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Analysis of deductive reasoning capabilities on circle materials in elementary mathematics learning

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Abstract: Deductive reasoning ability is a reasoning skill that every student should possess in mathematics learning because it helps develop a systematic way of thinking in solving problems, particularly in the topic of circle circumference. However, in reality, many students still face difficulties in understanding this material. This study aims to identify students' abilities in performing calculations related to circle circumference and to assess their level of deductive reasoning. The research uses a qualitative descriptive approach with the subjects being sixth-grade students of MIN 7 Kota Medan, totaling 24 students who were then divided into three groups. The research subjects were selected using purposive sampling. The results show that students with a high level of deductive reasoning, coded as subject S1, achieved all indicators of deductive reasoning ability; students with a moderate level, coded as subject S2, met two indicators; and students with a low level, coded as subject S3, met only one indicator. The conclusion is that the higher a student's deductive reasoning ability, the more proficient they are in solving circle circumference problems.

Keywords: Deductive reasoning, circumference of a circle, mathematics

Abstrak: Kemampuan penalaran deduktif merupakan keterampilan penalaran yang harus dimiliki setiap siswa dalam pembelajaran matematika karena membantu mengembangkan cara berpikir sistematis dalam memecahkan masalah, khususnya pada topik keliling lingkaran. Namun, pada kenyataannya, banyak siswa yang masih menghadapi kesulitan dalam memahami materi ini. Penelitian ini bertujuan untuk mengidentifikasi kemampuan siswa dalam melakukan perhitungan yang berkaitan dengan keliling lingkaran dan untuk menilai tingkat penalaran deduktif mereka. Penelitian ini menggunakan pendekatan deskriptif kualitatif dengan subjek penelitian adalah siswa kelas VI MIN 7 Kota Medan yang berjumlah 24 siswa yang kemudian dibagi menjadi tiga kelompok. Subjek penelitian dipilih secara purposive sampling. Hasil penelitian menunjukkan bahwa siswa dengan tingkat penalaran deduktif tinggi, kode subjek S1, mencapai semua indikator kemampuan penalaran deduktif; siswa dengan tingkat sedang, kode subjek S2, memenuhi dua indikator; dan siswa dengan tingkat rendah, kode subjek S3, hanya memenuhi satu indikator. Kesimpulannya adalah semakin tinggi kemampuan penalaran deduktif siswa, semakin mahir mereka dalam memecahkan masalah keliling lingkaran.

Kata kunci: Penalaran deduktif, keliling lingkaran, matematika

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INTRODUCTION

Mathematics must be studied at school. Mathematics is one of the main subjects taught to students starting from elementary school to college (Antika et al., 2023; Siregar et al., 2025). Learning mathematics is also an absolute requirement for students to advance from one level of education to another (Amir et al., 2025; Amoah et al., 2023; Harahap & Rakhmawati, 2020; Matorevhu, 2023). By studying mathematics, it is hoped that students' reasoning and logic can be trained and useful in everyday life (Harel & Weber, 2020). Borba (2021) emphasizing that mathematics will always be studied because it is very closely related to human life, where all human activities will not be separated from mathematics. In addition, mathematics is also used as the main foundation for science and technology

(Wardhani et al., 2023). Based on this description, it can be concluded that mathematics has a very important role in education and life.

In line with the basic education curriculum regulated in Law Number 20 of 2003 of the Republic of Indonesia states, "The curriculum in primary and secondary education must contain subjects, including mathematics". Mathematics is a subject that is structured with patterns, relationships, symbols from all groups of sciences (Purwati et al., 2019; Wandini et al., 2021). Structured is leveled, organized, clear, from simple definitions to very complicated definitions (Siregar & Ananda, 2023). For this reason, mastery of mathematics is very important and must be understood correctly (Siregar, 2023). However, in reality, students often find it difficult to follow math learning. Research by Waswa and Al-kassab (2023) shows that students' mathematics learning difficulties are caused by students' initial perceptions of mathematics. Many students think math is difficult before learning it (Chinn, 2020). This leads to feelings of fear of failure or feeling that they are not smart enough to master math (Gultom et al., 2024). This causes students to lack the ability to receive and understand the material well (Barokah et al., 2024). Having a poor mindset about a lesson can create challenges in the learning itself or produce suboptimal results (Diah & Siregar, 2023). This also applies to the topic of geometry.

Geometry material studies flat shapes, as well as spatial shapes (Agormor et al., 2022; Fauzi & Arisetyawan, 2022). Geometry learning itself has a special place in the mathematics curriculum (Sahara et al., 2023). Furthermore, geometry is related to the structuring of imaginary concepts (Laksmiwati et al., 2023). There are three reasons why geometry needs to be studied, namely: (1) geometry helps develop students' reasoning skills, (2) geometry methods are useful for solving problems in various fields of mathematics, and (3) geometry is able to improve understanding of scientific disciplines (Anwar et al., 2023). In geometry learning, the topic of circumference of a circle is taught in grade VI of elementary school (Uyen et al., 2022). However, in reality, many students do not understand the concept of circumference of a circle, it is evident from the mistakes made by students when solving problems related to the circumference of a circle (Khasanah & Purwaningrum, 2023).

Facts in the field found that related to the circumference of the circle, many students have not been able to understand the concept of the problem. Where students find it difficult to write what is known and asked in the questions asked. Ratna and Adlini (2024) suggests one of the reasons why students have difficulty understanding mathematical concepts is the lack of understanding and reasoning when working on the problems given. Very often students do a lot of problems without understanding the content thoroughly. Related to the circumference of a mathematical circle, it will be easy for students to understand and remember when the concept is conveyed with the right methods and stages, which can encourage the growth of their minds (Benavides-Varela et al., 2020). Another fact in the field is also found that most students find it difficult to understand the circumference of a circle material because students find it difficult to determine the formula and visualize how the relationship of the value of π (phi) on the circumference of a circle. This is discussed in Romansyah and Nurhamdiah (2018) shows that one of the causes of errors when working on math problems, lack of understanding of basic concepts that have been learned, and limited mastery of mathematics. This often leads to errors in how to interpret or use mathematical formulas. Sitepu et al. (2022) mentioned that students often make mistakes

in applying formulas, it is suspected that this happens because students do not memorize formulas. Thus, students have not been able to interpret or use mathematical formulas.

In line with previous research Wahyu et al. (2024) has similarities regarding the discussion of circular circumference material. The study describes the results of the Muhammadiyah 16 Surabaya Elementary School students' scores in solving problems on the circumference of a circle material which is still classified as insufficient. This is evident from the 38% of students who are still low ability, students cannot understand the problem solving stage correctly. Also research by Komariah et al. (2023) with the results of the acquisition of the average class value of class VI SDN Pasanggarahan II Solear is only 61.24 where the class ability value has not met the minimum standard of completion value for mathematics learning which is 75. Therefore, the obstacles found must be overcome by creating a didactic design that can help students understand the circumference of a circle material. This relates to Jean Piaget's cognitive theory, which states that math learning is a non-physical development, along with children's ability to remember, reason and solve problems (Kohnstamm, 2021). So it is believed that mastery in understanding circle material requires reasoning skills that will be useful for students who are working on problems related to the circumference of a circle.

This is in line with the statement that learning mathematics and mathematical reasoning are two things that cannot be separated, where mathematics learning is understood through reasoning and thinking, and practiced by learning mathematics (Widiyasari & Nurlaelah, 2019). There are two types of mathematical reasoning, namely inductive reasoning ability and deductive reasoning ability (Van Vo & Csapó, 2023). The focus of this research, taking deduvtive reasoning ability. The thought process that can draw conclusions to reach specific conclusions based on general terms is called deduvtive reasoning (Rott, 2021). The result of deduvtive reasoning must have a conclusion, where the conclusion must come from the general term given. The necessity means that if the general term is true, the conclusion must be true (Wibowo, 2022). The conclusion itself must be based on some specific empirical evidence which is then generalized.

As according Fajria (2024), activities included in deductive reasoning which are also indicators at the same time include: 1) carry out calculations based on certain formula rules, 2) draw logical conclusions (logical reasoning), 3) compile direct proof by mathematical induction This deductive reasoning ability is considered important in learning mathematics because it helps students in solving information from certain mathematical problems (Fajriyah & Hadi, 2023). However, research on students' deductive reasoning ability with the title analysis of students' mathematical deductive reasoning ability in research (Fadillah, 2020). There the results showed that the lack of deduvtive reasoning ability, where the high category was 12.82%, moderate deduvtive reasoning ability was 71.8%, and low deduvtive reasoning ability was 15.38%. One of the factors causing the lack of students' deduvtive reasoning ability is because students do not understand the questions correctly and do not repeat the material.

Based on the previous facts that have been described by the researcher above, this research has differences compared to previous studies, especially in terms of location design, to the number of students studied. In addition, the questions given are also not the same. then the researcher feels the need to identify the extent of students' ability to perform arithmetic operations on the circumference of the circle and also measure the level of

students' deductive reasoning in mathematics. With the research title “Analysis of Deductive Reasoning Ability of Circle Material in Mathematics Learning”.

METHOD

This research uses a descriptive qualitative approach. The qualitative method is in the form of explaining, describing and describing an event of social reality, phenomenon, or an event by looking at events in the field (Utari & Rambe, 2023). The research process is divided into 3 stages, namely planning, implementation, data collection and reporting. The subjects of this research were students of class VI MIN 7 Medan City, consisting of 24 students. In addition, students were divided into three groups, and one person from each reasoning category, one person from the medium deductive reasoning category, and one person from the low deductive reasoning category.

Group was selected for research. One person was selected from the high deductive The research subjects were taken using purposive sampling technique with upper, middle, and lower reasoning ability categories to analyze their answers and then conducted interviews related to strategies in solving the given reasoning problems. The interview was a structured format that focused on the motives of the research participants regarding their responses as recorded on their answer sheets. Based on these responses, additional investigations will be conducted to gather information about students' deductive reasoning ability. This study relies on primary data, specifically information collected directly by individuals who have an interest in or utilize such data. The primary data consists of test results obtained from answering circumference of a circle questions related to deductive reasoning as well as interview transcripts between researchers and students. To ensure data reliability, researchers used source triangulation techniques, namely by comparing the results of interviews with the results of observations obtained during the research.

RESULTS AND DISCUSSION

The results obtained from this study came from a test of students' mathematical deductive reasoning ability using 1 item of description related to the circumference of a circle material. In addition, the data were also obtained through interviews with three subjects with diverse ability levels. The three research subjects in the high ability student category were given the subject code S1, medium ability student subject S2 and low ability student subject S3. Information on how students answer questions related to their deductive reasoning ability is presented in the Figure 1.

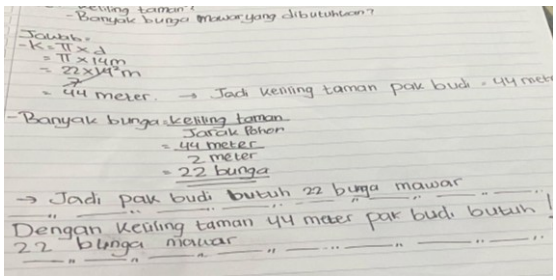

Fig. 1. S1 answer results

Based on answer shown in the Figure 1, subject S1 starts by writing down what is known and what is asked in the problem. Furthermore, subject S1 began to write the

formula that would be used to solve problems related to the circumference of the garden and the number of roses needed. Subject S1 used the formula (K = π x d). Then subject S1 substituted the value of phi (π) = 22/7 and the value of diameter (d) = 14 meters as known in the problem, thus obtaining a result of 44 meters on the perimeter of Pak Budi's garden. Furthermore, subject S1 to find out how many roses are needed, subject S1 divides the total circumference of the garden by the distance of the tree as known in the problem, namely 44 meters: The final conclusion of the subject S1 obtained the result that with a garden circumference of 44 meters, Pak Budi needs 22 roses. Furthermore, an interview was conducted with subject S1, which aims to investigate how subject S1 solved the problem.

The following is a transcript of the interview with the S1 subject, the indicator for carrying out a calculation based on a certain formula rule indicator:

P : What is known from the question?
S1 : Garden diameter = 14 meters, then flower distance = 2 meters
P : What is the problem asked in the question?
S1 : Go around the garden with how many flowers there are
P : What kind of formula do you use to solve this problem?
S1 : The formula is K = π x d
P : Why do you use the formula?
S1 : Ecause in the question the diameter is known

Transcript of interview subject S1 indicator of carrying out a calculation based on the indicator of drawing a certain logical conclusion (logical reasoning):

P : What are the steps to solve it?
S1 : First write the formula, then enter the diameter value and the phi value (π)
P : Why did you do the operation?
S1 : To find out the answer to the question and that is indeed the formula studied in the textbook
P : Were you able to get the answer?
S1 : I can
P : Did you have any difficulties when implementing the plan?
S1 : I had no difficulties

Transcript of interview subject S1 indicator of carrying out a calculation based on the indicator of compiling direct proof:

P : Is every step of the solution correct?
S1 : I think it is correct
P : How are you sure that the answer is correct?
S1 : Because the formula I used is correct according to what was taught and in the textbook, also the value of phi (π) that I entered is correct
P : Can the answer be found in another way?
S1 : No, because if the formula is wrong the answer will be wrong
P : Do you have difficulty looking back?
S1 : I have no difficulty

Table 1. Deductive reasoning ability of S1 subjects

Deductive Reasoning	Indicator Achievement Indicator
Perform calculations based on certain rules or formulas.	Subject S1 was able to show, write and tell clearly the calculations based on the rules or formulas to be used. S1 knows what elements are known and asked in the problem. And the formula used by S1 is correct by using symbols and numbers in mathematics.
Draw logical conclusions.	Subject S1 was able to draw logical conclusions by writing and substituting the value of Phi (π) and the diameter value. The multiplication and division done by subject S1 is also correct so that the answers obtained by subject S1 are all correct.
Compiling direct evidence.	Subject S1 was able to compile direct proof by drawing conclusions on the answers that subject S1 obtained in working on problems related to the circumference of a circle, equipped with justification and reasons to show that the requirements can be met.

Based on Table 1 provides an overview of the ability of the student subject S1 in performing arithmetic operations on the circumference of a circle and also his deductive reasoning ability. When subject S1 solved the problems related to the circumference of the circle, subject S1 had shown a good understanding by obtaining answers that were all correct. The subject was able to choose the formula correctly, and obtained the correct multiplication and division results so that the final answer obtained was also appropriate. Thus it can be said that subject S1 not only understands the concept of the circumference of a circle, but is also able to apply it appropriately in the context of the problem. This ability reflects that subject S1 has a strong concept mastery and good logic of the circumference of a circle.

As for the problem of deductive reasoning ability of the circumference of a circle material owned by subject S1, it can be seen that subject S1 can complete the three indicators well. Subject S1 was also able to answer all interview questions correctly, smoothly and without hesitation which showed the level of understanding and confidence in the answers Subject S1 gave. This can be seen in table 1. where all indicators of deductive reasoning were achieved thoroughly by subject S1 as well as in the interview transcripts of how students provided answers during the interview. This finding shows that students who are in the high deductive reasoning skill category will be able to achieve all indicators of

deductive reasoning ability (Wardani & Kusuma, 2020). Figure 2 is the result of subject S2's response to the question.

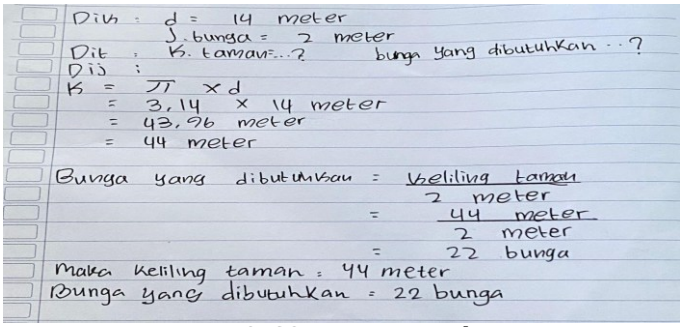

Fig. 2. S2 answer results

Based on the answers written by S2 in Figure 2, it can be seen that the first step taken by the subject S2 is to write down what is known and what is asked in the problem. However, it can be seen that in the element asked in the question, subject S2 only wrote the total circumference of the garden while the number of flowers needed to be planted was not written by subject S2. Furthermore, subject S2 wrote the formula for the circumference of a circle and substituted the value of phi (π) = 3.14 and the value of diameter (d) = 14 meters and obtained the circumference of the garden of 43.96 meters and rounded to 44 meters. In the answer written by subject S2, although he did not write the element asked about the amount needed, subject S2 still looked for the result. Subject S2 divided the sum of the circumference of the garden which is 44 meters by the distance of the flowers which is 2 meters and obtained the final result of the flowers needed which is 22 flowers. After this, an interview was conducted with subject S2 to test the deductive reasoning used by students.

The following are interview transcripts subject S2 carries out a calculation based on indicators of certain formula rules:

P : What is known from the problem?
S2 : Diameter of the garden circle and distance of flowers
P : What is asked from the problem?
S2 : The circumference of the garden and flowers are needed
P : What formula is used to solve this problem?
S2 : The formula is K = π x d and another is the circumference of the garden: distance of flowers
Q : Why do you use this formula?
S2 : Because this formula is taught as in the notebook

Transcript of interview of subject S2 carrying out a calculation based on certain indicators of drawing logical conclusions (logical reasoning):

P : What are the steps of the solution?
S2 : Just substitute the value of phi (π) with the diameter and then we multiply
P : Why did you do the operation?
S2 : To find out the total circumference of the garden and how many flowers are needed
P : Were you able to get the answer?

S2 : I can
P : Did you have any difficulty in carrying out the plan?
S2 : I feel a little hesitant because there are multiplication tables that use commas.

Transcript of interview subject S2 indicator of carrying out a calculation based on the indicator of compiling direct proof:
P : Is every step of the solution correct?
S2 : I think it is correct
P : How are you sure that the answer is correct?
S2 : Because I saw the formula in my notebook
P : Can you find the answer in another way?
S2 : No
P : Did you have any difficulties when implementing your plan?
S2 : I have no trouble

Table 2. Deductive reasoning ability of S2 subjects

Deductive Reasoning	**Indicator Achievement Indicator**
Perform calculations based on certain rules or formulas.	Subject S2 was able to achieve the first indicator through the form of symbols and numbers in mathematics. This is evidenced by the answers to the questions and the results of the interview transcripts that have been conducted.
Draw logical conclusions.	Subject S2 was not able to draw logical conclusions, this is evidenced when subject S2 substituted the value of Phi (π) subject S2 entered the value of 3.14 which should be 22/7. However, the answer obtained is still correct, only less precise.
Compiling direct evidence.	Subject S2 is able to compile direct proof by drawing conclusions on the answers that subject S2 obtained in working on problems related to the circumference of a circle.

Based on the tests and interviews conducted, Table 2 provides an overview of how the ability of subject S2 in solving the circumference of a circle problem and the extent of S2's deductive reasoning ability. It can be seen that although the multiplication results and answers obtained by subject S2 are correct, S2 is less precise in correctly subsuming the value of Phi (π). So that subject S2 can be said to be less capable in solving problems related to the circumference of a circle. The error in substituting the value of π shows that subject S2 has not understood the circumference of a circle material correctly. Thus, it can be

concluded that subject S2 still had difficulty in applying mathematical knowledge consistently in the context of the circumference of a circle problem.

The result found that subject S2 when solving deductive reasoning problems related to the circumference of a circle was able to obtain 2 indicators of deductive reasoning correctly, namely in indicators 1 and 3. As for the 2nd indicator, it is less precise and causes subject S2 to experience a little difficulty in doing the test questions given. This finding shows that students' deductive reasoning skills are included in the moderate category, because they have not fully mastered all indicators of deductive reasoning. In accordance with the theory of multiple intelligences by Howard Gardner which states that one of the intelligences possessed by students is mathematical logical intelligence where students have a high level of thinking related to numbers or numbers in mathematics (Berliana & Atikah, 2023). Although subject S2 has logical-mathematical tendencies so that he managed to find the answer correctly, this result shows that potential alone is not enough. Mastery of deductive reasoning still needs to be honed through practice, because having talent does not always mean that you have mastered deductive reasoning skills. Next will be seen Figure 3 of the results of the answers of students who fall into the low ability category with the subject code S3 when solving the given problem.

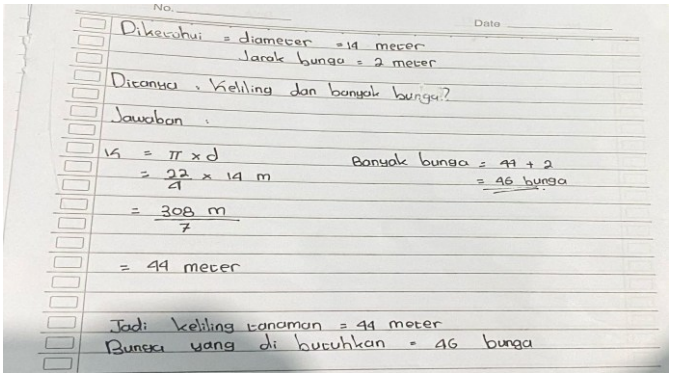

Fig. 3. S3 answer results

Based on Figure 3, it can be seen that the subject S3 starts by writing what is known and what is asked in the problem. Then subject S3 began to write the formula for the circumference of the circle and substituted the value of phi (π) which is 22/7 and the value of the diameter (d) which is 14 meters according to the rules and what is known in the problem. Furthermore, to find out the number of flowers needed subject S3 adds up the results of the circumference of the garden that he has obtained with the distance of the flowers, namely 44 + 2 = 46 flowers. The final result obtained by subject S3 is the circumference of the garden 44 meters and the flowers needed are 46 flowers. Furthermore, the interview process was carried out on subject S3 to explore the deductive reasoning that students do.

The following is a display of interview recordings with S3 participants when they perform calculations based on indicators of certain formula rules:

P : What is known from the problem?

S3 : The diameter of pak budi's garden and the distance of pak budi's flowers

P : What is asked from the question?

S3 : The circumference of the garden and the number of flowers needed
P : What kind of formula do you use in solving this problem?
S3 : The formula K= π x d
P :Why do you use that formula?
S3 : Because that's what the teacher taught

Interview transcript of subject S3 carrying out a calculation based on indicators of drawing certain logical conclusions (logical reasoning):
P : What are the steps of the solution?
S3 : Write the formula and then enter the known value
P : Why did you do the operation?
S3 : To find out the answer to the question
P : Are you able to get the answer?
S3 : The second answer I doubt
P : Did you have difficulty implementing the plan?
S3 : A little difficulty

Transcript of subject interview S3 carrying out a calculation based on indicators of compiling direct proof:
P : Is every step of the solution correct?
S3 : It seems to have been
P : How are you sure the answer is right?
S3 : From the formula that I consider correct
P : Can the answer be sought in another way?
S3 : No
P : Do you have difficulty in looking back?
S3 : I have no difficulty

Table 3. Deductive reasoning ability of S3 subjects

Deductive Reasoning	**Indicator Achievement Indicator**
Perform calculations based on certain rules or formulas.	Subject S3 is able to carry out calculations based on rules or formulas through symbols and numbers in mathematics. This is evidenced by the results of the answers to the questions and the results of the interview transcripts that have been conducted.
Draw logical conclusions.	Subject S3 is not able to draw logical conclusions, this is evidenced when looking for answers to the number of flowers needed by subject S3 using the wrong formula so that the final answer is wrong.

Compiling direct evidence.	Subject S3 is not able to compile direct proof by drawing conclusions because the answers obtained in indicator 2 subject S3 made mistakes.

Based on Figure 3 provides a lot of insight into the ability of subject S3 in solving the problem of the circumference of a circle and his ability in deductive reasoning. From the results of the answers obtained by students, most of them are wrong, meaning that it shows that subject S3 has not been able to fully understand the circumference of the circle material. Subject S3 was unable to understand the meaning of the problem correctly. The error is not only seen from the wrong final result, but also from the inaccuracy in choosing and using the appropriate formula. Thus it can be said that subject S3 is categorized as unable to perform arithmetic operations related to the circumference of a circle and experiencing confusion in applying the concepts that have been learned.

The deductive reasoning ability of Subject S3 related to the circumference of the circle material can only complete 1 deductive reasoning indicator, namely the indicator of carrying out calculations based on certain rules or formulas, being able to show and tell what is known and what is asked in the problem. However, on the indicator of drawing logical conclusions subject S3 is unable to draw logical conclusions, namely because of the wrong formula. While in the last indicator compiling direct proof subject S3 cannot compile direct proof because if the answer to the 2nd indicator is wrong then the proof in the 3rd indicator will be wrong. These findings indicate that students' skills in deductive reasoning are low, because they have not fully mastered all indicators of this type. In accordance with the theory of constructivism by Jerome Bruner, namely students who are responsible for their own knowledge, for what is obtained through the learning process carried out (Arafah et al., 2023). With that subject S3 shows that when students have not understood the material well, their ability to perform arithmetic operations and deductive reasoning will be hampered and classified as low.

Students' errors in answering the circumference of a circle problem lie in students who find it difficult to understand the known and questionable elements in the problem, especially in the description questions. Another difficulty experienced by students was that they found it difficult to determine the formula and visualize the relationship between the value of π (phi) and the circumference of a circle. Often students mistakenly use the value of 3.14 or 22/7 when they work on problems. This is discussed in Tang (2023), that one of the causes of errors when working on mathematical problems, lack of understanding of basic concepts that have been learned, as well as limited mastery of mathematics, and one of the contributing factors is due to students' lack of understanding of the concepts of the circumference of a circle material.

Conditions in the field show that the higher the deductive reasoning ability a student has, the more proficient the student is in answering questions around the circle. This can be seen from how students in the high deductive reasoning ability category with the Subject S1 code are able to answer all interview questions and achieve all deductive reasoning indicators so they can solve questions related to the circumference of the circle correctly. On the other hand, students in the deductive reasoning ability category, while the subject

S2 anda subjeck S3 have low abilities, and are unable to answer interview questions correctly due to lack of self-confidence and are still doubtful. As a result, they have not been able to achieve all deductive reasoning indicators and are unable to answer questions correctly. Relates to Albert Bandura's social cognitive learning theory about the important role of self-confidence (Self-Efficacy) in students. Students who are confident are expected to get better learning outcomes (Tullah & Amiruddin, 2020).

S2 and S3 subjects' lack of self-confidence hindered their ability to perform deductive reasoning and reach the correct answer. Students who lack confidence in solving math problems will not be able to achieve all indicators of deductive reasoning (Fajriyah & Hadi, 2023). Then it was found that the lack of deductive reasoning ability was also caused by one of the factors, namely students did not understand the concepts well when working on the given math problems and students were less trained in solving the mathematical concepts presented (Fadillah, 2020). In fact, mastering deductive reasoning requires a deep understanding of the concept.

The results of this research also support the cognitive theory put forward by Jean Piaget, which states that children's learning readiness is viewed from the readiness of their cognitive structure. Where cognitive structure is needed as a way to develop reasoning abilities that can be stimulated through the mathematical study of an object (Ardiningtyas et al., 2023). In this context, the circumference of the mathematical learning circle is a science whose object of study is abstract, requiring deductive reasoning to understand it (Safitri, 2021). For this reason, it is believed that in the mathematics learning process, especially in the material around the circle, students' deductive reasoning abilities are very important and are closely related to achieving students' learning outcomes.

CONCLUSION

Several conclusions can be drawn as follows: 1) The deductive reasoning ability of students in the high-ability category with subject code S1, when solving problems related to the circumference of a circle, was able to obtain correct answers and achieve all deductive reasoning indicators; 2) The deductive reasoning ability in the medium-ability category with subject code S2, when solving problems related to the circumference of a circle, is considered less adequate because of an error in substituting the value of Pi (π) and was only able to meet two deductive reasoning indicators; 3) The deductive reasoning ability in the low-ability category with subject code S3, when solving problems related to the circumference of a circle, falls into the low or incapable category, which means they could not answer the question correctly and were only able to meet one deductive reasoning indicator. This conclusion is based on the students' answers and the results of the interviews conducted. Therefore, deductive reasoning skills are considered highly necessary for solving problems related to the circumference of a circle in mathematics learning. The higher the deductive reasoning ability that students possess, the more deductive reasoning indicators they are able to fulfill. Furthermore, it is expected that future researchers will investigate the factors influencing students' low deductive reasoning ability in order to better understand the obstacles and challenges students face in developing deductive reasoning.

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