

THE EFFECT OF USING GEOGEBRA ASSISTED STAD TYPE LEARNING MODEL ON PROBLEM SOLVING ABILITY AND MATHEMATICAL DISPOSITION

Hardika Saputra¹

¹Dosen Prodi Pendidikan Guru Madrasah Ibtidaiyah,
Institut Agama Islam Agus Salim Metro
hardhika@iai-agussalimmetro.ac.id

Abstract

This study aims to analyze the effect of the geogebra-assisted STAD type cooperative learning model on improving geometric problem solving and mathematical disposition skills. The population in this study was the fifth grade students of SD Muhammadiyah Metro for the academic year 2021/2022 as many as 104 students spread into 3 classes. This study used quasi-experimental research with a non-equivalent pretest and posttest group design. With the sampling technique selected from 3 classes that have the same relative average math scores then taken randomly. Class V Ar Rahman was chosen as the class that uses cooperative learning type STAD assisted by geogebra and class V Al Haq as the class that uses direct learning. The data collection technique used a mathematical disposition test and questionnaire. Tests and questionnaires were given at the beginning of learning (pretest) and at the end of learning (posttest). After that the data were analyzed using the t-test formula. The results showed that students who received STAD cooperative learning with the help of geogebra had higher geometric problem solving abilities and mathematical dispositions than students who received direct learning. So it can be concluded that the application of geogebra-assisted STAD cooperative learning has an effect on increasing students' geometric problem solving abilities and mathematical dispositions

Keywords: STAD, Geogebra, Problem Solving, Mathematical Disposition

Abstrak

Penelitian ini bertujuan untuk menganalisis pengaruh model pembelajaran kooperatif tipe STAD berbantuan geogebra terhadap peningkatan keterampilan pemecahan masalah geometri dan matematika. Populasi dalam penelitian ini adalah siswa kelas V SD Muhammadiyah Metro tahun ajaran 2021/2022 sebanyak 104 siswa yang tersebar dalam 3 kelas. Penelitian ini menggunakan penelitian eksperimen semu dengan non-equivalent pretest and posttest group design. Dengan teknik sampling dipilih dari 3 kelas yang memiliki rata-rata nilai matematika relatif sama kemudian diambil secara acak. Kelas V Ar Rahman dipilih sebagai kelas yang menggunakan pembelajaran kooperatif tipe STAD berbantuan geogebra dan kelas V Al Haq sebagai kelas yang menggunakan pembelajaran langsung. Teknik pengumpulan data menggunakan tes disposisi matematis dan angket. Tes dan angket diberikan pada awal pembelajaran (pretest) dan pada akhir pembelajaran (posttest). Setelah itu data dianalisis dengan menggunakan rumus uji-t. Hasil penelitian menunjukkan bahwa siswa yang mendapatkan pembelajaran kooperatif tipe STAD dengan bantuan geogebra memiliki kemampuan pemecahan masalah geometrik dan disposisi matematis yang lebih

tinggi dibandingkan siswa yang mendapatkan pembelajaran langsung. Sehingga dapat disimpulkan bahwa penerapan pembelajaran kooperatif tipe STAD berbantuan geogebra berpengaruh terhadap peningkatan kemampuan pemecahan masalah geometrik dan disposisi matematis siswa.
Kata kunci: STAD, Geogebra, Pemecahan Masalah, Disposisi Matematika

INTRODUCTION

Permendiknas number 22 of 2006 states that mathematics is a basic science that is very important to learn at every level education in Indonesia. But in reality math lessons is quite a difficult lesson. According to Research and Development Data assessment published by the Organization for Economic Cooperation and Development (OECD) through the Program for International Student Assessment (PISA) since 2000 Indonesia has always been in a position below the average international. In 2000 Indonesia was ranked 39th out of 41 countries, in 2003 it was ranked 38th out of 40 countries, in 2006 is ranked 50th out of 56 countries, in 2009 was ranked 61th from 65 countries, in 2012 it was ranked 64th out of 65 countries, in 2015 it was ranked 64th, and in 2020 it was ranked 74th.¹

Based on data obtained from the Ministry of Education and Culture Balitbang website absorption of the results of the national exam for the year of high school mathematics in The ability tested related to geometry has a high absorption capacity smallest compared to the absorption capacity of other abilities. Some of the problems found in the field stated that students have difficulty when faced with geometric problems that the solution is quite complex. Whereas in mathematics problem solving is a very important part of the mathematics curriculum. National Council of Teachers of Mathematics (NCTM) states that problem solving is not just the goal of learning mathematics but is also the main tool for doing or working in mathematics. Furthermore, National Council of Teachers of Mathematics (NCTM) states that solving problem is the focus of learning mathematics, because solving Problems are a means of learning mathematical ideas and skills.² Problem solving ability is one of the skills that must be developed in learning mathematics. Van de Walle who states that the National Council of Teachers of Mathematics (NCTM) define problem solving as one of the five standard processes school math. Therefore,

¹ Balitbang. Survei Internasional PISA. Diambil 25 Februari 2020 dari situs World Wide Web <http://litbang.kemdikbud.go.id/index.php/survei-internasional-pisa>. (2013).

² National Council of Teachers of Mathematics (NCTM). Principles and Standars for School Mathematics. Reston, V.A: National Council of Teachers of Mathematics. 2000

problem solving is one of the the main purpose of mathematics education and an important part of the activity mathematics.³

Learning mathematics, especially on the subject of geometry, does not only intended to develop cognitive aspects, but also intended to develop the affective aspect, namely the mathematical disposition. Ruseffendi found that there are many people who after learning math even the simple parts are not understand, even many concepts are misunderstood. Mathematics considered a difficult, complicated and deceptive science, causing students' attitudes towards mathematics are not good.⁴

The use of geogebra in learning mathematics in class will always end with understanding deep in geometry.⁵ Disposition Mathematics is one of the factors that determine the success of learning student. Students need a disposition that will make them persistent face more challenging problems, to take responsibility for their own learning process, and to develop good habits in mathematics.⁶ Cooperative learning type STAD is a the simplest cooperative learning. Besides, it can be used to provide understanding of difficult material concepts to students where the material has been prepared by the teacher through a worksheet or device other learning.⁷ The selection of the type cooperative method can be the right choice for geometry learning. This method was chosen because of its effectiveness when collaborated with computer-assisted learning.

In general, this study aims to obtain objective information what is the effect of geogebra - assisted STAD cooperative learning. On the ability to solve problems in geometry and mathematical disposition. Specifically, this study aims to analyze the increase in geometry problem solving ability of students who use Geogebra-assisted STAD type cooperative learning compared to direct learning and analyze the improvement of students' mathematical disposition which uses geogebra-assisted STAD type cooperative learning compared to direct learning.

³ J.A. Van de Walle. Matematika Sekolah Dasar dan Menengah Pengembangan Pengajaran Edisi Keenam jilid 1. (Jakarta: Erlangga, 2008).

⁴ Muhammad Fu'ad. Pembelajaran Geometri Berbantuan Wingeom Melalui Model Kooperatif Tipe STAD Untuk Meningkatkan Kemampuan Spasial dan Disposisi Matematis Siswa. (Bandung: Tesis S2 UPI, 2013).

⁵ Ahmad Shulhany, dkk. Abstraksi Siswa SLTA Pada Materi Dimensi Tiga Dengan Bantuan Geogebra. Jurnal Penelitian dan Pembelajaran Matematika. Universitas Sultan Agung Tirtayasa, Vol 7, No 2, 31-42. (2014).

⁶ Nila Kesumawati. Peningkatan Kemampuan Pemahaman dan Pemecahan Masalah serta Disposisi Matematis Siswa SMP Melalui Pendekatan Pendidikan Matematika Realistik. (Palembang: Tesis S2, Jurusan Pendidikan Matematika FKIP Universitas PGRI Palembang, 2009)

⁷ Widyantini. Penerapan Pendekatan Kooperatif Tipe STAD dalam Pembelajaran Matematika di SMP. (Yogyakarta: P4TK Matematika, 2008).

LITERATURE REVIEW

1. Cooperative Learning

Cooperative learning is a series of learning activities carried out by students in certain groups to achieve the learning objectives that have been formulated. As explained by Rusman that cooperative learning is a form of learning in which students learn and work in small groups collaboratively whose members consist of four to six people with a heterogeneous group structure.⁸

2. Cooperative Type STAD

STAD is the simplest cooperative learning. According to Slavin STAD is the most studied variation of cooperative learning. This model is also very easy to adapt, it has been used in learning mathematics.⁹ The sequence of STAD cooperative learning activities consists of several steps, namely; (a) Students are grouped into study groups consisting of 4-5 students, who differ in terms of ability, gender, and ethnicity. (b) The teacher presents (delivered) the lesson. (c) Students study in their respective groups to understand or master the subject matter. (d) Each student independently takes a test or quiz about the subject matter. (e) The score obtained by each student is compared with the previous average score and then look for the increase in value.¹⁰

3. Problem Solving Ability

According to Reys, et al the problem is a situation where a person wants something, but does not know immediately what to do to get it. According to Polya there are four steps in problem solving, namely (a) understanding the problem, (b) making a resolution plan, (c) implementing a settlement plan and (d) rechecking the answers obtained.¹¹

4. Mathematical Disposition

According to Sumarmo mathematical disposition is a strong desire, awareness and dedication in students to learn mathematics and carry out various mathematical activities. As for measuring students' mathematical disposition, several indicators are needed.¹² According to Kilpatrick, et al to measure students' mathematical disposition the indicators used are (a) showing passion/enthusiasm in learning mathematics, (b) showing serious attention in learning

⁸ Rusman. Model Model Pembelajaran Mengembangkan Profesionalisme Guru. (Jakarta: Raja Grafindo Persada, 2012)

⁹ Robert E Slavin. Cooperative Learning: Teori, Riset dan Praktik. (Bandung: Nusa Media, 2005)

¹⁰ Jarnawi Afgani Dahlan. Analisis Kurikulum Matematika. (Jakarta: Universitas Terbuka, 2011)

¹¹ Akbar Sutawidjaja dan Jarnawi Afgani Dahlan. Pembelajaran Matematika. (Jakarta: Universitas Terbuka, 2011)

¹²Utari Sumarmo. Pembelajaran Matematika Berbasis Pendidikan Karakter. Diambil 02 Maret 2022 dari situs World Wide Web <http://publikasi.stkipsiliwangi.ac.id/files/2012/11/Prof.-Dr.-Utari-Sumarmo.pdf>. 2010.

mathematics, (c) showing persistence in dealing with problems (d) showing confidence in learning and solving problems, (e) showing high curiosity (f) showing the ability to share with others.¹³

5. Geogebra

Geogebra is dynamic mathematics software that can be used as a tool in learning mathematics. This software was developed for learning mathematics in schools by Markus Hohenwarter at Florida Atlantic University. According to Lavicza a number of studies have shown that geogebra can encourage students discovery and experimentation processes in the classroom. Based on Embacher's research students get more benefits from the geogebra program.¹⁴

RESEARCH METHOD

The research used is a quasi-experimental research with form of pretest and posttest non equivalent group design (group design not equivalent to pretest and posttest) to students of Muhammadiyah elementary School Metro. This study consisted of an experimental group and a group control. The experimental group received treatment using the model Geogebra assisted STAD type cooperative learning. While the group control was given treatment using direct learning. chart of The research design in question can be described as follows:

$O_1 \text{ X } O_2$ $O_1 \text{ X}_1 \text{ O}_2$	
O_1 / O_2	: Pretes / Postes
X	: Geogebra assisted STAD
X_1	: Direct learning

Determination of the sample is done by using a purposive sampling technique, namely the sampling technique based on certain considerations. The selection of the class to be used is done based on the value of daily test in mathematics. The average ability of students in each classes have relatively the same ability. Then class determination experiment and control using lottery

¹³ Yanto Permana. Mengembangkan Kemampuan Pemahaman, Komunikasi dan Disposisi Matematis Siswa SMA Melalui Model-Eliciting Activities. (Bandung: Disertasi Program Doktor UPI. Tidak Dipublikasikan. 2010)

¹⁴ Hohenwarter dkk. Teaching and Learning Calculus with Free Dynamic Mathematics Software GeoGebra. Diambil 20 Maret 2022, dari situs World Wide Web <http://www.geogebra.org/publications/2008-ICME-TSG16-Calculus-GeoGebra-Paper.pdf>. (2008).

method. After done draw, it is found that class V Ar Rahman uses cooperative learning geogebra assisted STAD type and class V Al Haq using learning direct.

RESULTS AND DISCUSSION

In general, this study aims to determine whether obtain information to what extent the effect of the type cooperative learning model Geogebra -assisted STAD for geometric problem solving skills and mathematical disposition of high school students. In particular, this research aims to analyze the improvement of students geometric problem solving abilities using geogebra assisted STAD type cooperative learning compared to direct learning, and analyze the improvement students' mathematical disposition using STAD type cooperative learning geogebra-assisted compared to direct learning. In this study, two hypotheses were proposed:

Hypothesis Testing 1:

Based on hypothesis 1 proposed in this study, then hypothesis 1 which will be tested are:

$H_0 : \mu_1 \leq \mu_2$: The improvement of geometry problem solving ability of students using STAD cooperative learning with geogebra-assisted type is less than or the same as students who use direct learning.

$H_1 : \mu_1 > \mu_2$: The improvement of students geometry problem solving ability using STAD cooperative learning with geogebra-assisted type is higher than students using direct learning.

The criteria for testing hypothesis 1 is to reject H_0 with a significance $\alpha = 0,05$ level if the value of t count $>$ t table, and accept H_0 , if the value of t count $<$ t table.

Hypothesis Testing 2:

Based on hypothesis 2 proposed in this study, then hypothesis 2 which will be tested are:

$H_0 : \mu_1 \leq \mu_2$: The increase in the mathematical disposition of students using STAD cooperative learning with the help of geogebra was less than or equal to that of students using direct learning.

$H_1 : \mu_1 > \mu_2$: The increase in the mathematical disposition of students who use STAD cooperative learning with geogebra-assisted type is higher than students who use direct learning.

The criteria for testing hypothesis 2 is to reject H_0 with a significance $\alpha = 0,05$ level if the value of $t_{count} > t_{Table}$, and accept H_0 , if the value of $t_{count} < t_{Table}$. Hypothesis testing using the significance level $\alpha = 0,05$.

Aspect	Class	Mean	St. Dev	T_{count}	T_{Table}	Conclusion
Problem Solving	Direct Learning	0,7268	0,096764	2,495	1,955469	Reject H_0
	STAD <i>geogebra</i>	0,67286	0,117688			
Mathematical Disposition	Direct Learning	0,5383	0,16799	3,455	1,955469	Reject H_0
	STAD <i>geogebra</i>	0,3854	0,20068			

Based on the statistical calculations above, it can be concluded that improvement of geometric problem solving ability and mathematical disposition on the geogebra -assisted STAD type cooperative learning is higher compared to an increase in geometric problem solving skills and mathematical disposition of direct learning. In cooperative learning STAD type with the help of geogebra students can interact more to solve the problem to be solved. If there are students who have not understand and master the learning then other students who already understand and mastering learning can help. With more interact with other students, learning will be more effective and make students better at understanding learning given so that it can automatically help students in solve the problem at hand. It is as described by Eminingsih states that cognitive development is mostly depends on how far the child manipulates and is active in interacting with the environment. Further Vygotsky) argues that social interaction, namely the individual's interaction with other students, is the most important factor that encourages or triggers students' cognitive development.¹⁵

Geogebra has a good contribution to the learning of geometry. With the help of geogebra students can be more expressive in discussing solve existing problems. Geogebra helps students to be more explore and experiment with their group mates so that each students will gain a better understanding of geometric concepts three dimensions. This is as explained by Kariadinata who states that computers can guide students from simple to complex. Through a computer program can provide access students to analyze and explore mathematical concepts, so that students gain a

¹⁵ Eminingsih. . Peningkatan Hasil Belajar Matematika Melalui Pembelajaran Kooperatif Tipe STAD pada Siswa Kelas VII E SMP Negeri 3 Batang. Jurnal Lembaran Ilmu Kependidikan, Vol 42, No. 1, 29-35. (2013)

better understanding of the concept.¹⁶ This matter as explained by Lavicza a number of research shows that geogebra can drive the process of discovery and student experimentation in class.¹⁷ In geogebra assisted STAD type cooperative learning, in learning, students will discuss with other students in their groups and solve mathematical problems given seriously, confident, persistent, responsible and have a high curiosity to find new things in understanding mathematical concepts studied. With the learning process using cooperative type Computer-assisted STAD will make students more active and improve their students' mathematical disposition.

This is as concluded by Fu'ad in his research which states that "the mathematical disposition of students who get geometry learning assisted by the Wingeom program through STAD type cooperative learning is better than students who get conventional learning".¹⁸ When solving student geometry problems discuss using the help of geogebra so that it is easier for students understand and solve the given problem. In this way students will more enthusiastic in understanding and solving the problems given. This proves that geogebra which is collaborated with learning STAD cooperative type has a very good contribution to the disposition student mathematics. According to Yuliardi in his research concluded that: that learning mathematics by using geogebra can grow students interest in learning mathematics.¹⁹ Then Rahman stated that geogebra-assisted learning has positive benefits for teachers and students.²⁰

From the data and description above, we can see that: Improved student's geometry problem solving ability using geogebra-assisted STAD type cooperative learning more high compared to students who use learning direct. And improved mathematical disposition of students who use learning geogebra-assisted STAD cooperative type is higher than students who use direct learning.

¹⁶ Rahayu Kariadinata. Kemampuan Visualisasi Geometri Spasial Siswa Madrasah Aliyah (MAN) Kelas X Melalui Program Pembelajaran Mandiri. *Jurnal Edukasi Matematika*, Vol 1, No 2, 73-85. (2010).

¹⁷ Hohenwarter dkk. Teaching and Learning Calculus with Free Dynamic Mathematics Software GeoGebra. Diambil 20 Maret 2022, dari situs World Wide Web <http://www.geogebra.org/publications/2008-ICME-TSG16-Calculus-GeoGebra-Paper.pdf>. (2008).

¹⁸ Fu'ad, Muhammad. Pembelajaran Geometri Berbantuan Wingeom Melalui Model Kooperatif Tipe Stad Untuk Meningkatkan Kemampuan Spasial dan Disposisi Matematis Siswa. (Bandung: Tesis S2, Universitas Pendidikan Indonesia, 2013).

¹⁹ Ricki Yuliardi. Pembelajaran Matematika Berbantuan Software Geogebra Dengan Model Pembelajaran Technologically-Based Guided Inquiry (TBGI), Technologically Aligned Classroom (TAC) dan Technologically Misaligned Classroom (TMC) Untuk Meningkatkan Spatial Ability dan Kemampuan Komunikasi Matematis. (Bandung: Tesis S2 UPI, 2013)

²⁰ Rahim Rahman. Pengaruh Pembelajaran Berbantuan Geogebra Terhadap Kemampuan Berpikir Kreatif dan Self-Concept Siswa (Studi Kuasi Eksperimen Pada Siswa Salah Satu SMP Negeri di Jakarta). (Bandung: Tesis S2 UPI. 2010).

CONCLUSION

Based on the results of research and analysis in the previous section regarding problem solving ability and mathematical disposition, in general students who received geogebra-assisted STAD-type cooperative learning problem solving ability and mathematical disposition is better than with direct learning. More specifically, from this research, it was obtained the following conclusions: Improved student's geometry problem solving ability using geogebra assisted STAD type cooperative learning, higher than direct learning. And improved mathematical disposition of students who use learning Geogebra -assisted STAD cooperative type is higher than with direct learning.

BIBLIOGRAPHY

- Balitbang. (2013). Survei Internasional PISA. Diambil 25 Februari 2020 dari situs World Wide Web <http://litbang.kemdikbud.go.id/index.php/survei-internasional-pisa>
- Dahlan, Jarnawi Afgani. (2011). Analisis Kurikulum Matematika. Jakarta: Universitas Terbuka
- Eminingsih. (2013). Peningkatan Hasil Belajar Matematika Melalui Pembelajaran Kooperatif Tipe STAD pada Siswa Kelas VII E SMP Negeri 3 Batang. Jurnal Lembaran Ilmu Kependidikan, Vol 42, No. 1, 29-35.
- Fu'ad, Muhammad. (2013). Pembelajaran Geometri Berbantuan Wingeom Melalui Model Kooperatif Tipe Stad Untuk Meningkatkan Kemampuan Spasial Dan Disposisi Matematis Siswa. Bandung: Tesis S2, Universitas Pendidikan Indonesia.
- Hohenwarter, M., Hohenwarter, J., Kreis, Y., & Kreis, Z. (2008). Teaching and Learning Calculus with Free Dynamic Mathematics Software GeoGebra. Diambil 20 Maret 2022, dari situs World Wide Web <http://www.geogebra.org/publications/2008-ICME-TSG16-Calculus-GeoGebra-Paper.pdf>
- Kariadinata, Rahayu. (2010). Kemampuan Visualisasi Geometri Spasial Siswa Madrasah Aliyah (MAN) Kelas X Melalui Program Pembelajaran Mandiri. Jurnal Edukasi Matematika, Vol 1, No 2, 73-85.
- Kesumawati, N. (2009). *Peningkatan Kemampuan Pemahaman dan Pemecahan Masalah serta Disposisi Matematis Siswa SMP Melalui Pendekatan Pendidikan Matematika Realistik*. Palembang: Tesis S2, Jurusan Pendidikan Matematika FKIP Universitas PGRI Palembang.
- National Council of Teachers of Mathematics (NCTM). (2000). Principles and Standars for School Mathematics. Reston, V.A: National Council of Teachers of Mathematics
- Permana, Yanto. (2010). Mengembangkan Kemampuan Pemahaman, Komunikasi dan Disposisi Matematis Siswa SMA Melalui Model-Eliciting Activities. Bandung: Disertasi Program Doktor Universitas Pendidikan Indonesia. Tidak Dipublikasikan.
- Rahman, Rahim. (2010). Pengaruh Pembelajaran Berbantuan Geogebra Terhadap Kemampuan Berpikir Kreatif dan Self-Concept Siswa (Studi Kuasi Eksperimen Pada Siswa Salah Satu SMP Negeri di Jakarta). Bandung: Tesis S2, Universitas Pendidikan Indonesia.

Hardika Saputra : The Effect of Using Geogebra Assisted STAD Type Learning Model on Problem Solving Ability and Mathematical Disposition

- Rusman. (2012). Model Model Pembelajaran Mengembangkan Profesionalisme Guru. Jakarta: Raja Grafindo Persada
- Shulhany, Ahmad. Sukirwan., dan Syamsuri. (2014). Abstraksi Siswa SLTA Pada Materi Dimensi Tiga Dengan Bantuan Geogebra. Jurnal Penelitian dan Pembelajaran Matematika. Universitas Sultan Agung Tirtayasa, Vol 7, No 2, 31-42.
- Slavin, Robert E. (2005) Cooperative Learning: Teori, Riset dan Praktik. Bandung: Nusa Media.
- Sumarmo, Utari. (2010). Pembelajaran Matematika Berbasis Pendidikan Karakter. Diambil 02 Maret 2020 dari situs World Wide Web <http://publikasi.stkipsiliwangi.ac.id/files/2012/11/Prof.-Dr.-Utari-Sumarmo.pdf>
- Sutawidjaja, Akbar and Dahlan, Jarnawi Afgani. (2011). Pembelajaran Matematika. Jakarta: Universitas Terbuka
- Van de Walle, J.A. (2008). *Matematika Sekolah Dasar dan Menengah Pengembangan Pengajaran Edisi Keenam jilid 1*. Jakarta: Erlangga
- Widyantini. (2008). Penerapan Pendekatan Kooperatif Tipe STAD dalam Pembelajaran Matematika di SMP. Yogyakarta: P4TK Matematika
- Yuliardi, Ricki. (2013). Pembelajaran Matematika Berbantuan Software Geogebra Dengan Model Pembelajaran Technologically-Based Guided Inquiry (TBGI), Technologically Aligned Classroom (TAC) dan Technologically Misaligned Classroom (TMC) Untuk Meningkatkan Spatial Ability dan Kemampuan Komunikasi Matematis. Bandung: Tesis S2, Universitas Pendidikan Indonesia.