The Influence of Problem-Based Learning with the Assistance of Geogebra on Student Mathematical Problem-Solving Ability

Nurjannah Samosir[1], Madyunus Salayan[2]

[1,2]*(Universitas Muslim Nusantara Al-Washliyah, Jl. Garu II No. 93 Medan, Indonesia)*

* Corresponding Author. E-mail:
[1]nurjannah.samosir123@gmail.com

Abstract

This study aims to analyze the significant effect of the Geogebra-assisted Problem Based Learning model on students' mathematical problem solving abilities and independent learning. This study uses a quantitative approach to the type of quasi-experimental research, the research design uses a Post-test Only Control Group Design. This study uses only one class. Test the hypothesis in this study using a one-way MANOVA. The sample in this study was class XI-IPA.4 SMA Negeri 1 Galang for the academic year 2022/2023 with a total of 34 students as an experimental class using Geogebra-assisted Problem Based Learning. The hypothesis testing data analysis technique uses the Manova test with the help of SPSS. The results of this study indicate, the results of the MANOVA test with Hotelling's Trace analysis show a significant value of 0.000 less than 0.05 (H0 is rejected) so it can be concluded that there is a significant influence of the Problem Based Learning model with the help of Geogebra on problem solving abilities and student learning independence .

Keywords: Problem Based Learning, Mathematical Problem Solving Ability, Student Learning Independence.

Abstrak

Penelitian ini bertujuan Untuk menganalisis pengaruh yang signifikan model Pembelajaran Problem Based Learning dengan berbantuan Geogebra terhadap kemampuan pemecahan masalah matematis dan kemandirian belajar Siswa. Penelitian ini menggunakan pendekatan kuantitatif jenis penelitian eksperimen semu (quasiexperimental research), desain penelitian menggunakan Post-test Only Control Group Design. Penelitian ini hanya menggunakan satu kelas. Uji hipotesis dalam penelitian ini menggunakan MANOVA satu jalur. Sampel dalam penelitian ini adalah kelas XI-IPA.4 SMA Negeri 1 Galang Tahun ajaran 2022/2023 berjumlah 34 orang sebagai kelas eksperimen yang menggunakan Poblem Based Learning berbantuan geogebra. Tehnik analisis data uji hipotesis menggunakan uji Manova dengan bantuan SPSS. Hasil penelitian ini menunjukkan, hasil uji MANOVA dengan analisis Hotelling's Trace menunjukkan nilai signifikan 0.000 lebih kecil dari 0,05 (H_0 ditolak) sehingga dapat disimpulkan bahwa terdapat pengaruh yang signifikan model pembelajaran *Problem Based Learning* dengan berbantuan geogebra terhadap kemampuan pemecahan masalah dan kemandirian belajar siswa.

Kata Kunci: Problem Based Learning, Kemampuan Pemecahan Masalah Matematis, Kemandirian Belajar Siswa.

Introduction

Mathematics learning aims to develop all students' mathematical abilities

in obtaining maximum mathematics learning outcomes. One way to achieve good learning outcomes is to maximize learning on students' problem-solving abilities and learning independence (Wiratmaja et al., 2014). Independence in the mathematics learning process is increasing students' problem solving abilities and skills in the learning process without the help of other people, with the aim of training students to be confident and not depend on teachers, mentors, friends or other people in learning. The demands for problem solving abilities and the development of learning independence have been included in the mathematics learning objectives in the curriculum (Nurfadilah, 2019).

The 2013 curriculum includes mathematics learning objectives, namely so that students can: 1) Understand mathematical concepts; 2) use patterns as conjectures in solving problems, and be able to make generalizations based on existing phenomena or data; 3) use reasoning on properties, carry out mathematical manipulations both in simplifying, and analyzing existing components in solving problems in mathematical and non-mathematical contexts; 4) communicate ideas, reasoning and be able to compile mathematical evidence using complete sentences, symbols, tables, diagrams or other media to clarify situations or problems; 5) have an attitude of appreciating the usefulness of mathematics in life; 6) have behavioral attitudes that are in accordance with mathematical values and learning; 7) carry out motor activities that use mathematical knowledge; 8) use simple props and technological results to carry out activities **(kemendikbud, 2014)**

Students' mathematical problem solving abilities and independent learning are still underdeveloped at SMA Negeri 1 Galang. Based on the results of tests on problem solving and problems faced by teachers in the mathematics learning process, many students still experience difficulties in solving mathematical problem solving questions independently. students are less able to do the questions correctly, students still find errors in understanding the questions and in solving problems mathematically as well as a lack of student independence in solving the questions given by the teacher. So students tend to expect help from friends or teachers in solving mathematical problems, without wanting to find out more about problem solving.

This was found in a preliminary study of problem solving abilities. In the LJK results it was found that only around 30% of students were able to complete and answer mathematics questions correctly.

Figure I. Student Work Answer Sheet
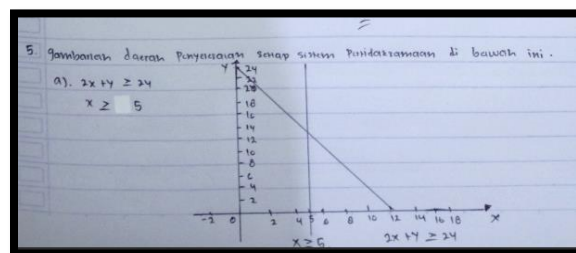
From the student LJK picture above, we can see that students' abilities in solving mathematical problems in determining the solution area are still low and students' learning independence is also still low. Because the same form of answer is still found in solving questions on students' LJK.

Seeing students' problems in problem solving abilities and the lack of student independence in solving mathematical problems, efforts are needed to create a more effective and interesting learning atmosphere that is able to increase students' mathematical problem solving abilities and learning independence. One alternative that can be chosen is to use the Problem Based Learning learning model (Sariningsih & Purwasih, 2017).

The problem based learning model is an innovative learning model that improves students' problem solving abilities and learning independence. This problem based learning model requires student activity in finding solutions to problem solving with various creative ideas so that it can improve students' ability to understand the material and develop students' thinking abilities and student independence so that learning is more meaningful (Tri Pudji Astuti, 2019).

From the problem-based learning model stage, it can be seen that students are trained to become accustomed to solving problems. The learning process begins by giving mathematical problems to students which can stimulate students to carry out investigations and analyze them to find solutions to solve problems.

In this way, this problem based learning model can encourage students to be actively involved in solving problems in learning both independently and in groups (Elita et al., 2019). In line with Setiyawati's research results in (Azizah & Granita, 2020) stated that "mathematics learning using the Problem Based Learning learning model can increase independent mathematics learning and mathematical problem solving abilities".

This model is combined with software-based learning media, and Geogebra was chosen as an aid in the mathematics learning process, considering that Geogebra is software that is easy to use. Geogebra is a dynamic geometric system, which can carry out construction with points, vectors, line segments, conic sections, as well as functions, and change the results of subsequent construction (Sutrisno et al., 2020). So Geoebra can be used as a mathematics learning medium to demonstrate or visualize mathematical concepts and as a tool to construct mathematical concepts.

Based on the description of the problem above, the aim of the researcher's research is to analyze the significant influence of the Problem Based Learning learning model with the help of Geogebra on students' mathematical problem solving abilities and learning independence.

METODE PENELITIAN

This research uses a quantitative approach, quasi-experimental research, the research design uses Post-test Only Control Group Design. This research only uses one class. Because there is more than one dependent variable in the research, the analysis used is Multivariate analysis, namely Multivariate Analysis of Variance (MANOVA). Hypothesis testing in this study used one-way MANOVA. The sample in this research is class

The instruments used in this research were test and non-test instruments. The test instrument is in the form of an essay test about problem solving abilities. Meanwhile, the non-test instrument is in the form of a learning independence questionnaire which is prepared based on learning independence indicators.

HASIL DAN PEMBAHASAN
Hasil Penelitian

This research was conducted over 8 meetings using one class as an experimental class, namely class XI IPA-4 which had 34 respondents.
The data obtained here is in the form of test data on students' problem solving abilities and learning independence in the form of a posttest and consists of 3 questions in the form of descriptions. Before conducting research, a validity test was first carried out by expert validation consisting of 3 validators.

Figure II. Problem Solving Ability Diagram
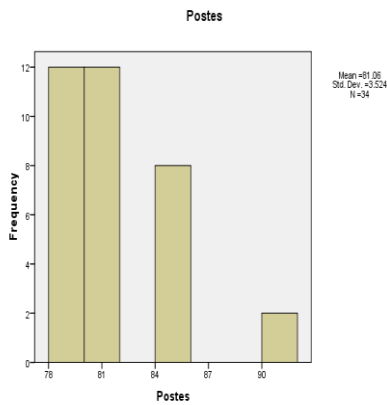
Based on the table above, it is known that the average score on the posttest is 81.06 with a standard deviation of 3,524 and the total is 2756. The table shows that the average student's mathematical solving ability is in the high category. The following are descriptive statistical results on student learning independence.

Table I.
Descriptive Statistics of Learning
Independence Questionnaire

Kemadirian Belajar		
N	Valid	30
	Missing	
Mode		98,00
Std. Deviation		13,86959
Variance		192,366
Minimum		68,00
Maximum		128,00
Sum		2884

Based on data obtained from the results of the final questionnaire on student learning independence, it can be seen that the total mode score is 98.00 with a minimum score of 68 and a maximum score of 128. This shows that student learning independence is in the high category.

Summary of normality test calculation results using SPSS. 22 is shown as below

Table II. Normality Test in Pottest

	Kolmogorov-Smirnov(a)			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
KPM	,129	30	,200(*)	,935	30	,067
K_B	,120	30	,200(*)	,971	30	,577

Based on the table above, it is known that the student's mathematical problem solving ability variable with a significant value of $0.67 > 0.05$ has a normal distribution. Meanwhile, the student learning independence variable with a significant value of $0.577 > 0.05$ is normally distributed. It can be concluded that the distribution of students' problem solving abilities and learning independence in the posttest data is normally distributed. Therefore, we will proceed to the homogeneity test stage.

Testing for homogeneity of normally distributed population variance was carried out using the SPSS application. 22. With the test criteria, if the significance value or Sig. < 0.05 then it is said that the variance of two or more population data groups is not the same (not homogeneous). Meanwhile, if the significance value or Sig. > 0.05, then it is said that the variance of two or more population groups is the same (homogeneous).

Table III. Homogenty Test

Variabel	F	df 1	Sig
KPM	0,185	1	0,669
Learning Independence	0,217	1	0,643

From the table above, it can be seen that the test results show that the variance in the mathematical problem solving ability variable has a sig value of $0.669 > 0.05$. Meanwhile, student learning independence has a sig value, namely $0.643 > 0.05$. Based on the two data above, it can be concluded that the distribution is normal and homogeneous so that it can be continued with hypothesis testing.

The hypothesis test used is the MANOVA test by looking at the Hotelling Trace. Testing was carried out with the help of the SPSS 22 for Windows program at a significance level of 5%. If the significance value is smaller than 0.05 then H0 is rejected, which means that there is a significant influence of the Geogebra-assisted Problem Based Learning model on students' problem solving abilities and learning independence.

The test statistic in the MANOVA analysis used in this research is Hotelling's Trace:

Table IV. Manova Test Results

Multivariate Tests^b

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.999	68979.014^b	2.000	75.000	.000	.999
	Wilks' Lambda	.001	68979.014^b	2.000	75.000	.000	.999
	Hotelling's Trace	835.071	68979.014^b	2.000	75.000	.000	.999
	Roy's Largest Root	835.071	68979.014^b	2.000	75.000	.000	.999
Model_Pembelajaran	Pillai's Trace	.000	25.134	8.000	152.000	.000	.498
	Wilks' Lambda	1.000	104.599^b	6.000	150.000	.000	.807
	Hotelling's Trace	.000	308.1079	6.000	148.000	.000	.926
	Roy's Largest Root	.000	631.902	3.000	76.000	.000	.961

Based on the table of MANOVA test results above, this research seen from the Hotelling's Trace analysis shows a significance value of 0.000 which is smaller than 0.05 (H0 is rejected) so it can be concluded that there are differences in problem solving abilities and independent learning taught using the problem based learning model with the help of Geogebra. . It can be concluded that the problem based learning model has a positive effect on students' problem solving abilities and learning independence with the help of Geogebra. This is in line with the research of Putu Lia Muliani, et al (2021). Using the one-way MANOVA test assisted by SPSS 22.

From the results of the analysis it is concluded as follows: (1) there is a difference in the mathematical problem solving abilities of class VII students at SMP Negeri 8 Denpasar for the 2020/2021 academic year who apply the use of Geogebra learning media and students without the media. Geogebra (2) there are differences in the learning interest of class VII students at SMP Negeri 8 Denpasar for the 2020/2021 academic year who apply the use of Geogebra learning media and (3) there are simultaneous differences in the mathematical problem solving abilities and interest in learning of class VII students at SMP Negeri 8 Denpasar 2020/2021 academic year which applies the use of Geogebra learning media.

KESIMPULAN

The results of the MANOVA test with Hotelling's Trace analysis show a significance value of 0.000 which is smaller than 0.05 (H0 is rejected) it can be concluded that there is a significant influence of the Geogebra-assisted Problem Based Learning model on students' problem solving abilities and learning independence. The suggestions given in this research are as follows: Mathematics teachers are expected to be able to use problem based learning models assisted by Geogebra in learning to improve students' mathematical problem solving abilities and learning independence. It is hoped that this research can be used as a benchmark for further research related to mathematics learning models in improving the quality and quality of education.

DAFTAR PUSTAKA

Saidul Amin. (2019). Eksistensi Kajian Tauhid. Eksistensi Kajian Tauhid Dalam Keilmuan Ushuluddin, 22, 71–83. doi: https://doi.org/10.15548/tajdid.vAzizah, N. I., & Granita, G. (2020). Pengaruh Penerapan Model Pembelajaran Problem Based Learning terhadap Kemampuan Pemecahan Masalah Matematis ditinjau dari Self-Confidence Siswa SMP/MTs. *JURING (Journal for Research in Mathematics Learning)*, *3*(4), 311–322.

Elita, G. S., Habibi, M., Putra, A., & Ulandari, N. (2019). Pengaruh Pembelajaran Problem Based Learning dengan Pendekatan Metakognisi terhadap Kemampuan Pemecahan Masalah Matematis. *Mosharafa: Jurnal Pendidikan Matematika*, *8*(3), 447–458.

Nurfadilah. (2019). Kemandirian Belajar Siswa dalam Pembelajaran Matematika. *Prosiding Sesiomadika 2019*, *2*(1), 1214–1223.

Sariningsih, R., & Purwasih, R. (2017). Pembelajaran Problem Based Learning Untuk Meningkatkan Kemampuan Pemecahan Masalah Matematis Dan Self Efficacy Mahasiswa Calon Guru. *JNPM (Jurnal Nasional Pendidikan Matematika)*, *1*(1), 163–177.

Sutrisno, S., Zuliyawati, N., & Setyawati, R. D. (2020). Efektivitas Model Pembelajaran Problem-Based Learning dan Think Pair Share Berbantuan Geogebra Terhadap Kemampuan Pemecahan Masalah Matematis. *Journal of Medives : Journal of Mathematics Education IKIP Veteran Semarang*, *4*(1), 1–9.

Tri Pudji Astuti. (2019). Model Problem Based Learning dengan Mind Mapping dalam Pembelajaran IPA Abad 21. *Proceeding of Biology Education*, *3*(1), 64–73.

Wiratmaja, C., Sadia, M., & Suastra, M. (2014). Pengaruh Model Pembelajaran Berbasis Masalah terhadap Self-Efficacy dan Emotional Intelligence Siswa SMA. *Jurnal Pendidikan Dan Pembelajaran IPA Indonesia*, *4*(1), 1–10.

22i1.282
Putrawan, B. K. (2022). Allah Tritunggal, Tauhid, Dan Firman Allah. *VIDYA WERTTA: Media Komunikasi …*, *5*, 18–28. doi: https://doi.org/10.32795/vw.v5i2.3357

Purba, Hadis. Salamuddin (2016). Buku Teologi Islam Ilmu Tauhid_2. 5. Medan: Perdana Publishing.

Fitri, Amalia. Astri Widyaruli Anggraeni (2017). Semantik dan Contoh Analisis

Aqidatul Muslimin. (2016). Tersedia pada: https://www.darulfatwa.org.au/en/terjemahan-aqidatul-muslimin-2/ (Diakses: 11 February 2023).

Basyir, D. (2014). Tauhid Kalami (Aqidah Islam). 1–205.

A Muzammil Alfan Nasrullah. (2019).

Pengantar Ilmu Tauhid. Duta Media Publishing

Hasan Bin Ahmad, 1989. *"Kitabut Tasrif."*: Penerbit Rabhan Bangil

Muhammad Ahmad Khalafallah, Abdul Halim Montaser dkk. 2004. *"Al-Mu`jam Al-Wasit."*

Achmad Warson Munawwir dan Muhammad Fairuz, 2007. *"Al-Munawwir."* : Penerbit Pustaka Progressif

Dihyat Haniful Fahwad, 1956. *"Al-Munjid Fii Al-Lughah."* : Penerbit Daarul Masyriq Beirut Lebanon

Ahmad Mukhtar Umar, 2008. *"Mu`jamul Lughah Al-Arabiyah Al Muashiroh."* : Penerbit PT Alamul Kutub, Kairo Mesir

Abu Khalid. *"Kamus Bahasa Arab Al-Huda."*. Surabaya: Fajar Mulya

https://www.almaany.com/dicpdf.php?language=indonesian. Diakses: 10 Januari 2023

Y.R Taher (2017). Konsep Tauhid Menurut Syeikh Nawawi Al Bantani. doi: https://doi.org/10.15575/jaqfi.v2i1.4251

Sunoto "Nilai-Nilai Pendidikan Tauhid Dalam Surat Al-Fatihah", Skripsi, Jurusan Pendidikan Agama Islam Fakultas Tarbiyah, STAIN Surakarta 2010

Teungku Muhammad Hasbi Ash-Shidieqy, Sejarah dan Pengantar Ilmu Tauhid/ Kalam, (Semarang: PT. Pustaka Rizki Putra, 2002), hal 1

Sachiko Murata dan William C. Chitthik, Trilogi Islam (Islam, Iman dan Ikhsan), penerjemah: Ali hasybi,(Jakarta: PT. Raja Grafindo Persada, 1997), hal. 14

Musa Asy'arie, Filsafat Islam: Sunah Nabi dalam Berpikir, (Yogyakarta: Lesfi, 1999), hal. 170

Shalih bin Fauzan al-Fauzan, Kitab Tauhid, (Jakarta: Ummul Quro, 2016), 43.

Jauziyah (al), Ibnu Qoyyim. 1398 H. al-Qasha'id an-Nuniyah. Pakistan: Idarah

Turjuman as-Sunnah.

Syeikh Muhammad Bin Abdul Wahhab, 2002. *"Fathul Majid Syarah Kitabut Tauhid" :* Penerbit Universitas Muhammadiyah Surakarta

Manqur Abd Al-Jalil, Ilm Al-Dalalah: Ushuluhu WaMabahitsuhuFi AlTurats Al-Arabi, (Dimasyq: Mansyurat Ittihad Al-Kitab Al-Arabi, 2001), 13.

Chaer,Abdul. Linguistik Umum, Jakarta: Rineka Cipta, cet. 2, 2003

Abdul Karīm Mujâhid, al-Dalâlah al-Lughowiyah 'inda al-'Arab, t.t), h. 10-11

Ahmad Mukhtar, Umar, Ilmu Dilalah, Kairo: Alam Al-Kutub, 1998, hal 11

(T. Fatimah Djajasudarma, Semantik 1: Pengantar ke Arah Ilmu Makna,Bandung: Erasco, 1993, hal. 1) (Thoshihiko Izutsu, Konsep-Konsep Etika Religius dalam Al-Qur'an, (Yogyakarta, PT. TiaraWacana, 1993), hlm. 43)

(Henry Guntur Tarigan, Pengajaran Semantik, Bandung: Angkasa, 1995)

Muhammad Abdul Rauf. (2018). "Semantics of the Qur'an in the Light of Fakhr Al-Din Al-Razi's Exegesis." International Journal of Linguistics, Literature and Translation, 1(3), 178-185

(Farid Audh Haidar, Ilm al-Dilâlah Dirâsah Nazhariyyah wa Tathbiqiyyah, Kairo: Maktabah al-Nahdhah al-Mishriyyah, 1999, hal. 12.;Aminuddin, Semantik; Pengantar Studi Tentang Makna, Bandung: Sinar Baru, 1988, hal. 15.)