Proceeding of International
Conference on Science and Technology
Lembaga Penelitian Pengabdian kepada Masyarakat dan Dakwah Islamiyah, Universitas Islam Kuantan Singingi, Indonesia, November 10th 2022
DOI : https://doi.org/10.36378/internationalconferenceuniks.v0i0.2817
ISSN 2985-8739
Page: 7-11

Digital Literacy Strengthen Based of Cycle Learning-Constructivism on GeoGebra Strategy Training

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Abstract

One of application that can be used in education is GeoGebra. GeoGebra improved the quality of the learning process, increased the creativity of educators in learning processes, and upgraded understanding and knowledge of virtual learning media. The profile of educators is expected to be educators who are able to provide good learning. Therefore, this activity makes educators have the ability to operate or use technology-based learning media such as the GeoGebra application. The strategy carried out is a GeoGebra workshop or training for Mathematics educator in Sorong, West Papua, Indonesia. The implementation of this training or workshop is carried out of participant active learning or direct online practice educators. The online media used are ebooks called EPUB, that enhance and strengthen digital literacy. This workshop based on cycle learning-construktivism in GeoGebra training. The benchmark used as an indicator of the success of this activity is the output produced by educators, such GeoGebra skills and collection of teaching guide with GeoGebra learning media.

Keywords: GeoGebra, cycle learning-construktivism, EPUB, digital literacy

1. Introduction

The last three years have been a challenge in all aspects due to the COVID-19 pandemic, as well as after the pandemic began to subside, the education sector in Indonesia was maximized adapt to technology. Therefore, teachers must have good digital literacy skills. Teachers' digital literacy skills need to be continuously improved, one of which is through training or workshops. The development of training or workshops is carried out to adjust the level of technological progress. Currently, there are not many teacher trainings that are specifically oriented towards increasing digital literacy skills.

Geogebra

One form of technology application that could be used in education known as GeoGebra. GeoGebra is an application that could be used in learning mathematics [1]. Geogebra as a tool to construct, demonstrate or visualize abstract problems in mathematics, especially in the field of geometry that could not be solved manually [2]. The GeoGebra application has the advantage of showing a geometric shape that could not be formed manually using a ruler. Geometry visualization can be made quickly and more accurately, there are animations and manipulation movements (dragging). Furthermore, GeoGebra could also be used as feedback or evaluation in knowing the visual truth in showing objects, making it easier for educators or students to investigate or show the properties of geometric objects [3]. Geogebra has three uses, namely as a medium for learning mathematics, as a tool for making mathematics teaching materials, and even being able to solve math problems. Geogebra is free software that could be downloaded according to the platform used. GeoGebra could be run by online too. Several studies have examined technological learning innovations such as the use of the Geogebra application in making virtual learning media [4][5]. Geogebra could be a means of guidance in the discovery learning method [6]. The Geogebra application improve the quality of the learning process and increase the creativity of educators on creating lesson plan. Indeed, educators have innovation, understanding and knowledge of virtual learning media.

Cycle learning-constructivism

"Constructivism is an approach to teaching and learning based on the premise that cognition (learning) is the result of mental construction. In other words, students learn by fitting new information together with what they already know"[7]. Constructivism is a learning theory that knowledge is obtained through a process of active, reflective, and intective in idea. The learner must consider the information being taught and based on past experiences, references, and an theory interpretation. This idea constructivism affirms that strategy training offered output the teaching guide as assignment for the participant. Inside-Outside Circle learning model is a learning model involving of groups who share information from the content of the material or theory that has been conveyed [8]. All participant divided into groups then received learning information about GeoGebra material simultaneously, which aims to make

participant can practice and develop skills in GeoGebra. Cycle learning-constructivism is blended both contructivism and Inside-Outside Circle learning model.

Digital Literacy

Spires and Bartlett have divided the various intellectual processes with digital literacy into three categories: (a) using and consuming digital content, (b) creating digital content, and (c) communicating digital content [9]. This study is about streghten the digital literacy trough GeoGebra training. The training maximize the use of digital content as media. By strengthening digital literacy, teachers can also transmit it to their students. Most high schools in Sorong, Papua Barat use conventional learning in mathematics, especially in the material on systems of linear equations, integrals, and three dimensions. It is hoped that the results of increasing digital literacy obtained in the training can bring learning innovations that maximize digital content in visualizing.

EPUB

There some research find out that textbook do not effect the learning process and some study show that texts have no significant impact on students' understanding, on the other hand textbook used as instructure media, delivering materials, and central part of an education system [10][11][12][13]. This electronic book called EPUB which is have audio-visual, designed for GeoGebra strategy training. There is study that has shown the results of practicum using audiovisual media in improving student learning outcomes effectively [14]. EPUB help participant in order to understand and practice GeoGebra. This electronic book EPUB-based provide GeoGebra practical tutorial, materials about theory math in geometri algebra, and sample of teaching guide.

GeoGebra could be visually strengthen the understanding of mathematical material at a higher level of geometry. Thus, it is necessary to develop training and strategies for strengthening teacher digital literacy through the GeoGebra training based on learning-constructivism cycle model. Based on the things above, the following problems are formulated:

1) How does the program design for improving teachers' digital literacy?
2) How is the digital literacy training program implemented?
3) What could be produced during the implementation of the digital literacy improvement training?

2. Research Methods

This research is descriptive-practical providing a strategy design or training implementation model [15]. This training measures three abilities that are applied to educators as participant trainees using the cycle learning-constructivism model. This Geogebra training is based on in Geometry and algebra. The stages of the cycle learning-constructivism carried out include: 1) engagement, trainees comprehend the material is about GeoGebra; 2) exploration, trainees practise GeoGebra in group or individually; 3) explanation, trainees present the results of the GeoGebra practice; 4) elaboration; trainees should provide examples of learning using GeoGebra; 5) evaluation, trainees could assess the ability of the teaching guide that have been formed.

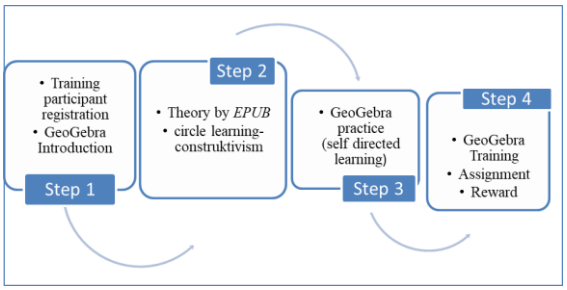

Figure 1. The GeoGebra Training Development Stage

GeoGebra training is an online-offline mentoring for several high school Mathematics teachers in Sorong. Offline training is conducted at the Muhammadiyah University Sorong campus. Meanwhile, online training is conducted through Live Streaming Youtube and video converencing with Zoom Meeting. GeoGebra training uses the cycle learning-constructivism model as a training strategy in the form of participant active learning or direct teacher practice. The training participants are joined in a WhatApp and Telegram application group to facilitate communication and assistance between the activity instructor and the workshop participants. The training materials or workshops are presented in the form of an EPUB (electronic book featuring GeoGebra theory and practicum videos).

Teacher digital literacy training is carried out through 4 (four) stages as shown in Figure 1. Step 1 describes the use of the GeoGebra application in learning mathematics. In this activity, it is explained and given an example of how to use the GeoGebra application in learning mathematics. Furthermore, a simulation of the use of the GeoGebra application in mathematics learning was carried out. In this activity, the teacher is divided into small groups to select and simulate the use of the GeoGebra application in learning mathematics based on circle learning-constructivism model. Step 2, by introducing EPUB as a training teaching material, participants independently based on self-directed learning read and practice the training materials at EPUB within independently or in

group. Step 3, the training carried out in the form of GeoGebra practice. Students are assisted in practicing GeoGebra and presenting the results of their practicum. Stage 4, Making teaching guides as assignment of the last training. Furthermore, the collection of teaching guides will later be made into an e-book so that it could be used as a reference for learning Mathematics. More over, some participant could have reward for the best teaching guide as motivation.

3. Results and Discussions

Teachers are expected not only to be able to convey material well, but also to be able to develop the literacy and numeracy skills of students. So that, teachers' digital literacy skills need to be continuously improved, the way to improve digital literacy skills is through training or workshops [16]. The development of training is carried out to adjust the level of technological. Currently, there are not many teacher trainings that are specifically oriented towards increasing digital literacy skills. Some teachers in Sorong have not used digital literacy optimally in learning mathematics. This motivates to provide training for mathematics teachers. Training is conducted online and offline. Go online using several applications such as WhattApp, Epub, and Zoom. Meanwhile, offline is carried out by each study group located in each school. The training participants consisted of several Mathematics teachers. The following Table 1 is the data of the training participants.

Table 1. Training Location Based on *Cycle Learning*-Construktivism

No	Name of School	Member
1	SMA NEGERI 1 KOTA SORONG	2 Participants
2	SMP NEGERI 5 KOTA SORONG	2 Participants
3	SMKN 3 SORONG	3 Participants
4	SMKN 3 SORONG	2 Participants
5	SMAIT PERADABAN AL IZZAH	2 Participants
6	SMA N 1 KOTA SORONG	2 Participants
7	SMAN 1 RAJA AMPAT	2 Participants
8	SMP PGRI FAK FAK	2 Participants
9	SMP ALAM INSPIRASI	2 Participants

The training is held according to the training stages as shown in Figure 1. Communication and discussion between mentors and participants is carried out for strengthen digital literacy by aplication. The training measures the three abilities that are applied to educators as trainees by using the constructivism-learning cycle model. The training stages are arranged based on the training schedule as shown in Table 2.

Table 2. Schedule of GeoGebra Training Based on Cycle Learning-Construktivism

No	Agenda	Description
1	Registration Making groups	Google Form and WhatApp
2	Reading EPUB *"Pembelajaran Matematika dengan Dasar (EPUB)"* and "*Pembelajaran Matematika dengan jilid 2*" individually or in group	Book Creator
3	Reporting learning by documented picture (submitted in *Google Form)*	Google Form
4	Training held by mentor	Practical, discuss, question and answer through GeoGebra
5	Assignment	Compile lesson plan based on Geogebra
6	Assignment collection	*Google drive*
7	Evaluation and Feedback	Presentation the lesson plan, discuss,and question-answer
8	Reward	Gift and certificate

The e-book used in the training is a form of effort to improve digital literacy by using EPUB. EPUB provides training in the form of materials, training in the form of audio videos, and examples of SAP (Learning Reference Units/Lesson Plan).

Figure 2. Cover *EPUB*

The EPUB link that could be accessed as follows:

1. "Pembelajaran Matematika dengan Dasar (EPUB)" https://read.bookcreator.com/0ox5AiX3pTMK6BYZKCVsfqpNwz23/Lev7oJ1FS6i12W_pXN5xVQ
2. "Pembelajaran Matematika dengan jilid 2"

   https://read.bookcreator.com/0ox5AiX3pTMK6BYZKCVsfqpNwz23/2wSAi6YKSASCEJXPFcyLLA

Several studies reveal the success of GeoGebra in learning [17][18][19]. This strategy training used a learning-constructivism cycle model on GeoGebra for Geometry and algebra materials. The steps taken include:

1) *engagement*
At this stage, training participants are given instructions on how to download, install, and use the GeoGebra application. Then, *EPUB* volume 1 "*Pembelajaran Matematika dengan Dasar (EPUB)*" is given to participants to learn what icons in GeoGebra.

2) *exploration*
At this stage, the participants formed study groups according to the location of the school. Participants are given time to practice individually and together as a group via EPUB volume 2 "*Pembelajaran Matematika dengan Jilid 2*". It could be seen from the documentation in Figure 3 that the training participants sent via google form during their attendance in self-directed learning activities with EPUB volume 2.

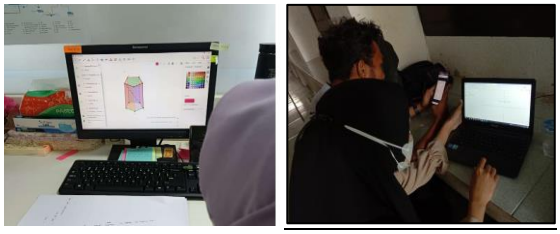

Figure 3. Documentation picture report (self-directed learning as a group and individually)

3) *explanation*
At this stage, the day when practice season through Zoom Meetings with mentors was held. cycle learning-construktivism model was introduced to the training via Zoom Meeting with a recorded mentor with the following link:
link youtube day 1 https://youtu.be/tOGhPSzQuWg
In the Zoom Meeting training day-1, apart from introducing the cycle learning-konstruktivisme model, an example of how to make evaluations or questions that are properties of geometry was given through GeoGebra easily and efficiently. The teachers as the training participants could practice during the Zoom Meeting training and ask questions directly to the mentor. Discussions between participants and mentors run smoothly. At the end of the training day 1, mentor gave assignments to participants for present the subject matter in the next training via Zoom Meeting on day-2

On the second day, participants were given the opportunity to present their constructivism teaching guide through GeoGebra according to the material they chosen. Some participants presented quadratic equations distinguishing maximum and minimum points, straight line equations by making Cartesian points, Three Dimensions as recorded as below:
Link youtube hari 2 https://youtu.be/HRwRYANafgA
One of participants presented form of quadratic equations about comparing the maximum and minimum points which are visualized as "smile" and "sad" images using "check box" icon in GeoGebra (Figure 4).

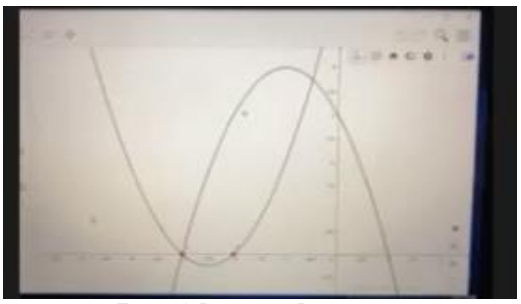

Figure 4. Participant Presentation

4) *elaboration*
After the deep learning is presented, the end of second day Zoom Meeting training, the participants had the task or assignment of writing the lesson into lesson plan called SAP (Learning Reference Unit). Participants are given the task of preparing leson plan from the material that has been presented. Assignment time is given for 6 days and is collected via the Google Drive (Figure 5).

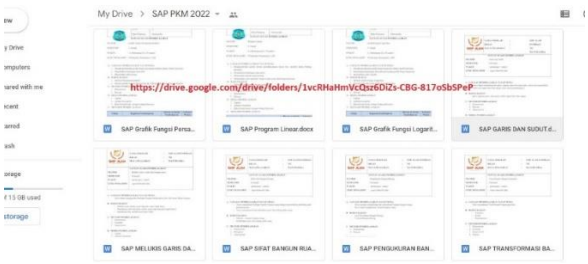

Figure 5. Collected assignment in G-Drive view

5) *evaluation*
The participants responsible on carried out the assignment, indeed some participants collected more than one assignment. A collection of teaching guide results with GeoGebra media from training participants formed into an e-book. This collection of teaching guides have been arranged by the participants, which could be used for fellow Mathematics teachers. The SAP collection of ebooks is useful in teaching mathematics hopefully. The following is the result of feedback from the training held.

Table 3. Indicator feedback

No	Indicator	Lesson hours	Persentage (score)
1	Geometry theory (point, line, plane)	4	95%
2	Toolbar introduction	2	100%
3	Linear Equation, gradient, transformation	2	90%
4	Checkbox, text ABC	2	95%
5	Volume, 3D Graphic	2	100%
6	Presentation and practical	8	95%
7	Lesson plan	4	90%

Note : Persentage (score) = $\frac{nilai\ rata-rata}{nilai\ maksimal}\ x\ 100\%$

4. Conclusion

Conceptual framework of training strategies in order to strengthen digital literacy with cycle learning-constructivism is learning practicum videos and teaching guides based on EPUB. This training is useful in training math teachers to improve their digital literacy skills and motivate themselves to improve their ability to develop learning methods using GeoGebra media. The use of EPUB motivates participants in digital literacy skill. Several video tutorials and examples of learning reference units are contained in this EPUB, so that training participants could learn and practice individually or as a group. GeoGebra could be accessed both online and offline. This training also introduces teachers as participants using the learning stage with the cycle learning-constructivism model. Training with the constructivism learning cycle model is construct mathematical concepts in geometry and algebra according to investigations trough visualisation on GeoGebra. This model could be practiced in class too. GeoGebra skills could help teachers presenting math material in class. GeoGebra also assist the mathematics teachers of the participants in preparing lesson plan on media learning.

Acknowledgment

This study was supported by directorate of research and technology.

Reference

[1] K. M. Kim and R. Md-ali, "GeoGebra : Towards Realizing 21 st Century Learning in Mathematics Education," pp. 93–115, 2017.

[2] Y. Wasiran, I. Maja, and F. Husien, "Pkm Bagi Guru Smp Yang Mengalami Kesulitan Menggunakan Software Geogebra Dalam Pembelajaran Matematika," *Aptekmas J. Pengabdi. Kpd. Masy.*, vol. 2, no. 2, pp. 13–19, 2019, doi: 10.36257/apts.v2i2.1601.

[3] I. M.Nur, "Pemanfaatan Program Geogebra Dalam Pembelajaran Matematika," *J. Mat. Dan Pendidik. Mat.*, vol. 5, no. 1, pp. 10–19, 2016.

[4] A. Rahadyan, P. M. Hartuti, and A. A. R. Awaludin, "Penggunaan Aplikasi Geogebra dalam Pembelajaran Matematika di Sekolah Menengah Pertama," *J. PkM Pengabdi. Kpd. Masy.*, vol. 1, no. 01, p. 11, 2018, doi: 10.30998/jurnalpkm.v1i01.2356.

[5] R. Ziatdinov and J. R. Valles, "Synthesis of Modeling, Visualization, and Programming in GeoGebra as an Effective Approach for Teaching and Learning STEM Topics," *Mathematics*, vol. 10, no. 3, 2022, doi: 10.3390/math10030398.

[6] V. Murni, S. Sariyasa, and I. M. Ardana, "GeoGebra Assist Discovery Learning Model for Problem Solving Ability and Attitude toward Mathematics," *J. Phys. Conf. Ser.*, vol. 895, no. 1, 2017, doi: 10.1088/1742-6596/895/1/012049.

[7] S. O. Bada, "The psychogenisis of knowledge and its epistemological significance," *IOSR J. Res. Method Educ.*, vol. 5, no. 6, pp. 23–34, 2015, doi: 10.9790/7388-05616670.

[8] V. Studies, K. Sarah, U. Malikussaleh, and A. Utara, "The Influence of the Inside Outside Circle Cooperative Learning Model on Students ' Mathematical Communication Ability," vol. 3, no. 3, pp. 177–185, 2021.

[9] H. A. Spires, C. Medlock Paul, and S. N. Kerkhoff, "Digital Literacy for the 21st Century," no. July, pp. 12–21, 2018, doi: 10.4018/978-1-5225-7659-4.ch002.

[10] E. Saripudin, D., Fauzi, W. I., & Nugraha, "The Development of Interactive E-Book of Local History for Senior High School in Improving Local Wisdom and Digital Literacy," vol. 11, no. 1, pp. 17–31, 2022, doi: https://doi.org/10.12973/eu-jer.11.1.17.

[11] J. Joyce, D. H. Gitomer, and C. J. Iaconangelo, "Classroom assignments as measures of teaching quality," *Learn. Instr.*, vol. 54, pp. 48–61, 2018, doi: 10.1016/j.learninstruc.2017.08.001.

[12] K. Roskos, K. Burstein, B.-K. You, J. Brueck, and C. O. Brien, "A Formative Study of an E-book Instructional Model in Early Literacy," *Creat. Educ.*, vol. 02, no. 01, pp. 10–17, 2011, doi: 10.4236/ce.2011.21002.

[13] O. W. Astuti and D. D. Kusumajanto, "Development of Electronic Book (E-Book) EPUB-Based for Display Course," *J. Pendidik. Bisnis dan Manaj.*, vol. 3, no. 2, pp. 157–164, 2017, doi: 10.17977/um003v3i22017p157.

[14] C. Dyah, S. Indrawati, P. Ninghardjanti, C. Huda, and A. Dirgatama, "The effect of practicum learning based audiovisual on students ' learning outcomes in Indonesian vocational secondary school," vol. 11, no. 1, pp. 403–408, 2022, doi: 10.11591/ijere.v11i1.21762.

[15] B. Black, *Workshop Processes, Practices and Materials*. 2015.

[16] C. Study, "European Journal of Educational Research," vol. 9, no. 1, pp. 239–255, 2019, doi: 10.12973/eu-jer.9.1.239.

[17] S. Huda *et al.*, "Understanding of Mathematical Concepts in the Linear Equation with Two Variables: Impact of E-Learning and Blended Learning Using Google Classroom," *Al-Jabar J. Pendidik. Mat.*, vol. 10, no. 2, pp. 261–270, 2019, doi: 10.24042/ajpm.v10i2.5303.

[18] WONG LIT MAY, "the Use of Geogebra in Collaborative Learning in Mathematics," *Geogebra Int. J. Rom.*, vol. 4, no. February, pp. 39–50, 2015.

[19] A. Tatarczak and M. Mędrek, "Educational Experience in Teaching Mathematics Online: a Case Study on the Implementation of Geogebra in an Interactive Learning Environment," *INTED2017 Proc.*, vol. 1, pp. 5416–5424, 2017, doi: 10.21125/inted.2017.1262.