



Development of Digital Mathematics Teaching Materials Based on a Self-Regulated Learning Approach to Increase the Creativity of Jakarta Teachers

Flavia Aurelia Hidajat

Universitas Negeri Jakarta

Flaviaaureliahidajat@unj.ac.id

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Abstract:

The creativity of teachers in developing digital mathematics teaching materials is required to increase students' independent understanding independently in online learning. A good learning strategy to increase creativity and independent learning is self-regulated learning. This community service training aims to increase the creativity of Jakarta teachers in developing teaching materials for digital mathematics learning based on a self-regulated learning approach. Twenty-three high school teachers in Jakarta attended the training. The stages consist of pre-training, training process, and post-training. The results of this community service training. The results show that: The teachers understand the material about the systematic development of digital mathematical teaching materials; Training provides clear information; The output of the training can help the learning of teachers; Teachers' creativity is increasing by making mathematics digital teaching material based on self-regulated learning Approach as the output of this training.

Introduction

In this digital learning era, teaching materials are varied and can be accessed easily by teachers and students. Digital teaching materials currently include blogs on the internet, online articles, and other digital books. Digital teaching materials in the form of digital books greatly affect academic achievement because digital books provide up-to-date experiences and information for students and teachers to access easily¹. If the

¹ Andrea de Giorgio et al., "Towards Online Reinforced Learning of Assembly Sequence Planning with Interactive Guidance Systems for Industry 4.0 Adaptive Manufacturing," *Journal of Manufacturing Systems* 60 (July 1, 2021): 22-34.; Kurniasih, Nuning, Rian Fiqih Rhefhansha, Muh Barid Nizarudin Wajdi, Armin Haluti, Deffi Ayu Puspito Sari, Rosida Tiurma Manurung, and Sri Wiwoho Mudjanarko. "Internet and Learning Resources: A Case Study of the Library and Information Science Students at Universitas

teacher as a facilitator can design learning with the help of digital teaching materials, learning becomes controlled and student-centered learning². Effectively designed digital teaching materials can help students learn independently, but students are still focused on instructions from digital books³. However, many teachers have not been able to develop digital teaching materials for implementing online learning. Therefore, training on the development of digital teaching materials to enhance online learning needs to be given to teachers.

Online learning and technology interconnect with each other to support student creativity and understanding. Educators must be creative in developing digital mathematics teaching materials for online learning⁴. Teacher creativity can improve the quality of learning because teachers need to be able to design learning independently for students, but teachers still guide students in a systematic and directed manner⁵.

Self-regulated learning is one of the effective learning approaches in guiding students' learning process creatively. An independent or self-regulated learning approach is called a self-regulated learning approach⁶. Developing digital teaching materials by following self-regulated learning indicators can be a breakthrough for understanding the material and increasing student creativity independently⁷. Therefore, teachers must be creative in developing and designing digital mathematical teaching materials based on online self-regulated learning.⁸

Padjadjaran." In *Journal of Physics: Conference Series*, 1114:12086. IOP Publishing, 2018.;

² Alex Yue Feng Zhu, Alex Lih Shing Chan, and Kee Lee Chou, "Creative Social Media Use and Political Participation in Young People: The Moderation and Mediation Role of Online Political Expression," *Journal of Adolescence* 77 (December 1, 2019): 108–117.

³ Ali Shakarami, Mostafa Ghobaei-Arani, and Ali Shahidinejad, "A Survey on the Computation Offloading Approaches in Mobile Edge Computing: A Machine Learning-Based Perspective," *Computer Networks* (Elsevier B.V., December 9, 2020).

⁴ Zhu, Chan, and Chou, "Creative Social Media Use and Political Participation in Young People: The Moderation and Mediation Role of Online Political Expression."

⁵ David C.D. van Alten et al., "Self-Regulated Learning Support in Flipped Learning Videos Enhances Learning Outcomes," *Computers and Education* 158 (2020): 1–16, <https://doi.org/10.1016/j.compedu.2020.104000>; Suprihatien, Marmi, Siti Azizah, Muh Barid Nizarudin Wajdi, Umi Farida, Dikson Junus, Isnin Harianti, S. Nuke L Chusna, Roslina, and Trida Trisno Zuono. "Blog Implications as Learning Media in Improving Learning Achievement of Students." In *Journal of Physics: Conference Series*, 2019.

⁶ Philip H. Winne and Dianne Jamieson-Noel, "Self-Regulating Studying by Objectives for Learning: Students' Reports Compared to a Model," *Contemporary Educational Psychology* 28, no. 3 (2003): 259–276, [https://doi.org/10.1016/S0361-476X\(02\)00041-3](https://doi.org/10.1016/S0361-476X(02)00041-3).

⁷ Ioana Jivet et al., "From Students with Love: An Empirical Study on Learner Goals, Self-Regulated Learning and Sense-Making of Learning Analytics in Higher Education," *The Internet and Higher Education* 47 (October 1, 2020).

⁸ Jacqueline Wong et al., "Examining the Use of Prompts to Facilitate Self-Regulated Learning in Massive Open Online Courses," *Computers in Human Behavior* 115 (2021): 1–27, <https://doi.org/10.1016/j.chb.2020.106596>; Chia Wen Tsai, Pei Di Shen, and Meng Chuan Tsai, "Developing an Appropriate Design of Blended Learning with Web-Enabled Self-Regulated Learning to Enhance Students' Learning and Thoughts Regarding Online Learning," *Behaviour and Information Technology* 30, no. 2 (March 2011): 261–271.

Teachers have difficulties in developing digital teaching materials. Teachers only ask students to do assignments and upload them through the Google Classroom platform. Teaching materials are only taken from the internet, and teachers have not developed them creatively. Digital teaching materials circulating are still rote and procedural, especially in mathematics. The scattered mathematics digital textbooks still contain many formulas and the application of formulas in procedural practice questions. Thus, training in developing self-regulated learning-based digital mathematics teaching materials needs to be carried out to increase the creativity of mathematics teachers.

The preliminary study results show that teachers need help developing digital teaching materials. Teachers are more dominant in using digital textbooks with lots of formulas. The results of the following questionnaire show the use of teaching materials in class.

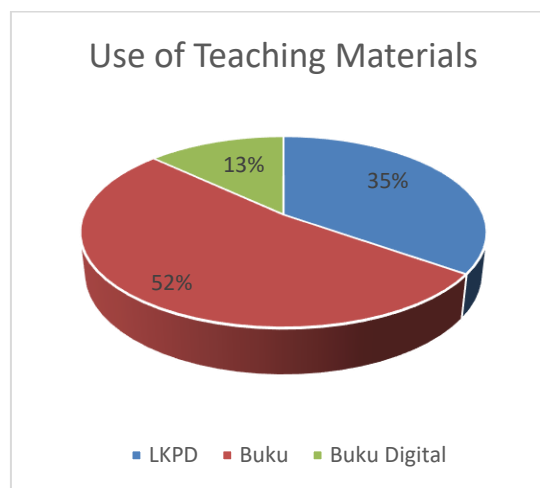


Figure 1. Use of Teaching Materials

Figure 1 shows that 52% of the participants used textbook teaching materials. 35% of participants used LKPD as teaching materials. Meanwhile, 13% of participants used digital books as teaching materials during class. This shows that participants rarely use digital books. The results of the interviews showed that teachers needed help making digital books. Therefore, training in the development of digital mathematics teaching materials is required by teachers.

Therefore, this community service activity aims to train high school mathematics teachers in Jakarta to increase teachers' creativity in developing digital mathematics teaching materials based on self-regulated learning for their students. In addition, the use of digital mathematics teaching materials (creative e-books, flipbooks, GeoGebra implementation, etc.) for teachers for the development of their student learning as an effort to improve quality and quality digital mathematics learning and can increase their

students' knowledge in understanding mathematics creatively ⁹.

Method

Training activities for the community related to developing digital mathematics teaching material based on a self-regulated learning approach to increase the creativity of Jakarta teachers were carried out at FMIPA Jakarta. The target of the training is DKI Jakarta High School teachers. The implementation of community service consists of three activities, including (1) observation and testing of partners; (2) service implementation on October 12, 2022; and (3) implementation of online mentoring processes through WA groups for the development of digital mathematics teaching material based on a self-regulated learning approach. The selection of locations and targets was adjusted to the analysis of needs related to the difficulties of DKI Jakarta teachers in developing digital mathematics teaching materials for the application of online learning so that the objectives of mathematics learning can be achieved.

The target of the community service training is high school teachers in DKI Jakarta, with a total of 23 people. By implementing mentoring activities, increasing insight, creativity, and skills in developing the digital mathematics teaching material based on a self-regulated learning approach can be maximized.

Community Service Implementation Methods

The community service training activities were conducted through a systematic and structured methodology, encompassing the following key phases:

First, Initial Planning. In September 2022, the community service initiative commenced with a comprehensive planning phase. This involved conducting initial observations and obtaining necessary permits from the head of MGMP MA DKI Jakarta, in collaboration with the dedicated team. The objective was to lay the groundwork for the subsequent stages of the program.

Second, Implementation of Community Service Training. The core of the initiative involved the meticulous implementation of community service training. This phase comprised several integral components: (1) Training for Mathematics Teachers: A specialized training session was conducted for mathematics teachers in DKI Jakarta. The focus was on enhancing their skills in developing digital mathematics teaching materials, utilizing a self-regulated learning approach; (2) Independent Development: Mathematics

⁹ Florence Martin, Ting Sun, and Carl D. Westine, "A Systematic Review of Research on Online Teaching and Learning from 2009 to 2018," *Computers and Education* 159 (December 1, 2020).; Wajdi, Muh Barid Nizarudin. "Optimization Of Game Character Education Based On Traditional Physical Education Of Children With Behaviour And Emotional Problems through Learning Model Quantum Learning (Neuro Psychology Learning And Learning)." *ADRI International Journal Of Psychology* 1, no. 1 (2017): 25-32.

teachers in DKI Jakarta were encouraged to engage in independent and creative development activities related to digital mathematics teaching materials, based on the principles of self-regulated learning; (3) Documentation: Rigorous documentation was carried out as a vital element of the program. This documentation served as tangible evidence of the effective implementation of community service, capturing the various aspects and outcomes of the training.

Third, Assistance in Development. A crucial aspect of the community service initiative involved providing assistance to educators in the development of digital mathematics teaching materials. This support aimed to ensure that the acquired knowledge and skills were translated into tangible, high-quality resources that could be utilized in educational settings.

Fourth, Community Service Activity Stages. The entire community service activity was systematically structured and progressed through distinct stages. Noteworthy steps in this regard included the preparation of laptops and LCD equipment. These preparations were essential for the seamless execution of material presentation activities related to the development of digital mathematics teaching materials based on a self-regulated learning approach.

Evaluation Design

Based on the follow-up to this community service training, participants and partners filled out a questionnaire to measure the success of this training. Questionnaire of participant satisfaction from the implementation of community service training. The questionnaire consists of a Google form. In addition, communication between partners and the community service team greatly increases teachers' creativity of DKI Jakarta in developing digital mathematics teaching material based on a self-regulated learning approach. This Community Service Implementation Method is detailed in a cycle from Figure 1.



Figure 1. Methods of Implementation of Community Service

Result

Twenty-three participants from mathematics teachers in DKI Jakarta attended the implementation of this community service training to develop digital mathematics teaching material based on a self-regulated learning approach. During the service training process, the team of presenters and participants followed the health protocols set by the government, namely wearing masks, maintaining distance, and providing hand sanitizers for each service participant.

Community service training related to "Developing the digital mathematics teaching material based on a self-regulated learning approach to improve the creativity of Jakarta teachers" has four stages in the implementation process, including:

Initial Planning Stage

The initial planning stage consisted of conducting initial observations to analyze the problems of teachers in DKI Jakarta. The problem shows that teachers have difficulties in developing mathematics Digital Learning Materials. Digital mathematics teaching materials are also associated with a self-regulated learning approach to guide their students in constructing knowledge independently. Furthermore, the community service team permitted partners to conduct training on developing the digital mathematics teaching material based on a self-regulated learning approach to improve the creativity of Jakarta teachers. The team and partners then determine the implementation schedule and service training plan.

Community service training phase

The implementation of the community service training went smoothly according to the goals and targets set by the team and partners. Partner participants follow government health protocols during the service training process. Indicators of success based on positive responses from participants include systematically arranged material, easy-to-understand digital mathematics teaching material, and material that can be applied to help increase the teacher's creativity of DKI Jakarta High School teachers in developing the digital mathematics teaching material based on a self-regulated learning approach for their students.



Online Assistance Phase

The post-training mentoring phase was carried out for two weeks via the WA group. This online mentoring process aims to review the progress of developing digital mathematics teaching material based on a self-regulated learning approach. In the phase of mentoring activities carried out after the material presentation activities were completed. The assistance increases teachers' creativity in developing digital mathematics teaching materials based on a self-regulated learning approach. Teaching materials created by teachers using CANVA and flipbooks.

Evaluation Phase

The evaluation phase is carried out after the material presentation activities from the training and mentoring have been completed. The team directed participants to complete a satisfaction form via the Google form. This online questionnaire acts as an indicator of the success of this community service training. The evaluation results showed a positive response from the participants. The face-to-face training provided opportunities for active and creative participants in developing digital mathematics teaching material based on a self-regulated learning approach; the use and assistance of applications for developing digital mathematics teaching material can be easily understood.

Overall, the provision of material from the community service training went well, followed by interesting discussion activities. PKM activities run well based on the goals and targets determined jointly by the team and partners.

Discussion

The implementation of community service activities went well and smoothly, with

good and satisfying results. The service participants were mathematics teachers in DKI Jakarta. Active participants participated enthusiastically in the service. This was shown by the participants, who actively discussed and asked questions. The service participants welcomed the provision of material during community service training related to the development of digital mathematics teaching materials. Training is important for developing online learning during the COVID-19 pandemic.¹⁰

The participants successfully implemented the development of digital mathematics teaching materials based on a self-regulated learning approach. 100% of participants gave a positive response in the Google form. The results of the participant's responses are that the material is systematically arranged, the material is easy to understand, and the material can be applied to help increase teachers' creativity in developing digital mathematics teaching materials based on a self-regulated learning approach for their students. The results show that the training meets the indicators of training success.

After the training, mentoring is implemented systematically by following a good and correct syntax. At this stage, the team and participants conducted online discussions through the WA group. The results of the assistance related to increasing teachers' creativity in developing digital mathematics teaching materials follow the opinion that digital mathematics learning media can improve high-level thinking skills and student creativity. This mentoring activity is online to produce digital mathematics teaching materials based on a self-regulated learning approach. Teaching materials through digital technology encourage students to think and find new ideas ¹¹.

Based on the final results of the evaluation, the positive response from the participants indicated the success of the community service indicator. The final evaluation results show that face-to-face training provides active and creative participants opportunities to develop digital mathematics teaching materials based on a self-regulated learning approach. The development of digital facilities can effectively improve student learning performance ¹². In addition, this community service training

¹⁰ Marlina, Yuli, Maryam Sulaeman, Achmad Sutrisna, Mulki Siregar, and Azka Azka. "Parental Support for Independent Learning and Student Learning Motivation in The Post Pandemic Era." *EDUTECH : Journal of Education And Technology* (2023).

¹¹ Ibid.

¹² Wong et al., "Examining the Use of Prompts to Facilitate Self-Regulated Learning in Massive Open Online Courses"; Shan Li et al., "Examining Temporal Dynamics of Self-Regulated Learning Behaviors in STEM Learning: A Network Approach," *Computers and Education* 158 (2020): 1-14, <https://doi.org/10.1016/j.compedu.2020.103987>; Danial Hooshyar et al., "Open Learner Models in Supporting Self-Regulated Learning in Higher Education: A Systematic Literature Review," *Computers and Education* 154 (2020): 1-19, <https://doi.org/10.1016/j.compedu.2020.103878>; Soewardini, Herfa Maulina Dewi, Ratna Ayu Supratiwi, Ananias Serin, Mariana Ulfah Hoesny, Muh Barid Nizarudin Wajdi, Sunu Hastuti, Agus Setiawan, Erli Lumban Gaol, and Chitra Dewi Yulia Christie. "Mathematical Comics on Class X Trigonometry Learning." In *Journal of Physics: Conference Series*, 1175:12013. IOP Publishing,

also assists in using applications to develop digital mathematics teaching materials that participants can easily understand.

Conclusion

This community service training activity aims to increase the creativity of Jakarta teachers in developing digital mathematics teaching based on a self-regulated learning approach. The implementation of service activities went smoothly, and each participant produced digital mathematics teaching based on a self-regulated learning approach. The service participants actively discussed and enthusiastically during the training process of this activity. Participants exchanged opinions, asked questions, and responded positively to the training materials. The availability of applications and how to use them can be accessed easily by teachers so that the objectives of this service training can be realized properly and precisely.

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