KHIRANI: Jurnal Pendidikan Anak Usia Dini
Vol.1, No.2 Juni 2023
e-ISSN: 2985-9190; p-ISSN: 2985-9670, Hal 10-17

Implementation Of Problem Based Learning Models In Learning Systems Of Linear Equations Three Variables

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Abstract*. This study investigates whether the use of the Problem-Based Learning model on the Three Variable Linear Equation System increases student learning outcomes. This investigation is quasi-experimental "Quasi Experimental Design". Class X-A as an experimental class with 17 students and X-B as a control class with 17 students at SMA Negeri 2 Tondano in the odd semester of the academic year 2022/2023 comprised the study's sample. An evaluation about the material description of a three-variable system of linear equations served as the research instrument. A pretest and a posttest are used to capture data from the experimental and control groups, respectively. Using the t-test statistic to test the null hypothesis, we obtain* t_{count} *= 12.64 and* t_{table} *= 2.037 at a significance level of 0.05, thus rejecting* H_0*. The Problem-Based Learning model improved student learning outcomes, according to the study's findings.*

Keywords*: Problem-Based Learning, Models, SPLTV*

Abstrak. Penelitian ini menyelidiki apakah penggunaan model1Problem-Based Learning pada Sistem Persamaan Linear Tiga Variabel meningkatkan hasil belajar siswa. Investigasi ini adalah quasi-experimental "Quasi Experimental Design". Kelas X-A sebagai kelas eksperimen sebanyak 17 siswa dan kelas X-B sebagai kelas kontrol sebanyak 17 siswa di SMA Negeri 2 Tondano semester ganjil tahun ajaran 2022/2023 menjadi sampel penelitian. Evaluasi tentang uraian materi sistem persamaan linier tiga variabel dijadikan sebagai instrumen penelitian. Sebuah pretest dan posttest digunakan untuk menangkap data dari kelompok eksperimen dan kontrol, masing-masing. Dengan menggunakan statistik uji-t untuk menguji hipotesis nol, diperoleh t_{hitung} = 12,64 dan t_{tabel} = 2,037 pada taraf signifikansi 0,05, sehingga menolak H_0. Model Pembelajaran Berbasis Masalah meningkatkan hasil belajar siswa, menurut temuan penelitian.

Kata kunci: Model, Problem-Based Learning, SPLTV

Received Maret 30, 2023; Revised April 12, 2023; Accepted Mei 28, 2023
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INTRODUCTION

A good education will impact the quality of human resources (Mangelep, 2015; Hasanah et al., 2021). To improve the quality of education, it is necessary to have educational institutions (Mangelep, 2017; Hartinah et al., 2019). One educational institution that plays a very important role in improving the quality of human resources is the school (Lefudin, 2014; Mangelep, 2017). There are several subjects taught in schools, one of which is mathematics. Mathematics is taught at every level of education, from early childhood education, kindergarten to university level; even when working, it is not uncommon to need knowledge of mathematics to solve some problems. Mathematics also plays an important role in improving the ability to think, argue, and contribute to solving everyday problems in social life (Mangelep, 2013; Abdurrozak & Jayadinata, 2016).

Based on the results of observations, interviews and teaching in the class conducted during PLP (Introduction to Schooling Field) at the beginning of the first semester of the 2021/2022 academic year at SMA Negeri 2 Tondano, the teacher stated that there were still many students, especially for class X students who scored below the KKM (65). The students who scored below the KKM were 70% of the 34 students. Students experience many difficulties in math material related to solving problems in the form of word problems, including difficulty understanding the subject matter, identifying important elements, choosing the correct procedure, and not stating the problem in mathematical form so that students do not answer questions. Besides that, some students do not conduct the process of re-checking the answers obtained, which is the final step of the problem-solving process, and students sometimes write down the final answer without any clear procedures.

Based on information from the mathematics teacher, it is known that learning is carried out using a direct learning model. Therefore, a model is needed to improve logical thinking skills, accuracy in solving problems, skills in understanding problems, making mathematical models, solving problems, and interpreting solutions (Misrayanti, 2019).

One subject matter in class X SMA is SPLTV, which is a continuation of the previous material (SPLDV) and a form of material expansion from SPLDV. Some students had difficulties solving SPLTV word problems, especially in making a mathematical model of the given story problems. This is because students need help

understanding the SPLTV concept due to not having mastered the previous concept (SPLDV), which is closely related (Yasmin, 2013; Mangelep et al., 2020).

Based on the problems above, it is very necessary to apply innovative learning models so that they can improve student achievement. One learning model that can improve problem-solving skills is the problem-based learning (PBL) learning model (Murwanto & Sukidjo, 2015). Learning Problem-based learning (PBL) is a teaching method with a focus on problem-solving that presents contextual problems, thereby stimulating students to learn from real problems in a context that leads students to learn about critical thinking and problem-solving skills and to gain knowledge of essential concepts of the subject matter (Naja et al., 2023). This model also requires students to work in teams to solve problems (Nuryadi et al., 2017; Domu et al., 2023). With this model, it is hoped that students will gain more skills from the knowledge received and are expected to improve their learning achievement (Ramadhani & Firmansyah, 2021).

Many learning models can be used in the learning process. However, the researcher chose problem-based learning in this study because this problem-based learning model is suitable for solving problems found during previous observations.

Based on the background description above, the researcher is interested in conducting research titled "Application of the Problem Based Learning Model in Learning Three Variable Linear Equation Systems".

METHOD

The type of research is an experiment. The population when researching was all students of SMA Negeri 2 Tondano; the sample that the researcher chose was high school class X students who were taken randomly and the researchers made for the experimental class, namely class X-A totalling 17 students and the researcher made control class X-B totalling 17 students so that the total number of students as a sample of 34 students. The researcher used the pretest-posttest control design as shown in the following table:

Table 1. Pretest-Posttest Control Design Study

Group/Class	Pre-test	Treatment	Post-test
Experiment	T_1	X	T_2
Control	T_1		T_2

Information:
T_1 = Test given to students in the experimental class and control class.
T_2 = Final Test given to students in the experimental class and control class.
X = Treatment in the experimental class with the Problem-Based Learning model.
T_1 = T_2

The research procedure, namely compiling learning tools in the form of learning implementation plans (RPP) and learning modules. Giving the pretest (initial test), then giving SPLTV material by applying the problem-based learning model to the experimental class and giving SPLTV material through direct learning models to the control class and then giving a posttest to collect student results in learning. When researching, the instrument was a test of learning outcomes in the form of a description given to 2 classes, namely the control and experimental classes. In analyzing the data, the researcher used hypothesis and prerequisite testing techniques before proceeding to test the average 2 differences (t-test) for testing the prerequisite data for normality through the Liliefors test (L) and homogeneous through the Fhiser test (F).

RESULT AND DISCUSSION

This research was conducted at SMA Negeri 2 Tondano odd semester 2022/2023 in class Xa as the experimental class, namely the class that studied using the Problem-Based Learning (PBL) learning model with a total of 17 students, and Xb as the control class, namely the class that studied using direct learning with 17 students—research data obtained from the results of the pretest and posttest.

The following is a summary of the pretest and posttest data results in the experimental and control classes, which can be seen in the following table.

Table 2. Summary of data on pretest and posttest scores in the experimental class

No	Statistic	Experiment Class	
		Pre-test	**Post-test**
1	Minimum Score	20	65
2	Maximum Score	75	95
3	Sum (Σ)	830	1375
4	Average	48,82	80,88
5	Varians(s_1^2)	320.4044	72.6102
6	Standard Deviation	17,8998	8.5211

Table 3. Summary of data on pretest and posttest scores in the control class

No	Statistic	Control Class	
		Pre-test	**Post-test**
1	Minimum Score	20	50
2	Maximum Score	55	90
3	Sum (Σ)	490	1150
4	Average	28,82	67,64
5	Varians(s_1^2)	82,9044	84,7426
6	Standard Deviation	9,1051	9,3737

Based on the table above, it was found that out of 17 students in the experimental class and 17 students in the control class, the total score achieved by students in the experimental class for the pretest was 830. The posttest was 1375, with an average score of students on the pretest 48.82, and for the posttest was 80 .88 on data spread from 20 to 75 for the pretest and 65 to 95 for the posttest. Whereas in the control class, the total score achieved for the pretest was 490 and the posttest was 1145, with the average student score in the pretest being 28.82 and the posttest being 67.64 in data that spread from 20 to 55 for the pretest and 50 to 90 for the posttest. Then the results of the deviation calculation showed the standard deviation in the experimental class was 17.8998 for the pretest and 8.5211 for the posttest, and the standard deviation in the control class was 9.1051 for the pretest and 9.3737 for the posttest. The variance of the experimental class was 320.4044 for the pretest and 72.6102 for the posttest, and the control class was 82.9044 for the pretest and 84.7426 for the posttest.

The results of the posttest normality test results in the experimental class show the value of L_{count} = 0.1882 and L_{table} = 0.2071; thus, the evidence is insufficient in rejecting related H_0, which means that the score data for the posttest results of the experimental class originates from a population with a normal distribution. Then to test the normality of the posttest score data for the control class L_{count} = 0.2044 and L_{table} = 0.2071, the evidence is also insufficient in rejecting H_0, so the posttest score data for the control class originates from a population with a normal distribution.

The results of the analysis of the similarity of the 2 variants through F-test statistics for the posttest data, which has the largest variance, namely 61,401 and the smallest variance, 24,633 F_{count} = 2.4926 < F_{table} = 2.7613, it was decided that the evidence was

insufficient in order to give a rejection H_0. Thus the conclusion is that the variance of the 2 classes is homogeneous.

The test criteria used are $t_{count} > t_{table}$, then reject H_0; otherwise, if $t_{count} < t_{table}$ is not enough evidence to reject H_0. The results of the hypothesis test with a significant level of 0.05 obtained $t_{count} = 12.64$ and $t_{table} = 2.037$ because $t_{count} = 12.64 > t_{table} = 2.037$ reject H_0, which means the average result students in learning SPLTV material after using the problem-based learning model exceeds the average student results in learning by being taught using a direct learning model.

Based on the research results on class X-A (experimental class) and class X-B (control class) at SMA Negeri 2 Tondano for the 2022/2023 academic year. The material in the experimental class, namely class X-A, is a system of three-variable linear equations by applying the problem-based learning model. In general, it shows an increase in learning outcomes through the average results of the two classes, whereas the experimental class students are in class with an average student score in the pretest was 48.82 with a score of 20 to 65. 90.

Testing the hypothesis of student learning outcomes showed that there was a difference between the control class and the experimental class, namely the fundamental level alpha = 0.05 obtained $t_{count} = 12.64$ and $t_{table} = 2.037$. So, $t_{count} = 12.64 > t_{table} = 2.037$, which means that the test statistic falls within the critical area, then H_0 is rejected; This indicates that the average learning outcomes of students1who use problem-based learning models are superior to those of students who do not use problem-based learning models. Based on the preceding description, it can be concluded that the problem-based learning model produces higher typical learning outcomes than the direct learning model.

This study is supported by research conducted by Ajeng Rizki Sakinah in 2019 and titled "Application of the Problem-Based Learning (PBL) Model on Mathematical Problem-Solving Ability in SMA Negeri 2 Palembang." According to the findings of the study, 66.67 percent of students were classified as having very good problem-solving abilities, and 33.33 percent of students were classified as having good problem-solving abilities. This demonstrates that the PBL model can enhance mathematical problem-solving abilities.

Based on the hypothesis testing data, the problem-based learning model has a higher average value than the direct learning model in comparing the two learning

models. Problem-based learning also has advantages in training students' skills, honing critical, analytical, and creative thinking skills, fostering student initiative in work and efficiency, and developing interpersonal relationships in group work.

CONCLUSION

According to research on students in classes X A and X B at SMA Negeri 2 Tondano learning mathematics, particularly the Three Variable Linear Equation System material, the average student learning outcomes after applying the Problem-Based Learning model are 80.88, which is higher than the average student learning outcomes of students who do not apply the Problem-Based Learning model, which are 67.64.

REFERENCES

Abdurrozak, R., & Jayadinata, A. K. (2016). Pengaruh Model Problem Based Learning Terhadap Kemampuan Berpikir Kreatif Siswa. *Jurnal Pena Ilmiah*, *1*(1), 871-880.

Domu, I., Pinontoan, K. F., & Mangelep, N. O. (2023). Problem-based learning in the online flipped classroom: Its impact on statistical literacy skills. *Journal of Education and e-Learning Research*, *10*(2), 336-343.

Hasanah, U., Sarjono, S., & Hariyadi, A. (2021). Pengaruh Model Problem Based Learning Terhadap Prestasi Belajar IPS SMP Taruna Kedung Adem. *Aksara: Jurnal Ilmu Pendidikan. Nonformal*, *7*(1), 43-52.

Hartinah, S., & Ferdianto, F. (2019, October). Identifikasi Kesalahan Siswa Dalam Memahami Materi SPLTV. In *Prosiding Seminar Nasional Pendidikan Matematika (SNPM)* (Vol. 1, No.1, pp. 484-492).

Lefudin. (2014). *Belajar dan Pembelajaran.* Yogyakarta: Budi Utama.

Mangelep, N. (2013). Pengembangan Soal Matematika Pada Kompetensi Proses Koneksi dan Refleksi PISA. *Jurnal Edukasi Matematika*, *4*(7), 451-466.

Mangelep, N. O. (2015). Pengembangan Soal Pemecahan Masalah Dengan Strategi Finding a Pattern. *Konferensi Nasional Pendidikan Matematika-VI,(KNPM6, Prosiding)*, 104-112.

Mangelep, N. O. (2017). Pengembangan Website Pembelajaran Matematika Realistik Untuk Siswa Sekolah Menengah Pertama. *Mosharafa: Jurnal Pendidikan Matematika*, *6*(3), 431-440.

Mangelep, N. O. (2017). Pengembangan Perangkat Pembelajaran Matematika Pada Pokok Bahasan Lingkaran Menggunakan Pendekatan PMRI Dan Aplikasi GEOGEBRA. *Mosharafa: Jurnal Pendidikan Matematika*, *6*(2), 193-200.

Mangelep, N., Sulistyaningsih, M., & Sambuaga, T. (2020). Perancangan Pembelajaran Trigonometri Menggunakan Pendekatan Pendidikan Matematika Realistik Indonesia. *JSME (Jurnal Sains, Matematika & Edukasi)*, *8*(2), 127-132.

Misrayanti, M., & Amir, Z. (2019). Pengaruh Penerapan Model Pembelajaran Group Investigation terhadap Pemahaman Konsep Matematis Ditinjau dari Kemampuan Awal Matematis Siswa MTs. *JURING (Journal for Research in Mathematics Learning)*, *1*(3),207-212.

Murwanto, & Sukidjo. (2015). Peningkatan Hasil Belajar IPS Dengan Problem Based Learning Berbantuan Media Stimulan Gambar. *Harmoni Sosial: Jurnal Pendidikan IPS. 2,* 30-41).

Naja, Finsensius Yeheskiel, and Agustina Mei. (2023). "Penerapan Problem Based Learning untuk Materi Geometri Bangun Datar pada Siswa Kelas VIII SMP". *Jurnal Cendekia: Jurnal Pendidikan Matematika,* 7.1: 924-931

Nuryadi, dkk. (2017). Dasar-Dasar Statistik Penelitian. Yogyakarta: SIBUKU MEDIA.

Ramadhani, K. L., & Firmansyah, D. (2021). ANALISIS KESULITAN BELAJAR MATEMATIKA SISWA PADA MATERI SISTEM PERSAMAAN LINEAR TIGA VARIABEL (SPLTV). *MAJU: Jurnal Ilmiah Pendidikan Matematika*, *8*(1).

Sakinah, Ajeng Rizki and Cecil Hiltrimartin. (2019). *PENERAPAN MODEL PROBLEMBASED LEARNING (PBL) PADA KEMAMPUAN PEMECAHAN MASALAH MATEMATIKA DI SMA NEGERI 2 PALEMBANG.* Diss. Sriwijaya University.

Yasmin. (2013). *Strategi dan Metode dalam Model Pembelajaran.* Jakarta: Referensi GP Press Group.