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## Utilization of the Wondering, Exploring, and Explaining (WEE) Learning Model Assisted by GeoGebra to improve Understanding of Mathematical Concepts

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### ABSTRACT

This study aims to describe the application of the Geogebra-assisted Wondering, Exploring, and Explaining (WEE) learning model in improving the ability to understand mathematical concepts on lines and angles material at Junior High School of Darush Sholihin Batu in the 2022/2023 academic year. The study employs practical classroom action research, recruiting class VII-B as the research subjects. Interview guides, observation sheets, end-of-cycle test questions adapted to indicators of the ability to understand concepts, and field notes were the study's pilots for data collection. The findings showcased that the observation of teachers' and students' activities, the final cycle test completeness, and the interview results with happy students were boosted from cycles I to II. Furthermore, cycle II met the indicators of action success, indicating that the Geogebra-assisted Wondering, Exploring, and Explaining (WEE) learning model can improve the ability to understand mathematical concepts on lines and angles material at SMP Darush Sholihin Batu.

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## Introduction

Mathematics can manipulate human thinking processes to more advanced times with information and communication technology, requiring a certain understanding of mathematics foundation (Kartika, 2018). Permendikbud Number 58 of 2014 reveals that students must be able to master mathematics concepts, communicate related concepts, and apply accurate solving problems in learning mathematics concepts (Cahani et al., 2021). Thus, mathematics lesson is fundamental to learning. It may become a vessel in the process of understanding optimal concepts.

Understanding mathematical concepts is an initial capacity to understand mathematic materials, formulas, concepts, problem-solving, and estimating the truth of a statement in studying mathematics (Novri et al., 2018). Students should start by perceiving the concept to be able to solve various problems (Sepriani, 2021). Concept understanding is crucial to mastering mathematical concepts, an objective process in learning mathematics (Arfany &

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Faradiba, 2022). Moreover, Saragih (2018) crafted the objectives of learning mathematics as exploring understanding, explaining, and applying concepts or the interrelationships of concepts in mathematics and applying algorithm concepts precisely and accurately to solve problems. Thus, the ability to understand concepts becomes an essential aspect for every student because it is in accordance with schools' learning objectives. But in reality, there are still many problems related to these abilities which are still low, especially at the junior high school level. In line with Augustine dkk, (2020) revealed, one of the problems that arise in the teaching and learning process in junior high schools is related to the low ability related to solving a problem that prioritizes the process of mastering and understanding activities related to concepts in a range of material.

Furthermore, the interviews and observations with SMP Darush Sholihin Batu mathematics teachers revealed that the seventh-grade students had difficulty with different problems from the previously distributed questions. The problem occurs because of a lack of conceptual understanding of the materials, leading to inappropriate procrastinating problem-solving assigned. In short, the concept understanding ability of class VII (Junior High School of Darush Sholihin Batu) is still low.

The indecent concept of understanding ability is escorted by plenty of indicators. Many students cannot restate and contemplate the previous material of mathematical concepts was among the lists. The low ability to understand mathematical concepts relates to students' inability to convey relationships between concepts of mathematical material and the lack of students' concepts applications or algorithms to solve a problem flexibly, efficiently, accurately, and precisely. In brief, many VII-grade students at SMP Darush Sholihin cannot correctly solve mathematical problems because their concepts understanding is still low during the learning process.

The interview sessions also revealed that the students experienced a handicap in understanding the concept of lines and angles material. In line with Ananda dkk, (2018) states that students often have difficulty learning geometry on conceptual matters. These difficulties include the inability of students to connect between the concepts of lines and angles material, apply the concepts of lines and angles material, and also the inability to understand the principles of lines and angles material properly, steering students to experience impediments in the materials' problem-solving.

Typically, mathematics material contains many concepts that must be well understood, lines and angles material was among them. Ananda et al. (2018) state that lines and angles contain multiple concepts in geometry. Sepriani (2021) also states that lines and angles material have several concepts, principles, and efficient formulas to solve existing problems. Therefore, mastering all mathematics materials (lines and angles) requires solid concepts understanding ability.

The inappropriate learning model is among the influencing factors to the problem exposures, where the teacher as an educator applies conventional models and lecture methods, preceding students' inactivity during the class. In addition, the lack of media application also becomes a major problem in the visualization and teachers' assistance to facilitate students' understanding of mathematical concepts. Thereby, applying appropriate

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models and learning media assistance in creating a maximum ability to understand mathematical concepts is significant.

Based on the problems and factors above, the researcher attempts to implement the Wondering, Exploring, and Explaining (WEE) learning model assisted by GeoGebra at SMP Darush Sholihin Batu in the subject of lines and angles.

The WEE learning model is divided into three stages, Wondering, Exploring, and Explaining, involving the active role of students (Wahyuni et al., 2019). The first stage is creating a question, followed by the process of finding answers and presenting the answer with their understanding. This learning model is able to maximize the ability to understand mathematical concepts through the three stages of the learning model.

The learning model is complemented by the use of media assistance to ease the maximum process of understanding mathematical concepts with the help of GeoGebra. The use of GeoGebra is seen from the arising problems (the low ability to understand concepts related to the material of lines and angles). In addition, Fitri (2022) conveyed that the use of GeoGebra method is applicable to the material of lines and angles because the method may help the students understand and describe lines, relationships between lines, relationships between angles, etc. Nurfadilah & Suhendar (2018) also stated that GeoGebra is applicable to the material because the method may efficiently visualize the material.

Several studies on improving the ability to understand mathematical concepts in the material of lines and angles through the application of the GeoGebra-assisted Wondering, Exploring, and Explaining (WEE) learning model have never been carried out. However, several studies examine the relationship between this model and the ability to understand mathematical concepts, such as Iqoh et al. (2021) research discussing on WEE learning model in terms of Curiosity: the effect on the ability to understand mathematical concepts showcased an influence of the learning model in terms of Curiosity on students' ability to understand mathematical concepts. Wahyuni et al. (2019) quired the concept of the WEE learning model, employing the QSH strategy in self-regulation. The study confronted that the strategies are more efficient than conventional studies on the ability to understand mathematical concepts.

Therefore, the current study endeavours WEE learning model, portraying GeoGebra method to elevate the ability of mathematical concepts in lines and angles material, attempting to portray the application of the GeoGebra-assisted WEE learning model in improving the ability to understand mathematical concepts in the material of lines and angles at SMP Darush Sholihin Batu.

## **Research Methods**

The current study employs practical classroom action research, gearing qualitative method. Classroom Action Research (PTK) may properly improve the performance of educators to elevate students' learning outcomes (Sugiarni et al., 2021). Moreover, Kemmis's & Mc. Taggart's stages were applied to the study: (1) planning; (2) acting; (3) observing); and (4) reflecting.

The study took place at SMP Darush Sholihin Batu for the 2022/2023 academic year.

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The study recruited class VII-B with a total of 27 students as the sample of the study. Interviews, observations, end-of-cycle test questions, and field notes were the instruments of the study. The instruments validation was firstly tested by the lecturer of Mathematics Education at the University of Islam Malang and the mathematics teacher at SMP Darush Sholihin Batu.

The data collection procedure through the interview was initially completed by interviewing the mathematics teachers at SMP Darush Sholihin Batu before starting the method. After the method was applied, the researcher interviewed the students. Six students (two with high, two with moderate, and two with low concept understanding ability category) were recruited in the interview sessions. The category of ability to understand concepts in determining the interviewees can be seen in Table 1.

**Table 1.** Categories of Ability to Understand Mathematical Concepts

Categories	Score
High	75–100
Moderate	50–74,99
Low	25–49,99
Very Low	0–24,99

(Adhiska et al., 2020)

Observation instruments and field notes were given to two observers (the mathematics teacher and a colleague in mathematics education) to observe all the activities of the teacher (researcher) and students. In addition, the instrument at the end of the cycle test (essay) was distributed to test the student's ability to understand mathematical concepts after the applied treatment.

The data analysis techniques were qualitative and quantitative (Creswell, 2012). The qualitative data yielded from observation, interview and filed notes. Observation results are calculated using the following action percentage formula (Sani et al., 2020).

$$\text{Final Score Percentage} = \frac{\text{Total score}}{\text{Maximum score}} \times 100\%$$

The following formula calculates interview results.

$$\text{Final Score Percentage} = \frac{\text{The number of happy interviewees}}{\text{Total interviewee}} \times 100\%$$

Meanwhile, quantitative data analysis is only a support, which does not reach the statistical test. The data were analyzed quantitatively through end-of-cycle tests, which were then descriptively analyzed. Final test data of the ability to understand mathematical concepts were analyzed using the individual completeness formula. Sitepu et al. (2021: 412) formulates individual mastery:

$$\text{Individual Mastery} = \frac{\text{Correct Score}}{\text{Total Score}} \times 100$$

With: the total score is the maximum total score

The next step is to calculate the completeness of classical learning with the following formula (Sitepu et al., 2021).

$$\text{Percentage of Average Score (NR)} = \frac{\text{The number of completed students (score} \geq 75)}{\text{Number of students}} \times 100\%$$

The indicators of success for the implemented action can be seen from the observations results, achieving  $\geq 80\%$  (Khaulah & Novianti, 2019). In addition, the successful action is determined by the achievement of completed successful criteria, seen from the results of the final cycle test reaching the classical completeness indicator  $\geq 70\%$ . However, the students' scores in the cycle final test achieved individual completeness with the provisions of the Minimum Completeness Criteria (KKM) determined by the school  $\geq 75$  (Lestari et al., 2018). Furthermore, the action is categorized as a successful cycle if  $>50\%$  of students are happy with the application of the GeoGebra-assisted WEE learning model.

## Findings

### *Pre-Action Data Exposure*

The researchers carried out an activity before the action or pre-action (observation activities) to get insights into the students' ability to understand mathematical concepts, challenging material, and also the results of the Mid Semester Examination. The observation unpacked that participants passed the Mid Semester Examination test only three students (11.1% of the students). In other words, the ability to understand mathematical concepts in lines and angles material is still low. These problems occur due to the inaccuracy of the application of learning models and the lack of learning media assistance that can facilitate the process of understanding the material. Thus, the researcher applied the GeoGebra-assisted Wondering, Exploring, and Explaining (WEE) learning model to optimize the ability to understand the mathematical concepts of lines and angles.

### *Exposure of Cycle I Data*

#### 1. Planning

Researchers determined research objectives and compiled materials, learning tools, and research instruments (interview guidelines, observation sheets for teacher and student activities, final test questions for cycle I, field notes, and determining criteria for successful action).

#### 2. Acting

The actions were conducted in two meetings employing the GeoGebra-assisted WEE learning model. The first meeting on April 10, 2023, discussed the meaning of lines, the relationship between points, lines, planes, and the position of two lines. Meanwhile, the second meeting on April 11, 2023, discussed the division of line segments into several equal parts and finding the comparative values of line segments. The researchers' GeoGebra-assisted WEE learning model implementation is as follows.

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- a. Preliminary activities. This activity includes the initial series in the learning process including greetings, prayers, checking attendance, motivation, learning objectives, information on the GeoGebra-assisted WEE learning model, and apperception.
  - b. Main activities. This activity contains a series of activities of forming five groups. In the Wondering stage, the activity contains reading activities and creating questions, recorded in the Wonderment Log related to the material that has been determined at each meeting. The students design the Exploring Prior Knowledge and Exploring Plans at the Exploring stage. They carry out exploration activities and write the exploration into the Exploring Log. At the Explaining stage, the students organize the Explaining Summary and Explaining Plan, present the previous stage exploration, and work in groups on the exercises that have been given. In addition, at the end of the second meeting, a final test of the cycle I was carried out.
  - c. Closing Activities. This activity contains a series of activities which include concluding material, delivery of the next material, prayer, and closing.
3. Observing  
At this stage, two observers implement cycle I action by filling out field notes and observation sheets of teacher and student activities.
  4. Reflecting  
This stage intends to observe, examine, and conclude whether the actions of the cycle I was successful or not. Cycle II may occur if the previous cycle is considered unsuccessful. In cycle I, the percentage of teacher activity observations was 55.5%, students' activities observation was 55%, cycle I final test showed that only 16 students passed the test (59.3%), only three students were happy with the application of the GeoGebra-assisted WEE learning model (50%), and the field notes stated that the ability of the teacher (researcher) still had deficiencies in managing the learning process, where the teacher's activities in conditioning students during the learning process are still incomplete which results in students still being busy, joking with other friends, going around to other groups, not being serious when discussing with their groups during the learning process which includes the Wondering, Exploring, and Explaining stages, not pay attention to the teacher during the learning process so that the class is not conducive and students seem to still not know and cannot use GeoGebra in the learning process. In addition, interviews after the first cycle of action were conducted to the class VII-B math teacher, namely Mrs. Dra. Puji Lestari stated that the application of the GeoGebra-assisted WEE learning model is appropriate because it can help in honing the process of understanding the concept of the material being studied even though after the cycle I action it was seen that there were still students who could not understand the concept of line material and angles, especially the sub-line material. In conclusion, the first cycle was considered unsuccessful because it did not meet the indicators of successful action. Therefore, the cycle needs to go to the second cycle.
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### ***Exposure to Cycle II Data***

#### 1. Planning

Researchers determined research objectives and compiled learning materials, learning tools, and research instruments (interview guidelines, observation sheets of teacher and student activities, final cycle II test questions, field notes, and determining criteria for action success).

#### 2. Acting

The actions were done in two meetings employing the GeoGebra-assisted WEE learning model. The first meeting on April 13, 2023, discussed measuring angles with arcs and GeoGebra, the different types of angles. Meanwhile, the second meeting on April 17, 2023, discussed the relationship between angles, dividing two angles into equal parts, and the nature of angles if a transversal line cuts two parallel lines. The researchers' GeoGebra-assisted WEE learning model implementation is as follows.

- a. Preliminary activities. This activity includes the initial series in the learning process (greetings, prayers, checking attendance, motivation, learning objectives, information on the GeoGebra-assisted WEE learning model), and apperception.
- b. Main activities. This activity contains a series of activities of forming five groups. In the Wondering stage, the activity contains reading activities and creating questions, recorded in the Wonderment Log related to the material that has been determined at each meeting. The students design the Exploring Prior Knowledge and Exploring Plans at the Exploring stage. They carry out exploration activities and write the exploration into the Exploring Log. At the Explaining stage, the students organize the Explaining Summary and Explaining Plan, present the previous stage exploration, and work in groups on the exercises that have been given. In addition, at the end of the second meeting, a final test of the cycle II was carried out.
- c. Closing Activities. This activity contains a series of activities which include concluding material, delivery of the next material, prayer, and closing.

#### 3. Observing

At this stage, two observers implemented cycle II action by filling out field notes and observation sheets of teacher and student activities.

#### 4. Reflecting

This stage was carried out in the same way as in cycle I to observe and examine the actions of cycle II that have been carried out to draw conclusions whether or not the cycle has been considered successful. Cycle III may be applied if the current cycle is considered unsuccessful. Moreover, in cycle II, the percentage of teacher activity observations was 89.6%, students' activity observations were 87.3%, the score of cycle II final test was 81.5 %, with 22 students had passed the test, 83.3% with five satisfied students on the application of GeoGebra-assisted WEE learning model in the interview sessions, and the results of the field notes showed that the teaching and learning process has improved from the previous cycle I, where the teacher has been able to condition students as a whole to all students during the learning process so

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that students have followed the learning process without anyone being busy, joking, going around to other groups during the learning process, then students are also serious when discussing with their groups during the learning process which includes the Wondering, Exploring, and Explaining stages, students have also paid attention to the teacher during the learning process so that the class is conducive, and students already know GeoGebra and can already use GeoGebra in the learning process. In addition, interviews after the second cycle of action were conducted to the class VII-B mathematics teacher, namely Mrs. Dra. Puji Lestari stated that the application of the GeoGebra-assisted Wondering, Exploring, and Explaining (WEE) learning model is appropriate because it can help students hone the process of understanding the concepts of the material being studied and after the second cycle of action students are much more able to understand the concepts of the material lines and angles especially the angle sub material. In short, the implementation of the second cycle is considered successful. Thus, a summary of the data analysis is presented in detail in Table 2.

**Table 2.** Data Analysis Summary

<b>Action Success Criteria Indicator</b>	<b>Cycle I</b>	<b>Cycle II</b>
Teacher Observation Activity	55,5%	89,6%
Student Observation Activity	55,0%	87,3%
Final Cycle Test	59,3%	81,5%
Interview Results	50,0%	83,3%

## Discussion

Based on the description of the findings, it can be said that the learning process by applying the GeoGebra-assisted WEE learning model successfully increase the ability to understand mathematical concepts in lines and angles material. In line with Iqoh dkk, (2021) states that the WEE learning model is more effectively used for the ability to understand mathematical concepts, which has a good effect on students, namely being more active, conducive, and able to communicate well because there is a discussion process with groups. Then in line with Ma'ulah dkk, (2021) states that GeoGebra is a computer program that can help teachers and students understand geometry material. In addition, in line with Wahyuni dkk, (2019) . Then in line with Fitri, (2022) states that GeoGebra can make students confident and better able to understand the material of lines and angles. Also, in line with Lestiana dkk, (2018) states that the WEE model is a learning design with a function to instill concepts in students. Then in line with Suciati dkk, (2022) states that the use of GeoGebra has a positive, effective, and better effect in improving students' abilities in learning mathematics, one of which is the ability to understand mathematical concepts. In addition, it is also compatible with Desniarti & Ramadhani (2019) who stated that GeoGebra in the learning process has an advantage, namely the existence of facilities in Geogebra that can provide clearer visuals to students in understanding geometric concepts.

## Conclusion

In conclusion, applying the GeoGebra-assisted WEE learning model improved students' ability to understand mathematical concepts in the material of lines and angles, documented by the percentage of teacher activity observations in cycle I (55.5%) increased in cycle II (89.6%) with excellent success rate, student activity observation in cycle I (55.0%) increased in cycle II (87.3%) with an impressive success rate, then the completeness of the final cycle I test (59.3%) also improved in cycle II (81.5%) with an outstanding success rate, finally, the results of students' interviews in cycle I (50.0%) also elevated in cycle II (83.3%) with an impressive success rate. Thus, it is suggested that teachers should apply the GeoGebra-assisted WEE learning model. Applying the method requires the right time distribution to construct a practical method application. Combining the method to develop with other learning models or subjects is also suggested.

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