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GEOGEBRA-ASSISTED LEARNING, DOING, AND REPEATING (LDR) MODEL TO DEVELOP COMMUNITY NUMERACY SKILLS

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ABSTRACT

In the Society 5.0 era, strong numeracy skills are essential for processing complex data and making informed decisions. However, the numeracy levels of the Indonesian population remain relatively low, underscoring the need for effective educational interventions. This study investigates the effectiveness of the Learning, Doing, and Repeating (LDR) model, supported by GeoGebra, in developing community-based numeracy skills. The LDR model structures learning through iterative cycles: initial instruction (Learning), direct application (Doing), and reinforcement (Repeating), with GeoGebra facilitating the visualization of mathematical relationships. An experimental one-group pretest–posttest design was employed, involving community members guided by PKBM Yapenmas. Numeracy skills were assessed using mathematics tasks adapted from the PISA 2022 framework, alongside observations and interviews. The results indicated significant improvements in participants' numeracy skills following the intervention. The use of GeoGebra was found to enhance participants' conceptual understanding and engagement during the learning process. These findings suggest that the LDR model, when integrated with interactive technology, offers an effective approach to fostering numeracy development in informal educational contexts. This study contributes to the growing field of technology-assisted mathematics education and highlights the potential of iterative learning models for strengthening foundational numeracy skills within community learning environments.

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INTRODUCTION

The *Independent Learning (Merdeka Belajar)* policy is applied across the entire education system in Indonesia, from early childhood education to higher education. This policy emphasizes equal access to education. To support its implementation, the government has developed a digital platform that assists teachers, schools, and the Ministry of Education in delivering the Independent Learning curriculum. This curriculum aims to strengthen students' basic literacy skills while providing greater flexibility for teachers and schools (Randall et al., 2022). The Independent Curriculum has demonstrated some success in improving learning outcomes (Rosser et al., 2022). Empowering communities to foster engagement among teachers, principals, students, and parents is a key factor in enhancing the quality of education in Indonesia (Syahril, 2023).

The Community Learning Activity Center (Pusat Kegiatan Belajar Masyarakat/PKBM) Yapenmas is an out-of-school educational institution that aims to support community members in meeting their educational needs through both formal and non-formal education. PKBM Yapenmas offers programs such as early childhood education (PAUD), RA/TK, TPA, business learning activities, functional literacy, Package A, Package B, Package C, Community Reading Garden (Taman Bacaan Masyarakat/TBM), Majelis Ta'lim, and various education and training programs. Its organizational structure includes administrators, instructors, and learners.

Currently, PKBM Yapenmas has a relatively active community of learners, particularly within the TBM program, which consists of 20 participants of varying ages. This community has begun to engage regularly with the books provided through the TBM program. However, the development of this learning community has not yet addressed the improvement of numeracy skills—a key aspect of basic literacy essential for enhancing community welfare (Delima et al., 2022; Delima, et al., 2023; OECD, 2023).

The GeoGebra application is a digital learning medium that offers effective visualizations in mathematics education and facilitates direct interaction between students and teachers. This platform allows users to construct, demonstrate, and visualize abstract mathematical concepts (Asngari et al., 2017). GeoGebra has been recognized as highly effective in increasing student motivation and interest in learning (Rhilmanidar et al., 2020). Interactive mathematics learning supported by GeoGebra has been widely evaluated and found effective in improving students' numeracy skills (Delima, et al. 2023; Delima, et al., 2023; Istiqlal, 2017;

Suseno et al., 2020).

PKBM Yapenmas, as an out-of-school educational institution, seeks to empower the community to become self-reliant, independent, and capable of improving their standard of living. The development of numeracy skills within the PKBM Yapenmas learning community is expected to contribute to the long-term welfare of its members. The learning model applied to this community must accommodate differentiated learning, as participants vary in age and come from different sub-districts.

The Learning, Doing, and Repeating (LDR) model is a learning approach consisting of three stages. First, the learning stage is conducted through both online and offline face-to-face sessions, during which the community is introduced to using GeoGebra to solve numeracy problems. Second, the doing stage involves hands-on practice, supported by video tutorials provided to participants. Third, the repeating stage is carried out through project-based assignments (Mudian & Delima, 2024; Team, 2022).

The LDR model is an adaptation of the flipped learning model, structured into three stages—learning, doing, and repeating—within a single cycle. Similar to the flipped learning approach, the LDR model integrates technology into the learning process (Julinar & Yusuf, 2019). It has proven effective in improving community financial literacy (Mudian & Delima, 2024). The integration of technology into the LDR model represents the novelty of this study. The technologies used include the GeoGebra application and instructional videos/tutorials. The syntax of the LDR model used in this study is illustrated in Figure 1.

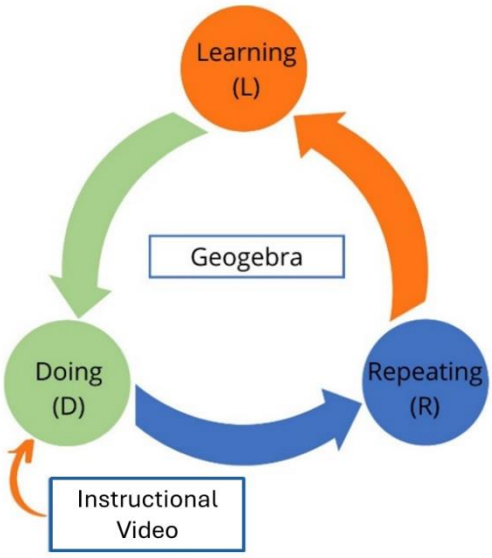


Figure 1. Syntax of LDR Model.

Based on the results of PISA 2022, it is evident that the numeracy skills of Indonesian students remain low. One contributing factor to this issue is the surrounding environmental context (Khurma et al., 2025; Wijaya et al., 2024). Consequently, the PISA results indirectly indicate that the numeracy skills of the broader Indonesian population are also relatively low.

The LDR model, supported by the use of GeoGebra, is believed to have the potential to enhance numeracy skills within the PKBM Yapenmas learning community. This study aims to examine the effectiveness of the LDR model assisted by GeoGebra in improving the community's numeracy abilities.

This research is significant and worthy of publication because very few studies have focused on developing numeracy skills at the community level, in contrast to the extensive research on improving students' numeracy. Continuing research in this area is essential to support Indonesia's development and progress in the future.

METHOD

This study employs a pre-experimental method using a one-group pretest-posttest design. Although some scholars question the validity of this approach, it remains a viable method for research purposes (Knapp, 2016). The effectiveness of the LDR model assisted by GeoGebra is evaluated based on the effect size calculated from the post-test results. The stages of this research are illustrated in Figure 2 below.

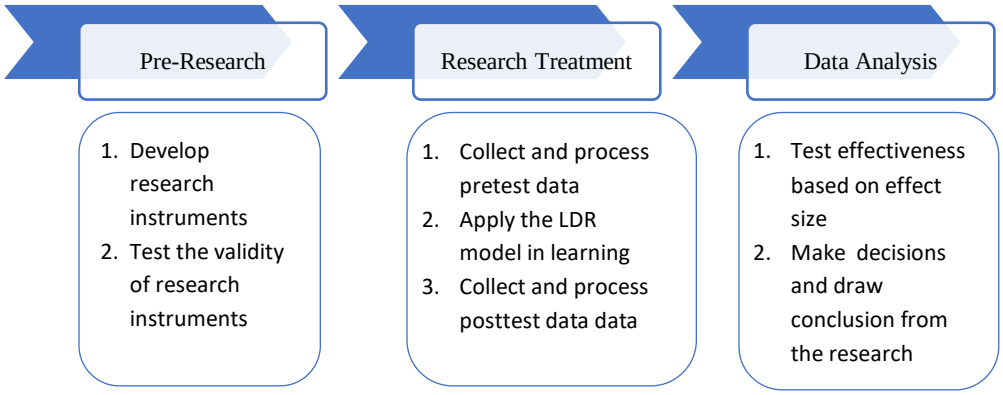


Figure 2. Research Stages

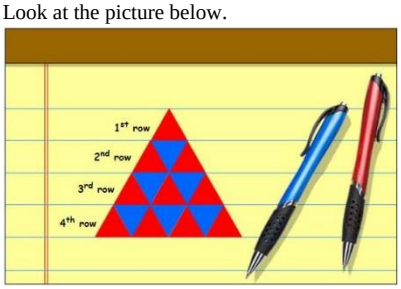
To avoid bias, three research instruments were used: pretest and posttest instruments, observation sheets, and interviews with selected research subjects. The pretest and posttest utilized two questions from PISA 2022, which did not require additional validity and reliability testing. These PISA questions were in multiple-choice format, resulting in ordinal pretest-

posttest score data. Therefore, the data were analyzed using the non-parametric Wilcoxon signed-rank test.

The observation sheet was designed as a checklist to monitor participant activities during the learning process. Interviews were conducted with two randomly selected participants after the posttest was administered. The subjects of this study consisted of 25 members of the PKBM Yapenmas learning community, ranging in age from 19 to 55 years.

The pretest-posttest instruments, observation checklist items, and interview questions used in this study are presented in Table 1.

Table 1. Research Instrument

Pretest-Posttest (OECD, 2023)	Observation	Interview
1. Look at the picture below.  Rudi will add one row of triangles following the same pattern. Then, Rudi makes the statement: **"The percentage of blue triangles out of the total number of triangles is always less than 50%."** Is Rudi's statement, correct? a. Yes b. No Pay attention to the table of average distances of planets from the Sun in astronomical units (AU) below. Planet / Average distance from Sun in au Mercury 0.39 Venus 0.72 Earth 1.00 Mars 1.52 Jupiter 5.20 Saturn 9.58 Uranus 19.20 Neptune 30.05 Suppose it is known that 1 AU = 150 million kilometres. Determine the distance between the Sun and the planet Neptune in kilometers. a. 5 million km b. 30 million km c. 180 million km d. 4500 million km	1. Participants can operate GeoGebra correctly (following the instructions during the learning process). 2. Participants can practice the steps to solve mathematical problems with GeoGebra, as demonstrated in the video tutorial. 3. Participants can use GeoGebra to solve mathematical problems.	1. How do you understand the math problems given? 2. How do you use GeoGebra to solve math problems? 3. How do you understand each step in solving a math problem? 4. How do you follow the steps to solve the questions provided in the video tutorial?

RESULT AND DISCUSSION

This research was conducted during the period of August – September 2024. The initial conditions of the research subjects (respondents) are described in Table 2.

Table 2. Initial Conditions of Respondents

Condition of Respondent	% Answer		
	Yes	Maybe	No
Knowing about GeoGebra	8	16	76
Participants have used GeoGebra	4	12	84

Table 2 shows that the majority of respondents do not know GeoGebra and have never used it, either in learning or in their work. This study uses the syntax of the LDR model assisted by GeoGebra. At each meeting, the learning process begins with an explanation of GeoGebra, covering everything from installation to its application in solving math problems. The next step is the doing stage, where participants are provided with video tutorials to practice the material explained, following the instructions in the video. A collection of video tutorials can be found at the following link: https://bit.ly/VideoTutorialGeoGebra. The final stage is the repeating process, where respondents are asked to solve math problems using the GeoGebra course menu. One of the GeoGebra menus used during the repeating stage is Simple Algebraic Operations, which can be accessed at the following link: https://www.GeoGebra.org/m/krvgfatr.

The results of the study showed differences in participants' conditions before and after receiving learning using the LDR model assisted by GeoGebra. A description of the data on participants' conditions before and after the treatment is shown in the pretest and posttest scores, illustrated in Figure 3.

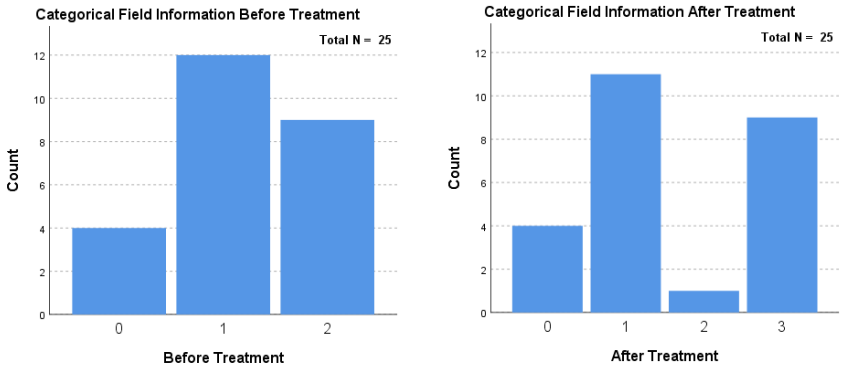


Figure 3. Description of Data Before (Pretest) and After Treatment (Posttest)

To determine whether there is a significant difference between participants' conditions before and after receiving learning using the LDR model assisted by GeoGebra, a Wilcoxon signed-rank test was conducted. The results of the Wilcoxon test are presented in Table 3.

Table 3. Wilcoxon Signed Rank Test

Value	Total N	Asymptotic Sig. (2-sided test)	Decision
55.000	25	0.002	Reject the null hypothesis

The results of the Wilcoxon test showed a significant difference between participants' numeracy abilities before and after receiving learning using the LDR model assisted by GeoGebra. These results were further supported by the analysis of observation sheet data, which revealed that 85% of participants were able to solve all the math problems presented during the learning sessions using GeoGebra. Additionally, the interview results indicated that participants understood how to solve math problems using GeoGebra. Participants mentioned that the video tutorials provided were very helpful in developing their reasoning skills for solving math problems. The use of GeoGebra during the learning process has greatly motivated participants to apply reasoning in mathematics. To assess the effectiveness of the GeoGebra-assisted LDR model, an effect size analysis was conducted.

Table 4. Effect Size

	Mean	Std. Deviation	Effect Size (%)
Before	1.20	0.707	41.8
After	1.60	1.155	

Table 4 shows that the GeoGebra-assisted LDR model has a positive impact on the community's numeracy skills, with an increase of 41.8%. This means that, for every 100 people learning with the GeoGebra-assisted LDR model, approximately 41 individuals have the potential to experience an improvement in their numeracy skills. Therefore, the GeoGebra-assisted LDR model can be considered quite effective in developing the community's numeracy skills.

The process of using reasoning to solve mathematical problems is an indicator of numeracy ability (Delima et al., 2022; Handayani et al., 2022; OECD, 2023). Numeracy is crucial for everyone, as it serves as the foundation for future empowerment (Ernest, 2015; Hoogland & Díez-Palomar, 2022; OECD, 2023). Improving people's numeracy skills contributes to advancing a country's economy (Ernest, 2015; OECD, 2023). The results of this study show that the GeoGebra-assisted LDR model is effective in enhancing community numeracy skills. This effectiveness is attributed to the 'doing' stage of the LDR model, which supports learners through video tutorials during the learning process. Additionally, the 'repeating' stage of the LDR model helps participants strengthen their problem-solving skills through the course menu in GeoGebra. The LDR model, a development of the flipped learning

model, has been proven effective in improving students' mathematical thinking skills (Lazzari, 2023; Ramdhani et al., 2020). The use of GeoGebra in mathematics education has also been demonstrated to improve students' mathematical thinking skills (Asngari et al., 2017; Benning et al., 2018; Delima, Elfandi, Ramadhani, et al., 2023; Rhilmanidar et al., 2020; Sari et al., 2016). Thus, it is reasonable to conclude that the GeoGebra-assisted LDR model has proven effective in developing the community's numeracy skills.

CONCLUSION

The GeoGebra-assisted LDR model has proven effective in enhancing the numeracy skills of the community in the Yapenmas PKBM learning community. The model positively impacted the community's numeracy skills by 41.8%. The 'doing' stage of the LDR model supports the community in the learning process through the video tutorials provided. Meanwhile, the 'repeating' stage aids in the development of problem-solving skills through the course menu in GeoGebra. The findings of this study contribute to enriching mathematics learning models, particularly in the development of community numeracy skills. To support Indonesia's development, efforts must be made to improve the numeracy skills of the general public, not just school students. Further research is needed to test the effectiveness of the LDR model with other communities to strengthen the findings of this study and help improve the quality of Indonesian society.

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