



Geogebra to Overcome Learning Loss in Mathematics Education

Yetti Ariani¹, Yullys Helsa¹, Sahrun Nisa¹, Sartono¹

¹ Universitas Negeri Padang, Prof. Dr. Hamka Street, Air Tawar Padang, West Sumatra, Indonesia
sartonolahi@gmail.com

Abstract. Learning loss is a negative impact that occurs on students when they lose their abilities and knowledge due to prolonged gaps or discontinuities in education. The change in the learning process from offline to online requires teachers to be able to facilitate students so that they do not lose knowledge and skills. This study aims to improve the quality and quality of elementary school teachers in dealing with students who experience learning loss and training in developing geogebra-assisted mathematics learning media. In this service activity, the first activity carried out was that the teachers were invited to understand the material about learning loss and then the teachers were given training in making media using Geogebra. Researchers conducting pretest and posttest activities to determine the teacher's diagnostic assessment ability.

Keywords: Learning Loss, Geogebra, Elementary Teacher

1 Introduction

The Covid-19 pandemic has had an impact on every aspect of human life including education. It is officially recognized by UNESCO. Nearly 300 million students around the world feel that their learning process is disrupted due to the transition from face-to-face to online class[1]. The transition to the implementation of this learning resulted in a decrease in student learning motivation. In addition, this condition also resulted in the development of students' abilities not being carried out as they should. Learning objectives are difficult to achieve so that students' understanding is far from expectations. The process that should be experienced by students is now difficult to implement so that students experience the phenomenon of learning loss. Learning loss can be interpreted as a condition where all learning material that has been studied is lost due to various factors[2].

There are several ways that can be done to solve the problem of learning loss in learning mathematics. According to Auday and Park (2017) strategies to overcome learning loss are 1) additional learning time and 2) additional instructional programme. The first strategy can be seen from the existence of additional lessons outside school hours. With regard to the second strategy, this method can be carried out using the assistance of various ICT facilities. School math teachers need to use

© The Author(s) 2023

J. Mistar et al. (eds.), *Proceedings of the 2nd International Conference on Multidisciplinary Sciences for Humanity in Society 5.0 Era (ICOMSH 2022)*, Advances in Social Science, Education and Humanities Research 811, https://doi.org/10.2991/978-2-38476-204-0_27

ICT like software for effective teaching and learning[4–6]. Actually, there are many software that can be used such as Geometer's Sketchpad, Cabri, Matlab, and Autograph. However, Geogebra is one of the most recommended software for use in school instructional processes[4–8]. The advantages of GeoGebra compared to other software are the types of commercial software that are available for teaching and learning Mathematics, can be used freely by educators in teaching classes, and allows users to download any software that is available and suitable for users. In addition, geogebra makes the process of learning mathematics fun and helps students concretize abstract concepts that are often found in mathematics. (Celeen, 2020). Geogebra is an effective tool to increase achievement, increase curiosity, creativity, to make clear understanding of concepts, as well as to promote overall student learning in mathematics[4]. This is because, Geogebra helps visualize concepts and offers opportunities for conceptual learning[7]. Based on these benefits, it can be concluded that GeoGebra can be used to solve learning loss problems. However, in reality GeoGebra is rarely used in elementary schools. This is because teachers do not really understand how to use GeoGebra in learning and need training[9, 10]. Therefore, the UNP PGSD Lecturer Team carried out PKM activities for elementary teachers in making digital media, especially making Geogebra-assisted media so that they could overcome the Learning Loss problem.

2 Methods

This training activity for elementary school teachers is part of Community Service (P2M) activities. This training activity includes two activities, namely a seminar related to learning loss and training on making Geogebra-assisted learning media. This activity uses mini-research by conducting pre-tests and post-tests on the mathematics learning outcomes of elementary students. The test carried out was the t test to see whether there was an increase in learning outcomes or not using Geogebra assisted learning media made by the teacher after the training.

3 Result

The training activity begins by introducing the Geogebra Classic 5 application to the training participants. Most teachers admit that this is their first time using Geogebra even though they have never heard of this software before. The teacher seemed enthusiastic about paying attention to the explanation regarding the menus and features provided in Geogebra. In the initial part, it is explained regarding the display of two-dimensional and three-dimensional graphics including features for creating points, lines, planes, circles, ellipses, angles, sliders, text creation, and graphic movement. The initial display can be seen in Figure 1.

After understanding the features of Geogebra, the next activity is to train teachers in the use of geogebra for simple geometry in two-dimensional planes. This simple geometry covers how to make squares, triangles, quadrilaterals, trapezoids, kites, and rhombuses. The demonstration is accompanied by a joint discussion regarding how to

invite students to explore each shape so that they can master concepts related to flat shapes. The purpose of this activity is for students to be able to distinguish each geometric shape according to its definition. While paying attention to the demonstration given, the teacher tried using geogebra himself. Some teachers who are still not used to using GeoGebra experience a few problems in making the required geometric shapes. However, after being given guidance,

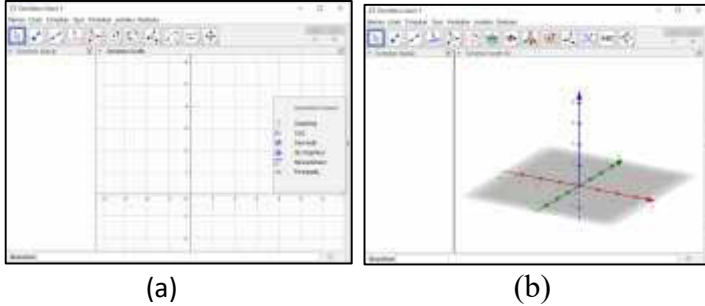


Fig. 1. (a) GeoGebra Classic 5 initial page on a two-dimensional graphic display; (b) GeoGebra Classic 5 home page on a three-dimensional graphic display.

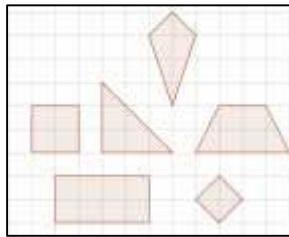


Fig. 2. Various flat shapes

The next activity is teaching the teacher how to make media for circle material. The goal is for students to understand the concept of circle elements and angles on circles. The features introduced in this activity are sliders, circular sectors, perpendicular bisectors, angles, and text.

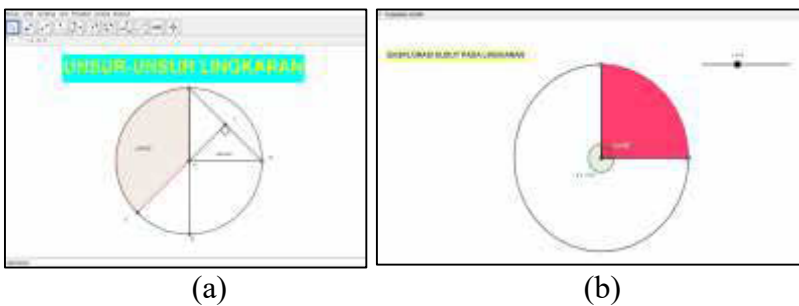


Fig. 3. (a) media display for circle elements; (b) the media view for the corners on the circle

After understanding how to draw geometric objects on two-dimensional graphics, the next activity is to create media that will be used in three-dimensional geometrical materials including cubes, blocks, pyramids, tubes. Teachers are taught how to make animations and make proof media with geogebra related to cylinder volume. The purpose of learning with this media is so that students can see how the process of forming three-dimensional nets is formed. Features introduced are cube, net, prism, pyramid, cylinder, and net.

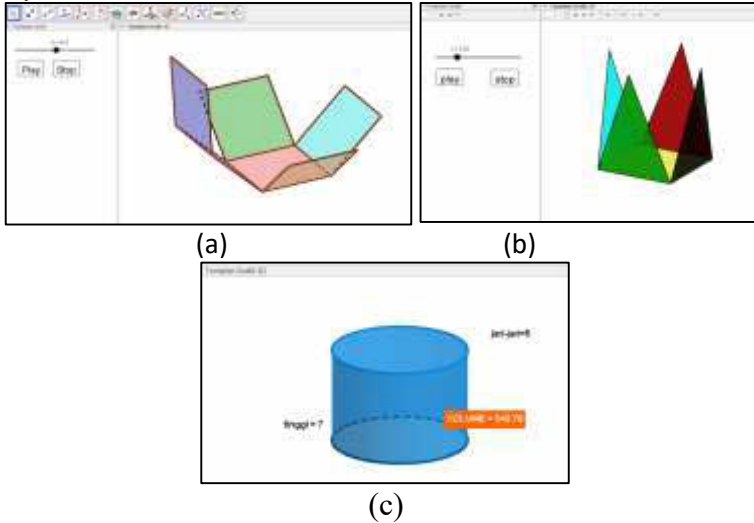


Fig. 4. (a) Cube net animation (b) pyramid net animation; (c) cylinder volume animation

After the training was carried out using Geogebra, teachers were asked to make simple media to be used in classroom learning. Then, testing is carried out to determine whether there is an increase in the average student learning outcomes or not. Based on the results of the t test on the pretest and posttest given to students, $t = -7.56$, $df = 27$, $p\text{-value} = 1.97 \times 10^{-8}$. In other words, the $p\text{-value} < 0.05$ so that H_0 is rejected. As a result, with a confidence level of 95% it can be concluded that there was an increase in the average pre-test and post-test scores of students. This shows that the use of Geogebra-assisted media used by teachers helps in improving student learning outcomes.

During the training, the participating teachers looked happy and enthusiastic in discussing various possibilities that could be used to enable students to explore the geometric objects being taught so as to strengthen students' understanding of concepts. Teachers admitted that this training provided great benefits for them in improving the quality of learning, especially geometry so that they could overcome the problem of learning loss. The teachers also hope that this activity can continue to be carried out on an ongoing basis and not only on geometric problems but other problems.

4 Discussion

From the results of interviews with elementary school teachers in Padang, it was found that the learning loss experienced by elementary school students mostly occurred in the geometry material. In fact, geometry is already a material that is considered difficult by students. The advent of online learning multiplies this difficulty. Actually, students are able to visually recognize geometric objects but difficulties occur when asked to analyze, understand relationships between geometric materials, and solve geometric problems.[11]. In addition, the teachers participating in the training stated that the learning loss experienced by students in geometry occurred because the teacher was no longer able to provide concrete learning experiences to explain abstract concepts in geometry. As a result, teachers need media that can visualize and clarify abstract concepts in geometry. GeoGebra is a digital media that can help teachers present geometry more concretely(August, 2018).

According to teachers' statements, the learning loss experienced by students in geometry material includes understanding related to the properties of flat shapes, circular elements, and difficulties in remembering various formulas for the area and volume of three-dimensional shapes. The problem with the nature of flat shapes is related to the difficulty for students to recognize shapes when the flat shapes are changed in position. The shape is no longer spawned as usual but changed to a slanted position. This is closely related to the point of view that students have. With the help of Geogebra, students can see first-hand visualizations of how each shape looks when it is tilted. Furthermore, for problems related to circle elements, most students have difficulty distinguishing one element from another. Fortunately, GeoGebra can be designed in a more attractive way and display motion animation and color combinations that can help students remember and distinguish one element from another. Then, for problems related to the difficulty of remembering various area and volume formulas, it is actually closely related to how to understand where the formula is formed. As for the actual surface area formula students can find through the nets of shapes. The display of the shape nets provided by Geogebra clearly helps strengthen students' conceptual understanding of what are the plane shapes that make up these shapes. Motion animation and the availability of features to rotate shapes so that they can be seen from various sides make students see the shape of the room as a whole. Therefore, To overcome the problem of learning loss in geometry material for elementary school students, the PGSD UNP Lecturer Team conducted training in the form of seminars related to learning loss and training for teachers to create Geogebra-assisted learning media. This training is also a form of support in an effort to improve teachers' abilities in digital aspects which indirectly support their pedagogical abilities.

5 Conclusion

Covid-19 resulted in a shift in learning from offline to online which had an impact on the imperfection of the learning process being carried out. This causes a decrease in students' motivation and understanding of the concepts being taught. The limited ability of teachers to compile media that will help students understand concepts in online learning causes learning loss in students. Learning loss occurs in almost all subjects including mathematics. For mathematics, most learning loss occurs in geometry material. Learning loss that occurs will cause a break in students' cognitive linkages between one material and another material so that incomprehension becomes more and more accumulated. One of the efforts to solve the problem of learning loss in geometric concepts is to improve the teacher's ability to design learning media that can visualize abstract concepts to become concrete through various kinds of training such as training held by PGSD FIP UNP Lecturers. This study shows that there is an increase in the ability of teachers to master digital media, especially in making media assisted by the Geogebra application as an effort to overcome the learning loss experienced by students.

Acknowledgements

Thank you to the Padang State University campus for supporting part of the funding for this community service research.

References

1. Engzell P, Frey A, Verhagen MD (2021) Learning loss due to school closures during the COVID-19 pandemic. In: Proceedings of the National Academy of Sciences
2. Hevia FJ, Vergara-Lope S, Velásquez-Durán A, Calderón D (2022) Estimation of the fundamental learning loss and learning poverty related to COVID-19 pandemic in Mexico. *Int J Educ Dev* 88:.
<https://doi.org/https://doi.org/10.1016/j.ijedudev.2021.102515>
3. Auday BC, Park L (2017) Best Practices for Learning Loss Recovery. *J Psychol Theol* 45:70–73. <https://doi.org/10.1177/009164711704500107>
4. Chalaune BB, Subedi A (2020) Effectiveness of GeoGebra in teaching school mathematics. *Contemp Res An Interdiscip Acad J* 4:46–58. <https://doi.org/10.3126/craiaj.v4i1.32729>
5. Celen Y (2020) Student Opinions on the Use of Geogebra Software in Mathematics Teaching. *Emerg Technol Comput* 19:84–88
6. Tamam B, Dasari D (2021) The use of Geogebra software in teaching mathematics. *J Phys Conf Ser* 1882:. <https://doi.org/10.1088/1742-6596/1882/1/012042>
7. Topuz F, Birgin O (2020) Developing teaching materials supported with geogebra for circle and disc subject at seventh grade. *Elem Educ Online* 19:1–17. <https://doi.org/10.17051/ilkonline.2020.735184>

8. Saha RA, Ayub AFM, Tarmizi RA (2010) The effects of GeoGebra on mathematics achievement: Enlightening Coordinate Geometry learning. *Procedia - Soc Behav Sci* 8:686–693. <https://doi.org/10.1016/j.sbspro.2010.12.095>
9. Delyana H, Yusri R, Mardiyah A, et al (2022) Pelatihan Penggunaan Software Geogebra dalam Memecahkan Soal Geometri Ruang Berbasis Contextual Teaching and Learning. *ADMA J Pengabdian dan Pemberdayaan Masyarakat* 3:77–86. <https://doi.org/10.30812/adma.v3i1.2094>
10. Yunita A, Jufri LH (2020) Pelatihan Guru Matematika Dalam Penggunaan Software Geogebra. *J Pengabdian dan Peningkatan Mutu Masyarakat* 1:101–108. <https://doi.org/10.22219/janayu.v1i2.12348>
11. Dewi WS, Maimunah M, Roza Y (2022) Analisis Kesulitan Siswa dalam Pembelajaran Daring pada Materi Geometri Kelas VII SMP Kota Pekanbaru. *J Cendekia J Pendidik Mat* 6:635–642. <https://doi.org/10.31004/cendekia.v6i1.624>
12. Agung S (2018) Pemanfaatan aplikasi geogebra dalam pembelajaran matematika SMP. *Pros Semin Nas* 03:312–322

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

