

## IMPLEMENTATION OF GEOGEBRA IN MATHEMATICS TO IMPROVE THE SKILLS OF TEACHERS

Andri Rahadyan<sup>1\*</sup>, Indra Kurniawan<sup>2</sup>, Halimatussa'diah<sup>3</sup>

<sup>1,2,3</sup>Department of Informatic Engineering, Universitas Indraprasta PGRI, Indonesia

[andri.rahadyan@unindra.ac.id](mailto:andri.rahadyan@unindra.ac.id)<sup>1</sup>, [indra.kurniawan@unindra.ac.id](mailto:indra.kurniawan@unindra.ac.id)<sup>2</sup>, [gbhock300679@gmail.com](mailto:gbhock300679@gmail.com)<sup>3</sup>

---

### ABSTRACT

**Abstract:** GeoGebra is one of the programs designed to improve the effectiveness of mathematics learning. For this reason, mathematics teachers should be able to operate GeoGebra to deliver learning material that is more interesting for students. This service activity aims to improve the math teacher's skills in constructing geometric shapes and other mathematical objects in the GeoGebra application to make it easier for students to understand mathematical material that requires more realistic visualisation. The service's target is mathematics teachers at HSPG Bekasi, where as many as ten teachers participated in this training. The method used in this activity goes through 4 stages: assessment, planning and development, and implementation of online workshops. Teachers are introduced to GeoGebra software and how to use it according to mathematical material, namely building spaces and completing linear and quadratic equations. Evaluation is carried out by giving a project test. The results of community service are that teachers can visualise geometric shapes and mathematical objects in GeoGebra so that students will better understand the concept of the material provided. The results of the project tests that have been carried out obtained an average value of 85, so there is an increase in the skills of teachers who are very good at using GeoGebra.

**Keywords:** implementation; GeoGebra; teachers; skills.



#### Article History:

Received: 09-12-2022

Revised : 02-01-2023

Accepted: 05-01-2023

Online : 01-02-2023



*This is an open access article under the  
CC-BY-SA license*

## A. INTRODUCTION

The use of technology is essential because it can affect the content and objectives of learning, and as a medium to enhance the teaching and learning process and plays a critical role in the development of the educational process. Technologies that can be used in the learning process in the classroom have been developed, one of which is GeoGebra. GeoGebra is a mathematical software developed to assist the teaching and learning of mathematics. Teachers can use GeoGebra to design effective learning. GeoGebra is handy as a mathematics learning media, such as demonstration and visualisation media, construction tools, and tools to assist the discovery process. The results show that using GeoGebra can improve students' mathematics learning outcomes and assist students in understanding mathematical concepts in the process of learning mathematics (Hadi et al., 2018).

GeoGebra can be used as an aid in teaching and learning activities, which is beneficial for students and teachers. GeoGebra can be used to develop students' abilities and creativity in mathematics. Several studies have been produced that GeoGebra can also help teachers create learning methods, mainly for geometry material (Sylviani & Permana, 2019). The GeoGebra application can support mathematics learning and improve students' visual understanding (Lestari & Sundi, 2021). The improvement in student learning outcomes at SMP Negeri 1 Mila, taught using the GeoGebra application, differs from learning outcomes other than the GeoGebra application (Junaidi, 2018).

Using GeoGebra can improve students' mathematics learning outcomes and assist students in understanding mathematical concepts in the mathematics learning process (Hadi et al., 2018). From the research above, GeoGebra should be implemented in mathematics learning. Learning about GeoGebra can increase students' understanding of learning function material. It is characterised by students being able to paint function graphs and see the shape of the function graph clearly and thoroughly. Students can also manipulate the function graph by changing the coefficients and constants in the function form. Students can see and explore function graphs, quadratic functions, and trigonometry with the help of GeoGebra (Nurhanan et al., 2019). Teachers can use GeoGebra as a learning medium in mathematics, especially in geometry and algebra, GeoGebra modules, and scientific articles (al Maududi et al., 2021).

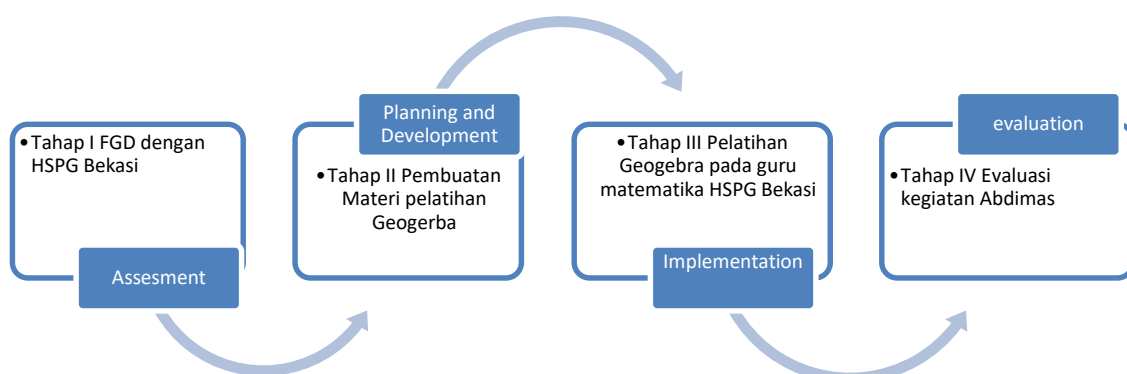
The GeoGebra software allows students to increase their creativity because students can make their own problem-solving according to their wishes (Ekawati, 2016). The matrix learning module assisted by the GeoGebra application that has been developed has a positive impact on student learning outcomes, and the application of the module in the learning process motivates students to study matrix material (Asdarina & Khatimah, 2021). At the university level, student perceptions of using GeoGebra software as learning multimedia for multivariable calculus courses are in a

positive category (Arfinanti, 2017). Students can understand deeper circle material and additional material related to the studied material (Hasanah, 2020). The results of the activities of the 24 Muhammadiyah teacher participants in Sukoharjo were that only a small proportion had used GeoGebra. As many as 50% of the training participants wanted a more comprehensive and in-depth follow-up of the GeoGebra software training (Waluyo, 2016). The results of this activity are that teachers can improve the quality of the learning process following the knowledge gained in training. Teachers are more creative and innovative in creating learning processes. Teachers have an understanding and knowledge of virtual learning media. Teachers can use the GeoGebra application to create virtual learning media. Teachers can create visual media, teaching materials, and assessment instruments related to algebra and geometry material (Rahadyan et al., 2018).

From the results of observations made on math teachers at HSPG Bekasi, it was found that the teachers needed to learn what the GeoGebra application was. From the description above, the GeoGebra application is very much required in learning mathematics. So the team tried to instruct the HSPG Bekasi math teacher to implement the GeoGebra application when learning mathematics. It aims to make the learning atmosphere more enjoyable and can foster students' creativity and independence in understanding mathematical material in class.

## B. METHODS

The community service method used in community service activities is broadly, as shown in Figure 1.



**Figure 1.** Methods of the Community Service Activities

The implementation of community service is carried out through several stages. The first stage was assessing with coordination and FGD (Focus Group Discussion) with HSPG Bekasi, especially math teachers. FGDs were carried out as well as observations for math teachers related to their understanding of GeoGebra. In the second planning and development stage, the community service team makes training materials on Geogebra, which will be used as a medium for geometrical materials, linear equations, and

quadratic equations. The third implementation stage was carried out by training related to the implementation of GeoGebra for HSPG teachers. The training was carried out with online presentations using the Zoom application. After presentations, questions, and answers, we practised GeoGebra's practical applications in making geometric shapes and linear and quadratic equations. The final stage is evaluation, which is carried out by giving tests in the form of projects on the implementation of GeoGebra on geometrical materials, linear equations, and quadratic equations. The results of this test will be used to measure the increase in the teacher's ability to implement GeoGebra in learning mathematics. The indicator of the success of this community service activity can be seen from the results of the project test given if the average project test results are with the conditions as shown in Table 1.

**Table 1.** Success Indicators

Average of the Project Test	Success Category
$\leq 60$	Bad
61-80	Good
$\geq 81$	Excellent

Assuming the average is 60, lousy success can be said to be no increase. The average 61–80 in the excellent category can be said to have increased but needs further development. If the average 81 success rate is perfect, it can be said that it has improved optimally.

## C. RESULTS AND DISCUSSIONS

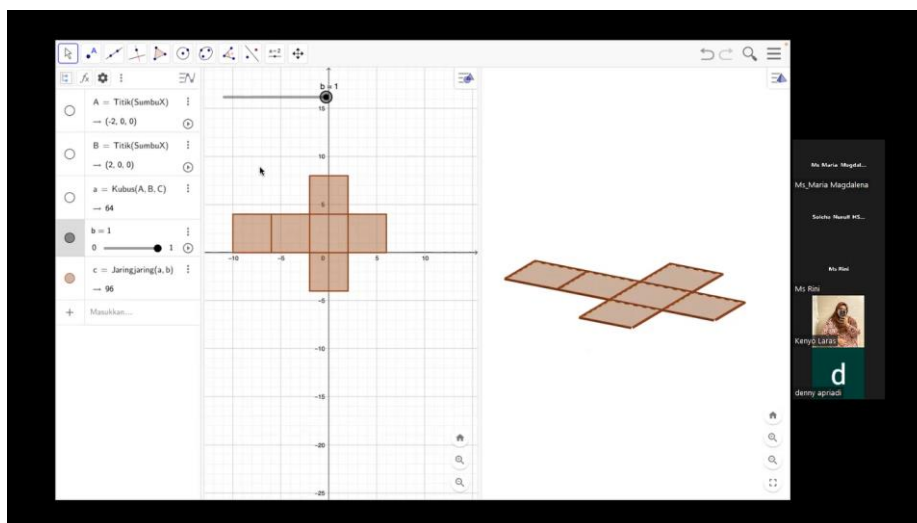
On 13 August 2022, it was permitted to carry out community service activities and the commencement of training for community service activities with the theme of using GeoGebra Implementation for math teachers to improve teacher competence. After obtaining permission from the school, we began to prepare and work on the training material module according to the number of participants who would attend the training. From the data obtained, the number of participants who participated in this training was around 10 HSPG Bekasi mathematics teachers.

### 1. The Implementations of the Community Service

#### a. The Implementation of Activities Meeting 1

We provide material for making cubes, blocks, and other building props with GeoGebra. This training activity was carried out with as many as 10 participants. This activity was carried out on Saturday, 20 August 2022, 08.00-09.00 Local Time through online Zoom. The teachers were very enthusiastic about participating in the waste training from start to finish, the implementation of Community Service went smoothly, and it was proven that in a relatively short time, the participants could

understand the material and practice making spatial structures on GeoGebra, as shown in Figure 2.

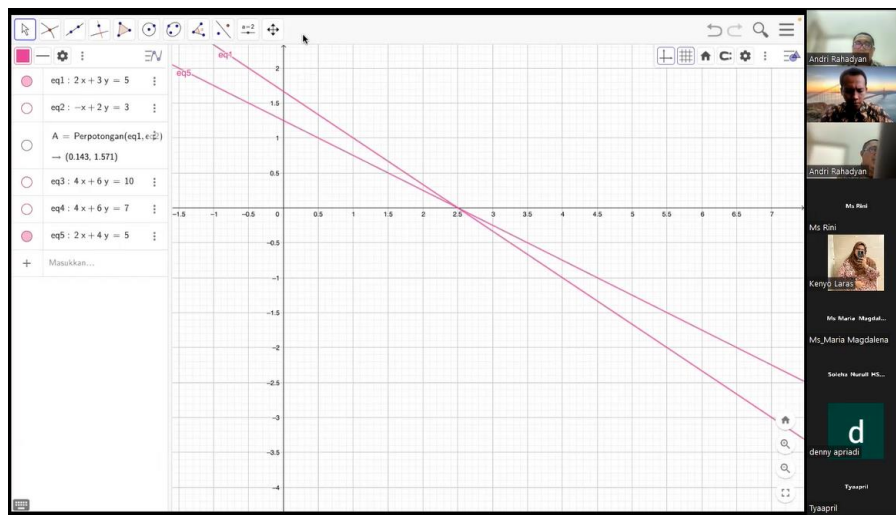


**Picture 2.** The Community Service Meeting 1

In this activity, the teachers were given training on implementing GeoGebra in making spatial structures, namely cube structures. The movement introduced creating cube sides to calculate the distance between a point and a plane on a cube. The teachers were enthusiastic about participating in the waste training from start to finish. The implementation of community service went smoothly. It was proven that in a relatively short time, the participants could understand the material and practice making spatial structures on GeoGebra.

#### b. The Implementation of Activities Meeting 2

We provide material about solving a system of one-variable linear equations with GeoGebra so that students can see visualisations directly. This activity was carried out on Saturday, 20 August 2022, 09.00-10.00 Local Time through online Zoom. The teachers were very enthusiastic about participating in the training from start to finish. The implementation went smoothly. It was proven that in a relatively short time, the participants could understand and practice the one-variable linear equation system with GeoGebra, as shown in Figure 3.

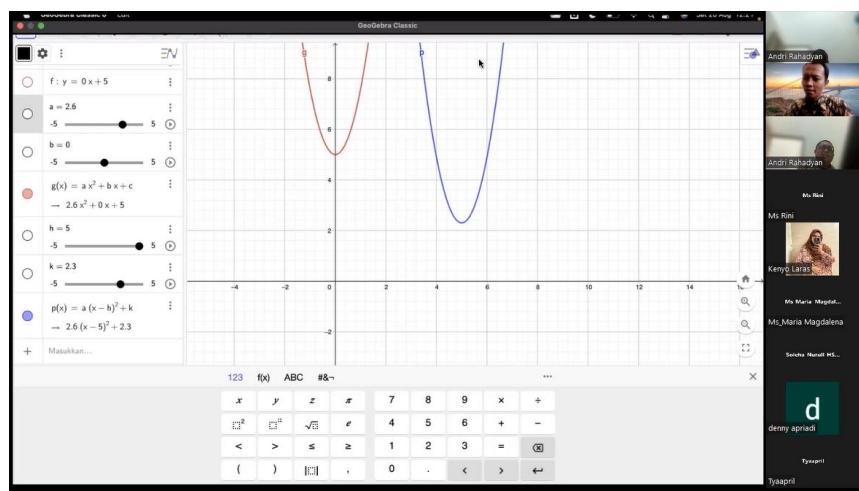


Picture 3. The Community Service Meeting 2

In this activity, the teachers were trained to implement GeoGebra in solving one-variable linear equations. The training on creating a system of linear equations in GeoGebra is then continued by finding solutions to linear equations. The teachers were very enthusiastic about participating in the exercise from start to finish. The community service implementation went smoothly, and it was proven that in a relatively short time, the participants could understand and practice the one-variable linear equation system with GeoGebra.

### c. The Implementation of Activities Meeting 3

On this occasion, the material was given about quadratic equations. This activity was carried out on Saturday, 20 August 2022, 10.00 - 11.00 Local Time through online Zoom. The teachers were very enthusiastic about participating in the training from start to finish. The implementation ran smoothly. It was proven that the participants could understand and practice quadratic equations with GeoGebra relatively quickly, as shown in Figure 4.



Picture 4. The Community Service Meeting 3

In this activity, the teachers were trained to implement GeoGebra in quadratic equations. The training ranges from graphing quadratic equations to finding the results of quadratic equations. The teachers were very enthusiastic about participating in the activity from start to finish. The community service implementation ran smoothly, and it was proven that in a relatively short time, the participants could understand and practice quadratic equations with GeoGebra.

## 2. Results of the Implementation

GeoGebra implementation training for HSPG mathematics teachers was conducted by a team of 2 lecturers from Indraprasta University PGRI. The training venue is held online with the Zoom application. Based on the training that has been carried out, the following results are obtained: (a) Teachers can practice making geometric shapes on GeoGebra to be applied in learning. It exists, and students will be more independent in knowledge because they can implement it directly in GeoGebra. It follows the opinion of Nuritha & Tsurayya (2021), which state that GeoGebra is effectively used as a medium or student aid in learning mathematics which can improve conceptual understanding and student learning independence; (b) HSPG Bekasi math teachers can find solutions to linear equations of two variables using GeoGebra. It is very useful because later, during the delivery of material on the system of linear equations, the teacher can implement GeoGebra to find the set of solutions so that students will be more interested in learning easy and fun math. It follows the opinion of Handayani (2021), which states that GeoGebra, through the android application in student learning activities, can significantly improve learning outcomes, marked by positive responses, the learning atmosphere is more exciting and interactive, and students are more active; and (c) Mathematics teachers can apply images of quadratic equations to the GeoGebra application. It is very useful because students can visually see the idea of a parabolic curve resulting from a quadratic equation. With GeoGebra, they can also easily change a value to be positive or negative. It will affect the curve image's position so students will understand the concept of quadratic equations more. It follows the opinion of Memolo (2018), which states that the graph of the quadratic equation function can be visualised using GeoGebra. The parameters  $a$ ,  $b$ , and  $c$  can be manipulated on GeoGebra, which can then be searched for the discriminant. Furthermore, a concept map can be made that visualises the relationship between the values of  $a$ ,  $b$ ,  $c$ , or  $d$  with a quadratic equation graph.

Based on the results of the project tests that have been carried out, the average is 85. Based on the indicators used, the teacher's ability to implement GeoGebra in geometric materials, linear equations, and quadratic equations is outstanding, so the teacher's capacity has increased very well.

## D. CONCLUSIONS AND SUGGESTIONS

GeoGebra was implemented for math teachers to improve competency at HSPG Bekasi. The average result of the project test is 85, which can be categorised as a teacher's ability to experience a remarkable increase. Based on the feedback results, information was obtained that this activity was very relevant to the needs of teachers in teaching mathematics. They feel that they have gained applicable and valuable insights and skills. In addition, they also feel happy with the training techniques and methods applied during the training. The participants' activity and abilities are advantageous for teachers to implement in learning for students to attract and understand mathematics with the correct concepts. It follows the opinion of Susanta & Koto (2021), which states that implementation activities can improve teachers' skills in using GeoGebra to make mathematics exciting and facilitate student learning.

Given the wide range of materials, the time provided feels less. Therefore, it is suggested that the parties responsible for improving the quality of human resources on specific topics for a relatively longer duration. It is hoped that participants will gain more comprehensive insight and experience.

## ACKNOWLEDGEMENTS

The authors would like to thank the Research and Community Service Institution (LPPM) Universitas Indraprasta PGRI for permitting this service activity to be carried out well. Furthermore, the authors remembered to thank Homeschooling Primagama Bekasi (HSPG Bekasi) for giving time to where the team performed this service.

## REFERENCES

- al Maududi, R., Putri, R. W., & Hartuti, P. M. (2021). GeoGebra Training for Making Mathematics Learning Media at SMPN 11 Depok. *REKA ELKOMIKA: Jurnal Pengabdian Kepada Masyarakat*, 2(2), 67–74. <https://doi.org/10.26760/rekaelkomika.v2i2.67-74>
- Arfinanti, N. (2017). Persepsi Mahasiswa Terhadap Penggunaan Software Geogebra Sebagai Multimedia Pembelajaran Matakuliah Kalkulus Multivariabel. *Al-Khwarizmi : Jurnal Pendidikan Matematika Dan Ilmu Pengetahuan Alam*, 5(1), 1. <https://doi.org/10.24256/akh.v5i1.427>
- Asdarina, O., & Khatimah, H. (2021). Pengembangan Modul Pembelajaran Matriks Berbantuan Aplikasi GeoGebra. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 10(2), 860–871. <https://doi.org/10.24127/ajpm.v10i2.3515>
- Ekawati, A. (2016). Penggunaan Software GeoGebra dan Microsoft Mathematic dalam Pembelajaran Matematika. *Math Didactic: Jurnal Pendidikan Matematika*, 2(3), 148–153.
- Hadi, M. S., Fattah, A. H., & Rizta, A. (2018). Penggunaan GeoGebra terhadap Hasil Belajar Matematika Materi Program Linier. *INDIKTIKA (Jurnal Inovasi Pendidikan Matematika)*, 1(1), 65–74. [www.geogebra.com/forum](http://www.geogebra.com/forum).
- Handayani, L. (2021). Pemanfaatan Software GeoGebra Melalui Aplikasi Android pada Materi Persamaan Kuadrat. *SCIENCE: Jurnal Inovasi Pendidikan Matematika Dan IPA*, 1(2), 164–169.



- Hasanah, H. (2020). Pelatihan Penggunaan Aplikasi GeoGebra pada Pembelajaran Materi Lingkaran di SMPN 10 Kota Serang. *Jurnal ABDIKARYA*, 2(2), 71–82.
- Junaidi, J. (2018). Meningkatkan Hasil Belajar Matematika pada Materi Bangun Ruang dengan Menggunakan Aplikasi GeoGebra di SMP Negeri 1 Mila. *Jurnal Numeracy*, 5(2), 184–193.
- Lestari, D. P. A., & Sundi, V. H. (2021). Pelatihan Penggunaan Aplikasi GeoGebra untuk Mempermudah Pembelajaran Materi Program Linear. *Prosiding Seminar Nasional Pengabdian Masyarakat 2021 Universitas Muhammadiyah Jakarta*, 1–6. <http://jurnal.umj.ac.id/index.php/semnaskat>
- Memolo, T. (2018). Pembuatan Peta Konsep Memanfaatkan Visualisasi Grafik Persamaan Kuadrat Berbantuan GeoGebra. *AdMathEdu*, 8(1), 95–104.
- Nurhanan, N., Slamet, M., & Kania, N. (2019). Penggunaan Software GeoGebra pada Materi Fungsi. *Prosiding Seminar Nasional Pendidikan FKIP UNMA 2019*, 585–591.
- Nuritha, C., & Tsurayya, A. (2021). Pengembangan Video Pembelajaran Berbantuan Geogebra untuk Meningkatkan Kemandirian Belajar Siswa. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, 05(01), 48–64.
- Rahadyan, A., Hartuti, P. M., & Awaludin, A. A. R. (2018). Penggunaan Aplikasi Geogebra dalam Pembelajaran Matematika di Sekolah Menengah Pertama. *Jurnal PkM Pengabdian Kepada Masyarakat*, 1(01), 11. <https://doi.org/10.30998/jurnalpkm.v1i01.2356>
- Susanta, A., & Koto, I. (2021). Pelatihan Penggunaan Geo Gebra Untuk Peningkatan Kompetensi Guru Dalam Pembelajaran Matematika Sekolah Dasar. *Jurnal Abdi Pendidikan*, 2(1), 23–29.
- Sylviani, S., & Permana, F. C. (2019). Pembelajaran Matematika Tingkat Sekolah Dasar Menggunakan Aplikasi Geogebra sebagai Alat Bantu Siswa dalam Memahami Materi Geometri. *Jurnal Pendidikan Multimedia*, 1(1), 1–8.
- Waluyo, M. (2016). Penggunaan Doftware GeoGebra pada Materi Persamaan Garis (Pelatihan untuk Guru-Guru SMP Muhammadiyah Sukoharjo). *Prosiding The Progressive and Fun Education Seminar*, 90–96.