried out as usual because schools are closed to avoid crowds.

In addition to being useful during the Covid-19 pandemic, blended learning-based learning can be used when students cannot come directly to the school to learn face-to-face because of other tasks such as industrial work practices (PKL) that must be carried out by SMK students, the existence of a virtual enriched strategy can be a solution to the problem.

According to [6], It can be concluded that 54% expressed strongly agree and 46% agreed related to the effectiveness and efficiency of learning using enriched virtual model strategies with edmodo virtual classroom features. The research from Siyamta can be used as a reference regarding the implementation of blended learning with the virtual enriched type.

The active learning of students born from active learning models such as problem posing models will help students be more active in learning because this model requires students to explore, discuss and infer information related to the material taught while the teacher acts as a facilitator who guides students in learning. The activeness of students will make students enthusiastic in carrying out the learning process so that learning outcomes or student scores related to the material studied can also increase. Meanwhile, as a step to prepare for the pandemic period which is not yet clear when it will end or students who cannot learn directly because of tasks outside of school such as PKL, the right learning strategy is needed, namely a virtual enriched learning blended learning strategy so that learning can still be carried out effectively. Based on these considerations, the researcher took the title "The Influence of The Application of Problem Posing Learning Model With Virtual Enriched Strategy on Mathematics Learning Outcomes (Case study at SMK Negeri Se Kabupaten Tegal Academic Year 2021/2022)".

2. Method

Researchers used a quantitative approach with an experiment method given to class XI students of vocational high school in Tegal Regency by taking samples in 3 schools, namely SMK N 1 Adiwerna, SMK N 1 Bumijawa, and SMK N 1 Dukuhturi [7]. The classes used as experimental classes are class XI TKRO 3 SMK N 1 Adiwerna, class XI MM 1 SMK N 1 Bumuijawa and class XI TKJ 1 SMK N 1 Dukuhturi. Each class has 36 students. The control class is class XI TKRO 4 SMK N 1 Adiwerna, class XI MM 2 SMK N 1 Bumuijawa and class XI TKJ 2 SMK N 1 Dukuhturi. Just like the experimental class, the control class also has 36 students in each class. The sample was determined by using purposive sampling, which is to

determine the sample based on the research objectives. The study design used Pretest-Posttest Design. The first stage to provide pre-tests, apply the Problem Posing learning model with virtual enriched strategies in the experimental class and conventional learning in the control class, and the final stage of providing a post-test. After data collection, the research data was processed using a t-test to conclude the results according to the requirements in this study. The research instruments used are multiple-choice tests and essays. Multiple choice questions will be given a value of 1 if you answer correctly and 0 if you answer incorrectly. For essay questions, you will get a score with a range of 0-5.

The instrument was carried out a validity test using thecorrelation formula of the ct moment program, out of 30 double-selection questions , there were 27 questions with valid categories and 3 invalid questions so that only 25 questions were used, while for the essay questions as many as 5 were declared valid based on validity tests. These questions have also been expertly validated by head of the FPKM study program at Pancasakti University, Tegal.. The reliability test of the research instrument usesthe Cronbach Alpha formula for multiple-choice questions to get a value = 0.855 > 0.8 so that it can be said that the questions are reliable and high-category. Meanwhile, the reliability test results for essay questions obtained a pearson moment value of 0.3291 and a sig value of < 0.05. Based on the results of validity tests using SPSS, it was found that all soal descriptions used were valid because the pearson correlation value > r table.

For the difficulty level test results, multiple-choice questions can be concluded that the number of easy questions is 12, the questions are 11, and the difficult questions are 2. While the difficulty level in the essay questions is 2 easy category questions, and 3 questions are in the medium category.

The distinguishing power test shows that the number of multiple-choice questions with a very good difference is 4, the good is 16, and the medium is 5. While in the essay questions, 4 questions have good differentiation and 1 question with medium differentiation.

3. Result & Discussion

The research began with field observations to document preliminary data such as recording many students who will be used as samples and populations in this study, as well as understanding the characteristics of all state vocational schools to select samples that are in accordance with the objectives of this study. Because in this study, purposive samples were used, namely the sampling method according to the purpose of the study, so the researcher must understand the characteristics of which schools will be used as research samples.

They were chosen because different majors from each other in differs location. Namely the central area of Tegal regency, and southern Tegal regency with distinct mountainous areas that dominate its territory. Then, northern of the Tegal district area is directly adjacent to the city of Tegal and has received various modernizations in learning. It is hoped that with these different circumstances, the research results will be more accurate because the research results are not only in one area which of course will more or less affect the characteristics of the school.

After observation, next is the trial of the instrument. Instrument trials are used to determine the questions' reliability, differentiability and difficulty. The trial was conducted in a class outside the research sample. Furthermore, after the instrument trial, researchers conducted research to obtain pre-test and post-test results. The pre-test is carried out with the Linear Program material, while the post-test uses the series row material questions. These materials are sequential, so they are easy to use in this study.

The results of the analysis of pre-test and post-test data, both control classes and experiments, the results of learning mathematics can be seen in the following table

Table 1. Learning Outcomes are learned in control and experiential classes

Statistics	Control		Experiment	
	Pre	Post	Pre	Post
Mean	55.278	60.759	56.352	75.815
Std Deviation	7.731	8.292	10.212	9.323
Minimum	38	44	36	50
Maximum	78	86	76	92

From the descriptive statistical results, it was obtained that the control group in the pre-test had an average value of 55,278 with a standard deviation of 7,731 and the minimum and maximum values were 38 and 78 while the post test had an average value of 62,759 with a standard deviation of 8,292 and the minimum and maximum values were 44 and 88. In the Experimental group, the pre-test had an average value of 56,352 with a standard deviation of 10,212 and the minimum and maximum values were 36 and 76 while the post test had an average value of 75,815 with a standard deviation of 9,323 and the minimum and maximum values were 50 and 92.

In table 1, there was an increase in the average in the experimental class from 56.3 to 76.8. Furthermore, the data will be analyzed using the t-test as well as the normality and homogeneity test as prerequisites for the t test.

3.1 Normality Test

The normality test is a test to measure whether the data obtained has a normal distribution or not. In this study, the normality test used the Kolmogorov-Smirnov Test One-Sample test method, where if the sig value > 0.05, it can be concluded that the data are normally distributed. The normality test results based on the pre and post-values in each group are as follows.

Table 2. One-Sample Kolmogorov-Smirnov Test

		Pre_Kontrol	Post_Kontrol	Pre_Eksperimen	Post_Eksperimen
N		108	108	108	108
Normal Parameters[a,b]	Mean	55.2778	62.7593	56.3519	75.8148
	Std. Deviation	7.73127	8.29240	10.21206	9.32302
Most Extreme Differences	Absolute	.103	.107	.130	.130
	Positive	.103	.107	.099	.072
	Negative	-.062	-.079	-.130	-.130

Kolmogorov-Smirnov Z	1.067	1.114	1.354	1.348
Asymp. Sig. (2-tailed)	.205	.167	.051	.053

a. Test distribution is Normal.

b. Calculated from data.

Based on the normality test using Kolmogorov Smirnov using SPSS, all sig values were obtained more than 0.05 so it can be concluded that the data are normally distributed.

3.2 Homogeneity Test

The homogeneity test is used to test whether the variance of both groups has the same variance or not. In this study, the homogeneity test used the Levene test method, where if the sig value > 0.05, it can be concluded that the data is homogeneous. The homogeneity test results based on the control group and experiments are as follows.

Table 3. Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Itself.
Control	.085	1	214	.771
Experiment	3.477	1	214	.064

Based on the homogeneity test using the levene test using SPSS, all sig values are obtained more than 0.05 so it can be concluded that the data have the same variance (homogeneous).

As for the overall homogeneity test results, the values are as follows.

Table 4. Test of Homogeneity of Variances

Value			
Levene Statistic	df1	df2	Itself.
1.349	1	214	.247

Based on the homogeneity test using the levene test using SPSS, a sig value of 0.247 > 0.05 was obtained so it can be concluded that the data have the same variance (homogeneous).

3.3 Uji Paired T Test

The Paired T Test is used to compare two data in pairs. The paired T test has test criteria if the score (1,659) then there is a significant difference t>t_tabelin the average learning outcomes of students before and after. If you use the sig value, the test criteria is if the sig value < 0.05 then there is a significant difference in the average learning outcomes of students before and after.

Table 5 Paired Samples Test Control Class

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pre_Kontrol - Post_Kontrol	-7.48148	8.46486	.81453	-9.09620	-5.86677	-9.185	107	.000

From the paired t test results, a t value of 9.185 > 1.659 and a sig value of 0.000 < 0.05 were obtained. So it can be concluded that there are significant differences in the average learning outcomes of learners before and after in the Control class. The average score of the students after the treatment, better than the scores of the students before.

Table 6 Paired Samples Test Experimental Class

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pre_Eksperimen - Post_Eksperimen	-19.46296	11.02455	1.06084	-21.56595	-17.35998	-18.347	107	.000

From the paired t test results, a t value of 18.347 > 1.659 and a sig value of 0.000 < 0.05. So it can be concluded that there is a significant difference in the average learning outcomes of students before the problem-posing learning model is carried out with the Virtual Enriched Strategy and the average student learning outcomes after the problem posing learning model is carried out with the Virtual Enriched Strategy in the Experimental class . Judging from the average score of the students, the value of the learners after the application of the learning model is greater than the value of the learners before the application of the learning model in the experimental class.

3.4 Independent Test T-Test

The Independent T-Test is a comparative test to compare two mutually free samples. In the independent test T-test, the compared data were the post value of the control class and the post value of the experimental class. The independent T test has test criteria if the score (1,625) then there is a significant difference t>t_tabelin learner learning outcomes between the control class and the experiment. Adapun if using the sig value the test criteria is if the sig value < 0.05 then there is a significant difference in learner learning outcomes between the control class and the experiment. The results of the independent t test are as follows.

Table 7 Independent Sample Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Itself.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Value	Equal variances assumed	1.349	.247	-10.874	214	.000	-13.05556	1.20063	-15.42213	-10.68899
	Equal variances not assumed			-10.874	211.129	.000	-13.05556	1.20063	-15.42231	-10.68880

Based on the independent t test results, a t value of 10.874 > 1.625 and a sig value of 0.000 < 0.05. So it can be concluded that there is a significant difference in learner learning outcomes between control and experimental classes. When viewed from the average score, the value of the experimental class, which uses a problem posing learning model with a Virtual Enriched Strategy, is greater than the control class that uses ordinary learning. So it can be concluded that the application of using a problem posing learning model with the Virtual Enriched Strategy affects student learning outcomes.

Furthermore, the results of research conducted at the sample show a significant increase in learning outcomes in the experimental class, namely, the average score in the pre test was 56.3 while the average value after the post-test was 75.8. The results indicated that there was an increase in the yield of the duty of 19.5. Based on the hypothesis test (t test) showing that Ha is accepted and H0 is rejected, this shows that the problem-posing learning model with the Virtual Enriched Strategy affects student learning outcomes. The application of the problem posing learning model with the Virtual Enriched Strategy has a significant influence on the mathematics learning outcomes of class XI students in Tegal

According to [2], problem-posing is a learning that can motivate students to think critically as well as dialogically, creatively and interactively which is expressed in the form of questions, the questions are then sought for answers both individually and in groups.

Problem posing learning involves students directly in learning, the involvement of students directly in learning can promote learning activity in students, this cooperative learning will also improve the ability to work together in teams, the characteristic of cooperative learning is that students are grouped into small groups to further cooperate with discussions to complete the ability to complete it's a learning problem. With the involvement of students in this learning

activity, students can reconstruct their own learning experiences so that the material learned can be absorbed properly, finally improving the results of teaching students.

It align with the results of the research on Mathematics Learning Outcomes of Class VIII Students of SMP Negeri 13 Bengkulu City [8]. The results of the study are that the learning model has an effect on the learning outcomes obtained by students. In the posing problem that was used as a model in the study, students who had been grouped into small groups were asked to ask questions according to the material provided by the teacher, students who asked this question must be able to solve the questions asked. This within posing type posing problem guides students to be able to formulate questions into new sub-sub-questions that have a sequence of completion as previously solved.

The enriched virtual strategy was chosen because the research was during a pandemic that limited face-to-face, in addition enriched virtual strategy was chosen to attract students to learn. This virtual enriched strategy makes it easier for students to learn. If the pandemic ends, this strategy is still useful considering that in the independent curriculum, students must take PKL for 5 months so that in order for learning to continue, students can use distance learning as a solution.

4. Conclusion

Based on the research results, it was concluded that the model of teachingposing problems with virtual enriched states affects mathematics learning outcomes. This is evidenced by the average pre-test result of 56.3 to 75.8 on the average value of the post test result. This shows an increase in student learning outcomes after being given the treatment of a learning model. The application of the problem posing learning model with a virtual enruched strategy can involve students to be active in learning so that they can significantly influence their learning outcomes.

References

[1] Asfiati. Redesign of Islamic Religious Education Learning Towards the Industrial Revolution. Jakarta: Pranameedia Group; 2020.

[2] Suryosubroto. Teaching and Learning Process in Schools. Jakarta: Rhineka Cipta; 2009.

[3] Sulistianingsih E. Pengembangan Model Pembelajaran Berbasis Multimedia Untuk Meningkatkan Efektivitas Kemampuan Membaca Mahasiswa. Cakrawala J Pendidik 2018;12:112–20. https://doi.org/10.24905/CAKRAWALA.V12I2.153.

[4] Cai J, Hwang S, Silber S, Jiang C. Problem-posing research in mathematics education: Some answered and unanswered questions. Math Probl Posing From Res to Eff Pract 2015:3–34. https://doi.org/10.1007/978-1-4614-6258-3_1.

[5] Parindra W, … AS-… : JR dan, 2021 undefined. Pengaruh Model Pembelajaran Problem Posing Terhadap Hasil Belajar Siswa Pada Pembelajaran Tematik. JurnalStkippgritrenggalekAcId n.d.

[6] Siyamta S. Implementasi Strategi Blended Learning Enriched Virtual Model pada Mata Kuliah Komputer dan Media Pembelajaran Mahasiswa Pendidikan Guru Sekolah …. Semin Nas Teknol Pendidik UNS 2015 2015:1–9.

[7] Sugiyono S. Metode Penelitian Kuantitatif Kualitatif dan R&D. Alfabeta; 2013.

[8] Ulfah P, Muchlis EE, Maulidiya D. Model Pembelajaran Problem Posing Tipe Within Solution Posing Terhadap Hasil Belajar Matematika Siswa Kelas VIII SMP Negeri 13 Kota Bengkulu. J Penelit Pembelajaran Mat Sekol n.d.;1:2581–253.