ISSN (print) : 2722-2934
ISSN (online): 2722-3043

BUBUNGAN TINGGI
JURNAL PENGABDIAN MASYARAKAT

Jurnal Pengabdian Masyarakat

The Use of Tangram Teaching Aids in Learning Plane Geometry for 8th-Grade Students

Rini Utami[1], Dewi Azizah[1], Amalia Fitri[1], Muhamad Najibufahmi[1,*], Dewi Mardhiyana[1], Nurina Hidayah[1], Sayyidatul Karimah[1], and Dwi Ario Fajar[2]

[1]Mathematics Education Study Program, Faculty of Teacher Training and Education
Universitas Pekalongan, Pekalongan, Indonesia

[2]English Language Education Study Program, Faculty of Teacher Training and Education
Universitas Pekalongan, Pekalongan, Indonesia

*muhamadnajibufahmi@yahoo.com

Abstract: Our activity aims to assist 8th-grade students at SMP Plus Muhammadiyah Doro in learning Geometry using tangram teaching aids. This is related to the lack of enthusiasm some students feel during the learning process, especially in Geometry. The community service activity was carried out through planning, implementation, and evaluation stages, using lectures, discussions, experiments, and demonstrations. The instruments used include questionnaires given to students before and after the activity. The results of this activity show that: 1) almost all students contend that teachers now need tangrams to help in explaining teaching materials in Plane Geometry; 2) almost all students are interested in the tangrams, which is due to their ease of making and using; 3) almost all students contend that tangrams can help them to train their understanding of mathematical concepts, especially in plane figures; 4) most students believe that tangrams can enhance their motivation to learn.

Keywords: conceptual understanding; learning motivation; plane geometry; tangram

Received: 10 October 2023 **Accepted**: 16 January 2024 **Published***:* 7 March 2024
DOI : https://doi.org/10.20527/btjpm.v6i2.10395

How to cite: Utami, R., Azizah, D., Fitri,A., Najibufahmi,M., Mardhiyana,D., Hidayah, N., Karimah, S., & Fajar, D. A. (2024). Penggunaan alat peraga tangram pada pembelajaran geometri bangun datar bagi siswa kelas 8 smp. *Bubungan Tinggi: Jurnal Pengabdian Masyarakat*, 6(2), 300-309.

INTRODUCTION

The government mandates that mathematics learning be carried out at every education level in Indonesia. This is reinforced by the national education goals, which are to develop thinking skills and shape the character of learners in order to educate the nation (Undang-Undang No. 20 Tahun 2003 tentang Sistem Pendidikan Nasional, 2003).In mathematics learning, teachers train students' thinking and logic skills. However, to achieve the national education goals above (especially learning goals), many aspects of cognitive, affective, and psychomotor domains must be considered. Furthermore, students' abilities trained and developed during mathematics learning should ideally be applicable in daily life(Anggreini & Priyojadmiko, 2022).

The implementation of mathematics learning must be adjusted to the curriculum in place at the school. This is done to make learning more effective for developing students' abilities and to achieve learning goals (Undang-Undang No. 20 Tahun 2003 tentang Sistem Pendidikan Nasional, 2003). Motivated by the COVID-19 pandemic, from 2022 to 2024, the government introduced several types of curricula: the 2013, emergency, and Merdeka Belajar curricula. For now, most educational institutions are still given the right to choose one of the three types of curriculum (Sari et al., 2023).

One of the subjects in the field of Mathematics that must be studied at the Junior High School level is Geometry. Specifically, Plane Geometry is studied by 8th-grade students. The topics studied for the 2013 Curriculum and the Merdeka Belajar curriculum are triangles and quadrilaterals (Tim Gakko Tosho, 2021). Brumfield in Wardhani (2020) stated that, by studying geometry, students can at least train their logic and think in a structured manner.

There are many ways to make mathematics learning more effective. One of them is using learning media, especially mathematical teaching aids. According to (Nurrita, 2018), learning media is a tool used in learning to convey messages more clearly and achieve learning goals. Some educational researchers believe that teaching aids are one of the learning media. One of them (Estiningsih, 1994) considers teaching aids to be learning media that carry characteristics of the concepts being learned. This means that teaching aids should be adjusted to the material being discussed. By demonstrating teaching aids, teachers can explain mathematical concepts in the material or subject matter more easily understood by students (Sudarwanto & Hadi, 2014).

SMP Plus Muhammadiyah Doro is one of the junior high schools in Kab. Pekalongan, which has a B accreditation. This school is located at Dukuh Tembelang Kulon RT. 005 RW. 001, Desa Rogoselo, Kec. Doro, Kab. Pekalongan. The school is integrated with the Muhammadiyah Rogoselo Quranic Boarding School. Islamic values are highly emphasized in implementing the 2013 curriculum at this school.

Based on the results of discussions with teachers of SMP Plus Muhammadiyah Doro on August 2, 2023, mathematics teachers still find it difficult to provide media facilities, especially teaching aids, to explain mathematics material to their students. The difficulties are due to several factors, ranging from the lack of school equipment facilities to the teacher's knowledge of the diversity or variety of mathematical teaching aids. Based on this, the authors' team tried to distribute questionnaires to 8th-grade students to obtain data to analyze teaching aid needs on August 2-3, 2023. Several phenomena experienced by 8th-grade students of SMP Plus Muhammadiyah Doro were found, which can be used as guidelines in formulating the problem, (1) 88% of students believe that teaching aids are important in mathematics learning, (2) 67% of students feel that the teaching aids used by mathematics teachers are relatively unattractive, and (3) 67% of students feel that the teaching aids used by mathematics teachers are still not varied.

The above findings underlie the author's team's attempt to introduce teaching aids to the school's students. One teaching aid that can be used to explain Plane Geometry material is tangram (Sarah & Lathifaturrahmah, 2017). This teaching aid is widely known to increase children's enthusiasm for understanding geometric concepts (plane figures and solids) (Bohning & Althouse, 1997).In addition, tangram can also be used by teachers to improve the learning outcomes of their students (Sirajuddin et

al., 2023). Illustrates the common shape of a tangram can be listed in Figure 1.

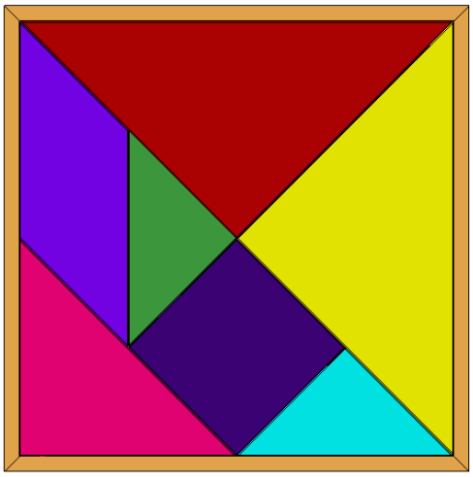

Figure 1 Illustrates the common shape of a tangram (Taken from freepatternsarea.com)

Based on Figure 1, we can see that a tangram consists of five equilateral triangles, one square, and one parallelogram. Students can play puzzles using tangram to form patterns resembling objects and living things in their environment. This increases students' creativity (Irawan et al., 2020).

In general, tangram can provide several benefits to students, including (Farihah, 2021): (1) Introducing various plane figure concepts; (2) Training students' mathematical concept skills in the material of area conservation and similarity; and (3) Cultivating students' creativity in forming patterns of plane figures based on the shapes of objects and living things in their environment.

Referring to several benefits above, understanding concepts is students' ability to understand concepts and perform procedures in a structured and accurate manner (BSNP, 2006). Understanding mathematical concepts cannot be separated from learning goals. NTCM explains that understanding concepts is one of the basic goals of learning mathematics (Bartell et al., 2013). With an increased understanding of concepts, students' mathematics learning outcomes will improve (Novitasari & Leonard, 2017).

On the other hand, students' creativity is related to learning motivation(Setiyoko, 2018). Motivation is a state within an individual with a drive to do something to achieve a goal (Rahman, 2022). Therefore, learning motivation can be considered as a driver of learning activities in students. Furthermore, learning motivation plays a role in clarifying learning goals (Wasty, 2006). Increasing learning motivation will improve students' mathematics learning outcomes (Nugroho & Warmi, 2022).

Based on the above explanation of the benefits of tangram teaching aids on students' learning outcomes through an increase in the ability to understand concepts and learning motivation, the author's team decided to provide tangram teaching aid assistance to 8th-grade students at SMP Plus Muhammadiyah Doro in learning Plane Geometry material.

METHOD

To achieve the objectives of this community service activity, support from various parties is needed in its implementation. Good coordination between the target community and the community service team is one of the determining factors for the success of the community service. In addition, the stages of the activity, including planning, implementation, and evaluation, need to be carried out to achieve the activity's objectives (Ismunandar et al., 2020).

Planning Stage

The planning stage is carried out to determine the learning conditions at SMP Plus Muhammadiyah Doro. Various parties, from stakeholders to our students, are involved. This stage is carried out for two days, on August 2-3, 2023.

Based on the findings at this stage, which were conducted through

discussions with teachers and the distribution of needs analysis questionnaires to students, we determined the theme of the community service activity, which is the assistance of tangram teaching aids for 8th-grade students at SMP Plus Muhammadiyah Doro, and also formulated the objectives of the activity. Furthermore, we developed the methods to be used in the implementation stage and created a satisfaction questionnaire design for the evaluation stage.

Implementation Stage

This community service activity was carried out on August 3, 2023, at SMP Plus Muhammadiyah Doro. The target of this activity was 42 8th-grade students. In implementing this activity, we used several methods, including the following:

a. Lecture Method

This method was carried out in several activity sessions. It was useful for introducing tangram teaching aids, describing the concepts of congruence and symmetry of plane triangles, the properties of triangles, and quadrilaterals.

b. Discussion Method

This method was carried out between activity sessions to allow students to discuss each material they received.

c. Experiment Method

This method was carried out in several activity sessions involving making tangram teaching aids and using tangram to form patterns of various animals assigned to them.

d. Demonstration Method

Using the experiment method, this method was carried out at the beginning of each activity session. This was done so students did not experience too much confusion in practicing the given material.

Evaluation Stage

This stage was carried out after the implementation stage of the activity was completed. In this stage, we evaluated the activity by distributing satisfaction questionnaires to the participating students. This stage was conducted to obtain final information after the community service activity. This information was then organized to draw conclusions and recommendations from this community service activity.

Initial information in the form of quantitative data is presented in percentage figures. Then, we used the category guidelines in Table 1 to convert this quantitative data into qualitative data.

Table 1 Interpretation of results in percentage (Arikunto, 2010)

Category	Percentage
Entirely	100%
Almost all	76-99%
Mostly	51-75%
Half	50%
Almost half	26-49%
Small portion	1-25%
None	0%

By using Table 1, it is hoped that the conclusions of this community service activity will be easier to understand and more meaningful.

RESULTS AND DISCUSSION

This community service activity generally received positive responses from teachers, and participating students were enthusiastic about participating from morning to evening.

In the planning stage, coordination was carried out with stakeholders at SMP Plus Muhammadiyah Doro. After obtaining information related to the general overview of the problems occurring at the school, we analyzed the needs of this community service activity by holding discussions with teachers and distributing needs analysis questionnaires to 42 8th-grade students. Based on the results of discussions on August 2 and 3, 2023, we found that mathematics teachers still find it difficult to provide media facilities, especially teaching aids, to explain mathematics

material to their students. These difficulties are due to several factors, ranging from the lack of school equipment facilities to the teacher's knowledge of the diversity of mathematical teaching aids.

Furthermore, on August 2-3, 2023, needs analysis questionnaires were distributed to 8th-grade students at SMP Plus Muhammadiyah Doro. The findings we obtained can be reviewed in the Introduction above. Based on these findings, we determined the theme and objectives of this community service activity. For the theme, we chose to assist with tangram teaching aids for 8th-grade students at SMP Plus Muhammadiyah Doro. After participating in the community service activity introducing tangram teaching aids, the students/participants became: (1) aware of the importance and benefits of tangram teaching aids in explaining Plane Geometry material; (2) interested in learning Plane Geometry material using tangram; (3) a better understanding of the concepts of Plane Geometry; and (4) motivated to learn Plane Geometry material.

The community service team conducted the implementation stage of the activity for one day, on August 3, 2023. The implementation team started the activity by introducing themselves to the teachers and 8th-grade students at SMP Plus Muhammadiyah Doro.

The content of the community service activity was delivered in 5 (five) sessions. Each session lasted 90 minutes, with lunch and afternoon breaks of 60 minutes and 30 minutes, respectively. In Session I, the material presented was the introduction of tangram teaching aids. In addition to introducing various types of tangram widely known in educational circles, a brief explanation was also given about the history of the discovery of tangram and the use of tangram in explaining the concepts of Plane Geometry. The methods used were lecture and discussion.

In Session II, students were divided into groups and asked to create tangram teaching aids using lined paper. The activity began with a demonstration of making tangram by the resource person. Afterward, each group discussed and experimented with making tangram using lined paper. In this session, students were enthusiastic about working in groups.

In Sessions III and IV, the resource person provided material through lectures and discussions on the concepts of plane geometry, including the concepts of congruence and properties of triangles, squares, and parallelograms. To prevent students from getting bored, ice breakers were also given during these two sessions. At the end of each session, an explanation was given regarding the relationship between the material presented and tangram. From the discussions, it can be seen that students became more aware of the benefits of understanding the concepts of triangles, squares, and parallelograms in making tangram teaching aids using lined paper. They also became aware of the errors they made in the sizes of the plane figures when arranging the tangram.

In the last session, Session V, various animal patterns were experimented with using tangram. This session began with a demonstration by the resource person, providing an example of an animal pattern that could be formed using tangram. After that, other animal patterns were given as examples to be formed using tangram by the students. The activity was conducted experimentally and through discussion by each group of students guided by the resource person. In this session, students were more enthusiastic as they could create various animal patterns using tangram more quickly and accurately. Some animal patterns that students can make using tangram can be seen in Figure 2.

Figure 2 Some results of animal patterns/shapes from tangram

The tangram teaching aids that the students made were then handed over to the school. At the end of the activity, the implementation team evaluated by providing satisfaction questionnaires to the 42 participating students. The results of the questionnaire are summarized in Table 2.

Table 2 Student responses to the activity (percentage of students)

Aspect Response	Strongly Agree	Agree	Disagree	Strongly Disagree
Tangram teaching aids are needed in learning.	12%	76%	7%	5%
Tangram teaching aids are interesting.	43%	29%	26%	2%
Tangram is easy to make.	34%	38%	26%	2%
Tangram is easy to use.	59%	29%	7%	5%
Tangram helps in understanding the concepts of Plane Geometry.	64%	26%	10%	0%
Tangram increases motivation to learn.	38%	29%	19%	14%
Satisfaction with the activity.	64%	17%	14%	5%

The data in Table 2, which is quantitative, was then analyzed into qualitative data using the interpretation rules in the previous table. The data analysis process is described in the Discussion section.

Overall, the participating students showed enthusiasm in the activity by asking questions to the resource person, discussing with peers, or experimenting with the tangram teaching aids. To facilitate the interpretation of the results in Table 2 above into qualitative data, quantitative data was first created with two classifications/dichotomies (Positive and Negative groups) for each response aspect in Table 2. In this case, Positive represents the sum of the percentages of agree and strongly agree in Table 2. On the other hand, Negative represents the sum of the percentages of disagree and strongly disagree in Table 2. Based on Table 2, the results are as follows.

Table 3 Classification with Dichotomy Based on Table 2

No	Aspect Response	Positive (Agree or Strongly agree)	Negative (Disagree or Strongly disagree)
1	Tangram teaching aids are needed in learning.	88%	12%
2	Tangram teaching aids are interesting.	72%	28%
3	Tangram is easy to make.	72%	28%
4	Tangram is easy to use.	88%	12%

No	Aspect Response	Positive (Agree or Strongly agree)	Negative (Disagree or Strongly disagree)
5	Tangram helps in understanding the concepts of Plane Geometry.	90%	10%
6	Tangram increases motivation to learn.	67%	33%
7	Satisfaction with the activity.	81%	19%

The data in Table 3, which is quantitative, is then analyzed into qualitative data using the interpretation rules in the previous table. Based on the students' responses in Table 3, number 1 and Table 3, almost all students in class 8 of SMP Plus Muhammadiyah Doro believe that teachers currently need tangram teaching aids in explaining Plane Geometry materials. This is in line with the results of a literature study by (Faniya et al., 2023). Based on this theoretical study, tangram teaching aids are highly needed by students, as they provide various benefits, including making students happier and more enthusiastic about learning Plane Geometry.

It is noted that based on student responses in Table 3, numbers 2, 3, and 4, and Table 1, almost all (an average of 3 aspects is 77%) students in class 8 of SMP Plus Muhammadiyah Doro believe that tangram teaching aids are interesting, easy to make, and easy to use by students. This finding reinforces the results of community service activities (Runisah et al., 2022), which argued that arranging various animal shapes makes students interested in using tangram. Thus, in addition to being able to form various animal patterns using tangram, students are interested in and are using tangram because it is easy to make and use.

Based on student responses in Table 3, number 5, and Table 1, almost all students in class 8 of SMP Plus Muhammadiyah Doro believe that tangram can help students practice their understanding of mathematical concepts, especially in Plane Geometry. This result reinforces the opinion of (Hanifah, 2023) that tangram's use has a significant influence on the ability to understand mathematical concepts of second-grade elementary school students, especially in Plane Geometry materials. Based on the above explanation, it can be said that the use of tangram in improving students' ability to understand mathematical concepts can be done in learning at the elementary and secondary school levels.

Based on student responses in Table 3, number 6, and Table 1, most students in class 8 of SMP Plus Muhammadiyah Doro believe that tangram teaching aids can increase student motivation to learn. As explained above, tangram can make students happy and enthusiastic about learning. Motivation to learn itself can be said to be a person's condition caused by the urge to achieve a specific goal. Based on this, the state of happiness and enthusiasm experienced by students can be a positive drive to learn. Therefore, tangram is believed to increase student learning motivation, especially in Plane Geometry.

Lastly, based on student responses in Table 3, number 7, and Table 1, almost all students in class 8 of SMP Plus Muhammadiyah Doro feel that the community service activity conducted is beneficial. This is indicated by the students' enthusiasm during the activity, both in the material explanation and experimentation sessions.

CONCLUSION

The mentoring activity of tangram teaching aids for class 8 students of SMP

Plus Muhammadiyah Doro is carried out by identifying problems obtained from the field and formulating them in the form of activity designs. Based on the results and discussion presented above, it can be concluded that this community service activity can be considered successful. This can be based on the results obtained during the evaluation. Tangram teaching aids are highly needed by students and teachers in mathematics learning, especially in Plane Geometry materials. Students' interest in tangram teaching aids is due to several factors, such as being easy to make and use. Tangram can train students' understanding of concepts in Plane Geometry. Then, a hypothesis or assumption is obtained that tangram can increase students' learning motivation. Finally, this community service activity benefits the participating students.

In addition to the above results, this community service activity still faces challenges in the field. Among them, almost some students are still not interested in tangram teaching aids. Furthermore, they still feel that motivation to learn mathematics, especially Plane Geometry, is still low. The interest and motivation of students are influenced by several factors that we have found. Among them is students' lack of interest in Mathematics School materials in general, which is influenced by environmental factors.

REFERENCES

Anggreini, D., & Priyojadmiko, E. (2022). Peran guru dalam menghadapi tantangan implementasi merdeka belajar untuk meningkatkan pembelajaran matematika pada Era Omicron dan Era Society 5.0. *Prosiding Seminar Nasional PGSD*, 75–87.

Arikunto, S. (2010). *Prosedur penelitian pendidikan: suatu pendekatan praktik*. Rineka Cipta.

Bartell, T. G., Webel, C., Bowen, B., & Dyson, N. (2013). Prospective teacher learning: Recognizing evidence of conceptual understanding. *Journal of Mathematics Teacher Education*, *16*(1), 57–79. https://doi.org/10.1007/s10857-012-9205-4

Bohning, G., & Althouse, J. K. (1997). Using tangrams to teach geometry to young children. *Early Childhood Education Journal*, *24*(4), 239–242.

BSNP. (2006). Model penilaian kelas. *Depdiknas*.

Estiningsih, E. (1994). *Penggunaan alat peraga dalam pengajar matematika SD*. PPPG Matematika.

Faniya, V. M., Karuniawati, A., Nugroho, D., Sutrianny, D. N., Sofia, & Ikashaum, F. (2023). Studi literatur: Penggunaan tangram sebagai media pembelajaran matematika. *Asimtot: Jurnal Kependidikan Matematika*, *4*(2), 91–99.

Farihah, U. (2021). *Media pembelajaran matematika*. Lintas Nalar.

Hanifah, S. (2023). Pengaruh penggunaan media puzzle tangram terhadap pemahaman konsep bangun datar oleh siswa Kelas II. *Bale Aksara: Jurnal Pendidikan Sekolah Dasar*, *4*(1), 17–22.

Irawan, J. N., Priyatama, A. N., & Fitriani, A. (2020). Pengaruh permainan konstruktif tangram terhadap berfikir kreatif pada siswa sekolah dasar. *Jurnal Intervensi Psikologi (JIP)*, *12*(1), 37–50. https://doi.org/10.20885/intervensipsikologi.vol12.iss1.art4

Ismunandar, D., Rosyadi, R., Nandang, N., & Aziz, K. (2020). Pendampingan belajar matematika pada Materi Pecahan di Desa Lajer Kecamatan Tukdana Kabupaten Indramayu. *Abdi Wiralodra: Jurnal Pengabdian Kepada Masyarakat*,

2(1), 45–56. https://doi.org/10.31943/abdi.v2i1

Novitasari, L., & Leonard, L. (2017). Pengaruh kemampuan pemahaman konsep matematika terhadap hasil belajar matematika. *Prosiding Diskusi Panel Nasional Pendidikan Matematika*, 758–766.

Nugroho, R., & Warmi, A. (2022). Pengaruh motivasi belajar terhadap hasil belajar matematika siswa di smpn 2 tirtamulya. *Edumatsains: Jurnal Pendidikan, Matematika dan Sains*, *6*(2), 407–418. http://ejournal.uki.ac.id/index.php/edumatsains

Nurrita, T. (2018). Pengembangan media pembelajaran untuk meningkatkan hasil belajar siswa. *Jurnal Misykat*, *3*(1), 171–187.

Undang-Undang No. 20 Tahun 2003 tentang Sistem Pendidikan Nasional, Sekretariat Negara (2003).

Rahman, S. (2022). Pentingnya motivasi belajar dalam meningkatkan hasil belajar. *Prosiding Seminar Nasional Pendidikan Dasar*, 289–302.

Runisah, R., Nandang, N., & Ismunandar, D. (2022). Pendampingan belajar bangun datar melalui media Tangram 7. *Jurnal Pengabdian Masyarakat MIPA dan Pendidikan MIPA*, *6*(1), 57–62. http://journal.uny.ac.id/index.php/jpmmp

Sarah, S., & Lathifaturrahmah, L. (2017). Penggunaan media tangram dalam pembelajaran matematika pada materi kesebangunan di kelas ix mts siti mariam banjarmasin. *Jurnal Pendidikan Matematika*, *3*(1), 81–102.

Sari, F. I., Sunendar, D., & Anshori, D. (2023). Analisis perbedaan Kurikulum 2013 dan Kurikulum Merdeka. *Jurnal Pendidikan dan Konseling (JPDK)*, *5*(1), 146–151.

Setiyoko, R. (2018). Hubungan motivasi belajar dengan kreativitas belajar siswa kelas X SMK PGRI 3 Kediri tahun pelajaran 2017/2018. *Simki-Pedagogia*, *2*(2).

Sirajuddin, S., Hadaming, H., & Amelia, N. (2023). Penggunaan media tangram untuk meningkatkan minat dan hasil belajar matematika kelas IV. *Delta-Pi: Jurnal Matematika dan Pendidikan Matematika*, *12*(1), 79–92.

Sudarwanto, S., & Hadi, I. (2014). Pengembangan alat peraga pmbelajaran matematika sekolah dasar untuk meningkatkan kemampuan berpikir matematis siswa. *Sarwahita*, *11*(1), 32–37.

Tim Gakko Tosho. (2021). *Matematika untuk sekolah menengah pertama kelas viii*. Kemdikbudristek.

Wardhani, I. S. (2020). Geometri dan permasalahannya dalam pembelajaran matematika di sekolah (suatu penelitian meta analisis). *Prosiding SI MaNIs (Seminar Nasional Integrasi Matematika dan Nilai-Nilai Islami)*, *3*(1), 124–129.

Wasty, S. (2006). *Psikologi pendidikan*. Rineka Cipta.