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Skepticism of Students Participating in National Science Olympiad in Solving Geometry Problems across Gender Differences

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Abstract: This study is a qualitative descriptive study that aims to determine and describe the skeptical attitudes of female and male students involved in solving logical problems in geometry material and identify differences in problem-solving strategies between them. The researcher refers to the skeptical stages developed by Berta (2024) which consist of two stages, namely skepticism confirming and skepticism dismissing. This study involved two tenth grader female students and two eleventh grade male students participating in national science olympiad from MAN 1 Jembrana, Indonesia. The data analysis techniques in this study were data reduction, data presentation, and drawing conclusions or verification. Data collection used in this study was in the form of Logical problems-III questions, interviews and the think aloud method. The findings of this study indicate that there are significant differences between the ways male and female national science olympiad students deal with illogical questions. Male national science olympiad students tend to show higher skepticism, characterized by a tendency to dismiss work and calculations without alternative solutions. In contrast, female national science olympiad students tend to use a more careful and systematic approach to solving problems and are more careful in questioning the information provided and getting alternative solutions that result in more systematic solutions. Although this sometimes causes confusion or doubt that can slow down the decision-making process but can get calculated results. This study concludes that gender differences in skepticism affect students' approaches to solving Logical problems-III which emphasizes the importance of adaptive learning strategies to support the development of critical and logical thinking skills in both groups of students.

Keywords: geometri,logical problems-iii, skeptis.

▪ INTRODUCTION

Mathematics is a subject taught at all levels of school, from elementary school to college (Samadara, 2020). Mathematics is a subject that plays an important role (Janina Siller, 2022). One important part of mathematics is geometry. In some materials, geometry is always an interesting topic. (Gladys, 2020) states that through the experience of learning geometry, problem-solving skills can be improved. The material studied in geometry is about points, lines, angles, flat shapes, spatial shapes along with their properties and relationships with each other (Aneta, 2023).

When compared to other fields in mathematics, geometry is one of the fields in mathematics that is considered the most difficult to understand. However, in fact, many still experience errors and difficulties in learning geometry (Yavuz karpuz, 2020). Difficulties in learning geometry occur in several sub-materials, such as tangents (Arsalan wares, 2018; Fauzi, 2023). Based on this, seen from the difficulties, students tend to engage in reflective skepticism activities. In addition, difficulties in geometry material influence students to be skeptical of quick solutions and single answers to problems and claims of universal truth (Arikan, 2017).

Skepticism is an attitude of doubt, so that skeptics always doubt or do not believe in something they receive (Nugroho et al. 2018; Rotondow, 2015). And skepticism carried

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out by (Berta, 2024) has 4 categories of skepticism, namely misleading skepticism, justifying, stopping, confirming. This study used 2 categories of skepticism, namely skepticism justifying and dismissing. Skepticism justifying, namely experiencing doubts about the results of work that were initially wrong changed to correct and what was correct was evaluated to increase confidence in the truth of the answer, while skepticism dismissing experiences doubts about the results of work and stops work even though they have not received the correct solution. Skepticism can encourage someone to reflect so that they produce correct conclusions and can make the right decisions (Abdur and Handayani, 2020). Based on this statement, skepticism is an important aspect of students to solve Logical problems-III in geometry material so that further research is needed on skepticism, especially in dealing with unclear or illogical problems.

Logical problems-III are often called unclear, unstructured problems in which there is conflicting information that contradicts the actual facts, and are also called undefined problems, undefined problems are divided into three types of problems: (1) problems with open ambiguous information (Vernon, 2017) (2) problems with incomplete information (Marla sole, 2016) (3) problems where there is conflicting information (conflicting information) (Vivianne, 2017). With the presence of Logical problems-III in learning, it encourages students to think, with a skeptical attitude, students develop and seek alternative strategies in solving problems, and deepen their understanding of the mathematical concepts taught (Hiebert, 1997).

Several previous studies have examined skepticism, one of which is (Abdur and Handayani, 2020; Nugroho et al., 2018). The research conducted by Nugroho is the critical disposition of skeptical students in facing illogical problems and what Abdur did in his research was to see the persistence of skeptical students in solving mathematical problems. There has been no in-depth study of the skepticism of female and male national science olympiad students in solving Logical problems-III on geometry material. Based on the results of the preliminary study, there were also indications of differences in skepticism in male and female students in answering logical problem III questions. This is supported by the opinion of (Borgonovi, 2020) which concluded that there are differences in attitudes and performance between men and women in solving problems. Basically, humans are created differently (Manuel, 2018), one of which is the difference in gender, namely men and women (Lisa, 2015; Magnus, 2019). From these differences, teachers must be aware and pay attention that each gender has its own characteristics (Davita, 2020; Saadati, 2023).

Some researchers believe that the influence of gender factors (the influence of differences between men and women) in mathematics (Caterina, 2017). Because of the biological differences in the brains of boys and girls which are known through observation, that girls, in general, are superior in the fields of language and writing, and finding solutions to problems while boys are superior in the field of activism because of their better spatial abilities (Indrawati, 2017; Marcus, 2015). That in boys the left brain is more developed so that they are able to think logically, think abstractly, and think analytically, while in girls the right brain is more developed, so that they tend to be active artistically, holistically, imaginatively, think intuitively, and some visual abilities (Hodiyanto, 2017). Based on the description above, it can be said that the skepticism of national science olympiad students in solving problems has an important role in determining the actions to be taken in solving Question III logical problems with

geometry material. This study aims to determine and describe the skepticism of female and male national science olympiad students in solving Logical problems-III on geometry material and identify differences in problem-solving strategies between female and male national science olympiad students. Therefore, it is necessary to conduct research on the skepticism of female and male national science olympiad students in solving Logical problems-III on Geometry material. This happened because the subjects of this study were more than one and the results of the study were used to complement the existing skeptical theory in the study (Abdur and Handayani, 2020; Nugroho et al., 2018). Each subject experienced a different event. In other words, each subject experienced different events even though the problems solved were the same. Moreover, the cases studied in this study were cases that had an impact on the skepticism of national science olympiad students (female and male) in solving problem III-local problems.

▪ METHOD

Participants

This study involved 8 students who were involved in the national science olympiad from State Islamic Senior High School 1 Jembrana who were divided into 2 national science olympiad students for mathematics and the sampling technique was based on the following criteria: (1) Eleventh grade female and male students participating national science olympiad (2) able to communicate their thoughts both verbally and in writing (3) students were skeptical of illogical mathematics problems.

Research Design and Procedures

This study uses a descriptive research design with a qualitative approach (Creswell, 2018). It is said to be descriptive research because the researcher only conducted an analysis up to the level of description, namely analyzing and presenting facts systematically (Moleong, 2012). This study describes the skepticism of female and male students of the national science olympiad towards Logical problems-III.

The first step in data collection is to recruit participants, recruitment starts from 8 national science olympiad students in grades X and XI selected based on the above criteria which are narrowed down to 2 female students in grade X and grade XI male and assisted by the national science olympiad coordinator. At the second meeting, the researcher gave questions to the selected students as an instrument to determine the skepticism of male and female students towards illogical mathematical problems. And using the think aloud method to find out the body movements and facial expressions and voices of students were observed carefully using direct observation and video recordings. Then an in-depth interview was conducted regarding the responses of male and female students in dealing with illogical mathematical problems. The results of in-depth interviews, tests and observations were analyzed.

Instrument

This study uses instruments: tests or giving Logical problems-III questions, interviews, and with the think aloud method. The skeptical indicators used in this study are indicators used (Berta, 2024) and developed in this study as presented in supporting information. The test instrument consists of one logical problem-III question, this test instrument will be used as an instrument to see the skepticism of female and male national science olympiad students and the test instrument used is a modification of the research

(Nugroho et al., 2018). This test is based on basic geometry, focusing on lines and angles, but the test is new to national science olympiad students because they rarely encounter illogical or contradictory questions, thus ensuring that with this test instrument the skepticism of national science olympiad students in solving Logical problems-III questions can be known. The quality of research in this study emphasizes validity and reliability. Validity in qualitative research involves checking the accuracy of findings using strategies such as triangulation, triangulation in this study includes confirming the validity of data obtained from observations and student test answer sheets through interviews using the think aloud method to strengthen the validity and reliability of the study. As defined by Creswell (2018), reliability in qualitative research means showing that the approach is consistent. The reliability strategy in this study includes listening to audio recordings and observing body language and facial expressions and students' voices carefully. The researcher carefully observed that male and female students had differences based on the skepticism indicator rubric. The researcher explained the purpose of the study, provided interview transcripts to further explore the skepticism of female and male students in solving Logical problems-III in order to obtain more detailed information about the steps to solve the problem. All instruments have been validated by two lecturers at the Kiai Haji Achmad Siddiq State Islamic University of Jember and the coordinator of the national science olympiad of Madrasah Aliyah Negeri 1 Jembrana.

Data analysis

The qualitative data analysis used by researchers in this study is the Miles and Huberman model, namely through three processes, including data reduction, data display and conclusion crawling/verification.

Data Reduction, Data obtained by researchers from field research will be increasingly numerous and complex. For this reason, it is necessary to immediately conduct data analysis through data reduction. Data reduction means summarizing, choosing the main points, focusing on the important things. In the context of research on national science olympiad student skepticism, this step may involve selecting and simplifying data from observations, interviews, or tests that describe students' skeptical attitudes towards Logical problems-III questions. Irrelevant or excessive data will be filtered, and focus will be given to the information that best describes students' skepticism. Thus, the data from the reduction will provide a clearer picture and make it easier for researchers to collect further data.

Data Presentation, After the data is reduced, the next step is to present the data. Data presentation can be done in the form of coding each indicator to make it easier, such as table 1 above, and graphs. However, the most frequently used to present data in qualitative research is with narrative text. By presenting data, it will make it easier for researchers to understand what is happening, plan further work based on what has been understood. For example, the results of observations, interviews and think aloud methods on how students analyze and are skeptical of Logical problems-III can be presented in the form of tables, transcripts, or concept maps, so that the stages of skepticism of female and male students can be seen clearly.

Drawing conclusions, drawing conclusions in this study is the process of making interpretations of the data that has been presented, while verification is the process of checking the validity and truth of the conclusions. Based on the data that has been presented, researchers will draw conclusions about the extent to which female and male

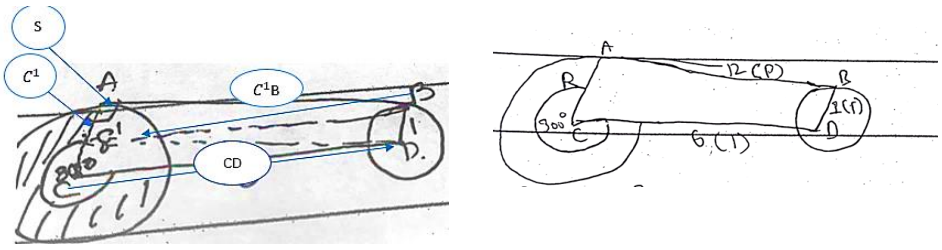
national science olympiad students differ in being skeptical in solving Logical problems-III. This conclusion is then verified by cross-checking against additional data or relevant theories to ensure that the conclusions drawn are valid and accountable.

Interpreting skeptical data. The stages of data analysis carried out in this study are 2: Skeptical confirming and skeptical dismissing in skeptical confirming can be interpreted as skeptics who experience doubts about the results of work that were initially wrong are given alternative solutions so that they become correct and what is correct is evaluated to increase confidence in the truth of the answer and in skeptical confirming has 5 stages: (a) identifying the problem (b) trying to solve the existing problem (c) realizing things that contradict the information given (d) trying to solve the problem by providing alternative solutions so that the question becomes correct and can be solved (e) the results of work that are correct are evaluated to increase confidence in the truth of the answer. While skeptical dismissing can be interpreted as experiencing doubts about the results of the work and stopping the work even though they have not received the correct solution. In skeptical dismissing has 4 stages: (a) identifying the problem (b) trying to solve the existing problem (c) after trying to work experiencing doubts about the results of the work (d) stopping calculations and work.

▪ RESULT AND DISSCUSSION

The findings of this study highlight the differences in skepticism of male and female students in solving Logical problems-III on geometry material, which is different from (Berta, 2024), which highlights the role of beliefs based on gender so that the results of this study are presented based on male and female gender. This study is different from (Nugroho et al., 2018) which highlights Critical Thinking Disposition: The Persistence of Skeptical Students in Solving Mathematical Problems. The research data were obtained from the results of the Logical problems-III test on geometry material, and the results of interviews using the think aloud method to obtain valid data, the results of the interviews and the think aloud method were written in transcript form so as to reduce missed data.

At the stage of identifying the problem, female national science olympiad students identify the problem by looking at the information in the question and observing carefully and drawing the angle lines, which are in the question. As for the stage of identifying the problem in male students, male students identify the problem by reading the question carefully, looking for information in the question and students read the question again to draw the angle lines that students know. Below are the results of identifying the problems of female and male students.



(a) **(b)**

Figure 1. Problem indentification of (a) female and (b) male students

Tabel 1. Think aloud and interview transcript for female students in problem identification

Metode Think Aloud	Wawancara
Hmm mau di gimana in ya soal ini sambil mengetuk ngetuk polpen di atas meja 'hm udah saya baca berkali kali juga sambil menggaruk kepala "	*P: Saya lihat tadi kamu sebelum mengerjakan kok kelihatan bingung ?* *SP:Tidak bingung,Cuma saya mencoba mengidentfikasi masalah yang ada pada soal dan mencari informasi yang ada pada soal dengan cara membaca berulang kali* *P: Terus bagaimana apa yang kamu lakukan.* *SP: Pada Langkah (1) saya akan membuat titik* C^1 *pada garis* C^1B *Sejajar dengan* CD *2) Dengan demikian* ABC^1 *merupakan segitiga siku siku di A seperti yang saya gambarkan di lembar jawaban tersebut.*

Based on the results of identifying the problems of female and male students doing think aloud and interviews with researchers, the first is the results of think aloud from female students. Judging from the results of think aloud and interview transcripts, at the stage of identifying problems, the first step taken by national science olympiad female students is to read the questions carefully [M1], students look for information in the questions, students describe the angle lines [M3]. And students look for information again in the questions [M2], and collect information in the questions by observing the images in the questions and students read repeatedly [M2] again so that it causes student skepticism. After students look for information in the questions, students can describe the angle lines [M3] as shown in the picture above. Seeing the information in the questions to solve the problems given, students will use several steps. Step (1) we will create a point C^1 in the line C^1 B In line with CD, thus 〖ABC〗^1 is a right triangle at A as shown in the figure 1. At the stage of identifying problems, male students also conducted Think Aloud and interviews with researchers as presented in table 2.

Table 2. Think aloud and interview transcript for male student in problem identification

Think aloud method	Interview
" ini saya sebelum mengerjakan sudah bingung gimana cara menghitungnya hmm udah saya baca berkali kali juga untuk mengidentifikasi masalah yang ada pada soal , tetapi setelah saya mengidentifikasi saya mempunyai keraguan sebelum mengerjakan gimana ya soal ini. Dengan eksperesi wajah yang bingung dan ragu	*SL: Setelah saya mengidentifikasi masalah ,saya mempunyai keraguan terhadap soal ini apakah soal ini tidak terdapat kekeliruan?* *P: Alasannya apa kok kamu ragu?* *SL: Ini terlihat aneh bagi saya ketika saya mau mengerjakan tapi saya memahami gambar tersebut berpendapat tidak bisa di kerjakan*

	karena garis singgung dan siku siku yang tidak sesuai dan sudut BD 1 cm itu sangat tidak mungkin. . *P: Coba dulu aja sebisa kamu mengerjakan.*

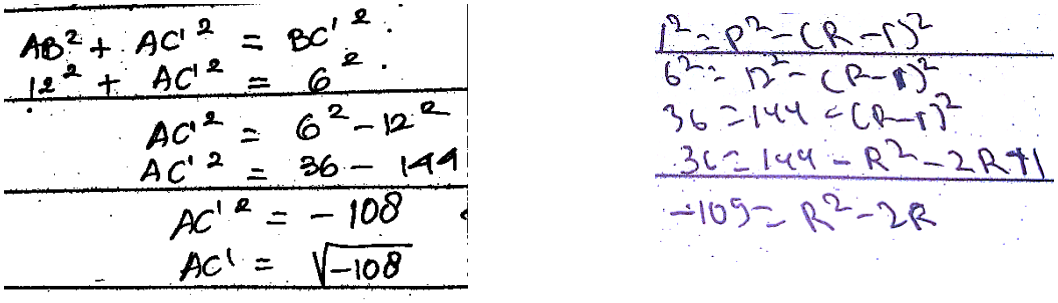
From the results of identifying problems, think aloud, and interview transcripts, male students identify problems by reading the questions carefully [M1], looking for information in the questions [M2]. Male students are skeptical about Logical problems-III questions, students ask researchers about the data in the questions, because they feel there is something wrong with the question. The doubt arises before students write their answers in writing. Skepticism is seen at the stage of identifying problems. And students have doubts about the question because the tangent and right angles are not appropriate and the angle BD 1 cm is very unlikely and considers the question illogical or unreasonable. Judging from the stage of identifying problems, there are differences in skepticism between female and male students, as can be seen from the coding of indicators and the illustration in the Figure 2.

(a) **(b)**

Figure 2. Differences in skepticism between female (a) and male (b) students

Judging from the coding results, there are differences in female students who tend to read carefully and search for information repeatedly even though there is an attitude of skepticism, similar to the research conducted by (Nugroho et al., 2018) where students try to describe the problem by writing down any information they know. Female students can solve problems by assuming what is in the problem information, unlike male students who work with a sense of insecurity because doubts arise, similar to the research conducted by (Berta, 2024) namely male students have more doubts before working on the problem, because this is in line with the opinion of (Shaheen Majid, 2020) where women show that girls read more and are more careful in searching for information than boys. At the stage of trying to solve the existing problem, female and male students try to do the calculations that have been searched for information from the two female students, here are the results of the stage of solving the existing problems from female and male national science olympiad students.

Based on the results of trying to solve the existing problems, male and female students conducted think aloud and interviews, the first is the result of think aloud and interviews with female students.



(a) (b)

Figure 3. Problem solving conducted by (a) female and (b) male students

Table 3. Think aloud and interview transcripts for female student in problem solving

Think aloud	interview
Saya melihat informasi dalam soal "nah tadi kan udah ketemu C^1 *pada garis* C^1B *yang Sejajar dengan* CD *Saya perlu mencari* ABC^1 *yang siku sikunya di A dengan menggunakan Teorema Pythagoras." Bisa gak yaa bisa lah kira kira saya coba dulu aja.*	*SP: Nah saya kan habis membuat titik* C^1 *lalu saya mencari* ABC^1 *apakah Langkah yang saya ambil benar ya?* *P: Ya di coba dulu aja* *SP: Iya saya coba dengan menggunakan teorema phytagoras untuk menghitung* ABC^1.

From the results of the think aloud test and the transcript of the interview of the female national science olympiad students trying to solve the existing problems, the female students tried to choose the formula [P1] that the students got from the results of identifying the problem to calculate the solution [P2] by finding [ABC]1which is right angled at A using the Pythagorean theorem using the information in the question, namely the length of line AB = 12cm, the length of line CD = 6 cm and the length of line BD = 1 cm. Although students in choosing the formula caused skepticism in the question, they still did it and got the calculation results [P3]. At the stage of trying to solve the existing problems, male students also did Think aloud and interviews with researchers.

Table 4. Think aloud and interview transcript for male students in problem solving

Think aloud	Interview
" Makai rumus apa yaa kok aku bingung,ragu juga mau mengerjakan ' sambil bengong hmm saya makai rumus garis singgung persekutuan dua lingkaran aja sayab coba dulu semoga dapat hasilnya biar tidak menambah keraguanku.	*SL: Disini saya bingung mau memakai atau memilih rumus apa* *P: Kamu memilih rumus apa untuk memherjakan?* *SL: saya memilih rumus garis singgung persekutuan dua lingkaran, saya coba dulu semoga aja ada hasilnya biar tidak menambah keraguanku terhadap soal ini.*

Based on the results of the test, think aloud, and interview transcripts, male students in trying to solve existing problems, students choose formula [P1], do calculations with the common tangent formula of two circles [P2], get the calculation results [P3]. From the results of the calculations carried out by students, high skepticism arises. Judging from

the results of solving existing problems, female and male students have similarities in coding but in choosing formulas, female and male students are different, although there are doubts in solving the problem, the same as research conducted by (Nugroho et al., 2018) namely that students have the determination to answer any problem even though they have doubts in solving the problem. This difference in choosing a formula can affect mathematics learning activities. Women tend to have the ability to choose formulas carefully and thoroughly while men choose formulas with what they know without finding out more details, this is in line with the opinion of (Marcus Samuelsson, 2016) where the ability to view their classroom environment and some differences in the relationship of boys and girls to mathematics. Based on the class conditions, we found that boys felt that they used group work more than girls and the way of capturing learning materials in girls and boys was different. At the stage of realizing the contradictory problems for female and male students shown in the Figure 4.

(a) **(b)**

Figure 4. Realized the contradictory problems for (a) female and (b) male student

Based on the results of realizing things that contradict the information, female and male students conducted think aloud and the first interview was the result of the female students' think aloud and interview.

Table 5. Think aloud and interview transcript for female students in realizing the contradictory problems

Think aloud	Interview
" ini hasilnya kok negative membuat saya ragu saja padahalkan bilangan kuadrat tidak ada yang bernilai negative atau Panjang sisi segitiga tidak ada yang mempunyai bilangan imajiner ini gimana yaa.. berdasarkan phytagoras tersebut maka Panjang sisi $\boldsymbol{AC^1}$ *tidak ada yang memenuhi " duhh jumlah panjang sisi siku siku segitiganya lebih besar dari sisi miringnya lagii nah dari sini aku ragu dan mikir deh terdapat kekliruan pada soal atau soal ini bisa di sebut tidak logis.*	*SP: Ini kok hasilnya kontradiksi setelah saya mencoba mengerjakan ya?* *P: Kok bisa kontradiksi bagaimana?* *SP: Menurut saya bilangan kuadrat tidak ada yang bernilai negative atau imajiner dan saya juga melihat dari jumlah Panjang sisi segitiga lebih besar dari sisi miringnya dan sisi siku siku AB nilainya lebih besar dari pada Panjang sisi miringnya* BC^1*Menurutku saya ragu dengan soal ini dan soal ini tidak logis.* *P: lalu apakah kamu berhenti di situ saja tau masih mau mencoba menyelesaikan* *SP: saya mencoba menyelesaikan dengan alternatif lain.*

From the test results, think aloud and interview transcripts, there is an attitude of student skepticism towards information on questions with contradictory calculation results [S1], or unreasonable because they have imaginary results and the sum of the

lengths of the right-angled sides of the triangle is greater than the hypotenuse, students are skeptical of the questions and call them illogical or unreasonable questions. At the stage of realizing things that contradict the existing information, male students also do Think aloud and interviews with researchers.

Table 6. Think aloud and interview transcript for male students in realizing the contradictory problems

Think aloud	Interview
" nah bener apa kataku dan firasatku nih dari awal saya sudah ragu terhadap soal ini kalau tidak akan mendapat hasil penyelesaian ,setalah saya mencoba melakukan perhitungan nah bener bahwa sikap raguku yang dari awal bener ,berhenti sampai sini saja dah saya beranggapan bahwa soal ini tidak bisa dikerjakan dan tidak akan mendapat hasil perhitungan.	*SL: Nah bener keraguanku di awal bahwa soal ini meragukan saya beranggapan tidak logis eh bener.* *P: Kamu beranggapan soal ini tidak logis apakah kamu tidak mempunyai solusi alternatif untuk mengerjakan.* *SL: Tidak ,saya tidak mempunyai solusi alternatif saya menghentikan perhitungan dan pekerjaan sampai sini saja.*

From the contradictory test results, think aloud, and interview transcripts that have been presented. The hesitation of male students occurred again, who were initially hesitant to try to solve the existing problems, but after getting the calculation results, they became more skeptical about the questions.

Judging from the results of the stage of realizing things that contradict the existing information, female and male students experienced high skepticism from before, especially those experienced by male students at the stage of identifying the problem, they had already experienced doubts, and at this stage they experienced contradictions so that high skepticism emerged. And realize that this question is illogical or unreasonable.

At the stage of stopping the calculation and work, at this stage it was only carried out by male students because of skepticism towards the Logical problems-III question, this is in line with the research conducted (Nestadt, 2021) namely Student doubts in this case greatly influence decision making to continue or stop their work. In this study, students were influenced to stop their work and resulted in the failure to complete the solution that should have been done by the students. And this male student called it an illogical or unreasonable question and the student did not find the calculation results and solutions [N1] of the Logical problems-III question. Similar to the research conducted by (Berta, 2024), namely students experience doubts about the answer plan that will be written. This doubt stops the problem-solving process so that students cannot solve the problem completely and correctly. In contrast to female students who continue the calculation without stopping the answer, the same as the research conducted by (Nugroho et al., 2018), shows that students have extraordinary persistence in trying to solve problems even though students have difficulty understanding the problem and experience contradictions in the calculations.

In the next stage, namely the stage of trying to solve the problem by providing alternative solutions so that the problem becomes correct and can be solved. At this stage, it is only done by female students because male students have stopped their work and stopped their calculations. Female students try to solve the problem by providing alternative solutions, so that the problem becomes correct and can be solved with

alternatives. Female students add information in problem [A1] and calculate changes in information in problem [A2] with [BC]1 > AB, namely AB=12 cm AC = 6 cm for AC = 6 cm because BD = 1 cm then [AC]1 = 5 cm as shown in Figure 5. Female students conducted another think aloud and conducted interviews with the researchers as presented in table 8.

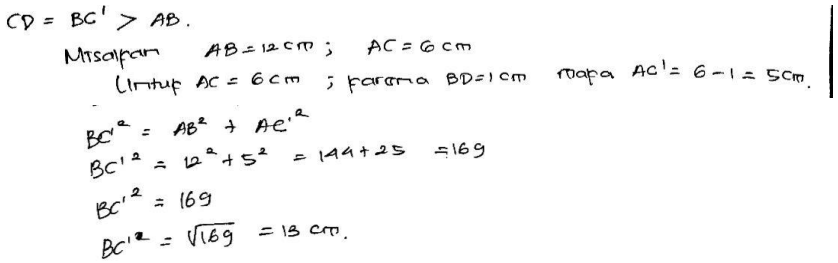


Figure 5. Providing the alternative solution

Table 7. Think aloud and interview transcript for female students in providing alternative solution

Think aloud	Interview
"ini gimana ya supaya saya bisa menyelesaikan soal ini saya apakan ya hmmm" Ohh nah dari sini saya mencoba memisalkan $\boldsymbol{BC^1 > AB}$ *yakni AB=12cm AC=6CM untuk AC= 6cm karena BD=1cm maka* $\boldsymbol{AC^1}$*=6-1=5cm nah nanti kalua ketemu hasil* $\boldsymbol{BC^1}$ *baru bisa menghitung luas daerah yang diarsir.*	*SP: Tadi kan saya bilang kalau saya mencoba mengerjakan nah disini saya mencoba memisalkan* $BC^1 > AB$ *nah nanti dari sini kalau sudah ketemu hasilnya baru saya bisa menghitung luas daerah yang diarsir.* *P: Apakah kamu tidak ragu dengan cara alternatifmu dan yakin dengan cara itu?* *SP: Iya saya ragu dan curiga karena awalnya soal ini tidak bisa dikerjakan tapi saya mencoba memisalkan ,apa salahnya saya mencoba dulu .*

Judging from the results of alternative solutions, think aloud and interview transcripts that have been presented, it appears that female students experience doubts about student alternatives in adding information [A1] and calculating changes in information [A2] in solving Logical problems-III. This female student made an alternative solution in order to solve the illogical problem. The same is true of research conducted by (Nugroho et al., 2018), namely when students are given a problem that is very difficult and cannot be solved, the student continues to think and tries to choose a formula that can be used to solve it.

Judging from the attitude of female, they are more systematic in working on it than men who do not find alternative solutions. This is in line with research conducted by (Scholes, 2019) showing that girls and boys are different, girls listen more often then provide solutions and read more often to get solutions to problems, compared to boys who often ignore problems. In the last stage, namely the stage of the results of the work that has been correct, it is evaluated to increase confidence in the truth of the answer. The female student has found an alternative solution in solving the problem. Similar to the

research conducted by Berta (2024), the student had doubts about the written answer so she checked the answer to make sure that the answer was correct. Female student continued the calculation to calculate the shaded area as shown in Figure 6. Female student did another think aloud and conducted an interview with the following researcher below.

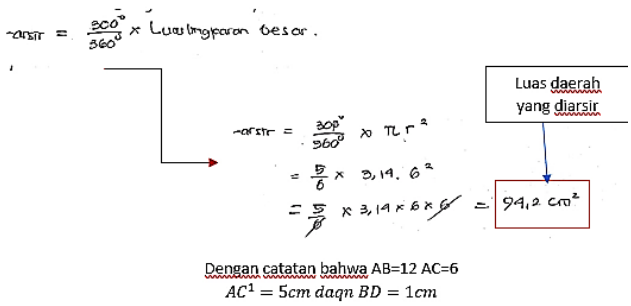


Figure 6. Calculation result of alternative solution

Table 8. Think aloud and interview transcript

Think aloud	Interivew
"Akhirnya bisa ketemu hasil penyelesaian luas daerah yang di arsir meskipun memakai solusi alternatif dan melalui banyak keraguan' hmm saya cek dulu dari awal hingga akhir supaya saya yakin bahwa soal ini bisa di selesaikan dengan solusi alternatif.	*SP: Akhirnya saya bisa melakukan perhitungan dan mendapat hasil penyelesaian tinggal saya mengecek ulang dan menyakinkan bahwa soal ini bisa di kerjakan.* *P: Apakah kamu tidak ragu dengan hasil perhitunganmu?* *SP: Makanya saya yakinkan dan mengecek ulang supaya saya yakin akan hasil yang saya lakukan.*

Based on the results of the final calculation test, think aloud and interview transcripts, female students try to solve problems by providing alternative solutions so that the problem becomes correct and can be solved for the Logical problems-III geometry problem, which initially could not be done, but could be done and get the calculation results for the area of the shaded area.

Female students check the calculation results that have been done [E1] and confirm the alternative calculation solution [E2] that has been done, the checks carried out by these female national science olympiad students are a form of seeking the truth for Skeptics about Logical problems-III. The same is true for the research conducted by (Berta, 2024), namely checking the answers is done to increase confidence and eliminate doubts. Increasing self-confidence can eliminate doubts about a view. And this is in accordance with the opinion of (Tan, Meng, Owuamalam, & Sarma, 2022) which states that increasing confidence can help thwart doubts among people who are skeptical of the Covid vaccine. Increasing confidence can thwart doubts not only about vaccines, but in this study we see that increasing confidence can also thwart doubts in solving problems. In this case, increasing confidence is done by re-checking the answers to eliminate doubts in yourself. At this stage, increasing confidence is done by re-checking the answers and

convincing the answers to eliminate doubts in yourself. This explanation supports the opinion of (Saifulloh, 2013) who said that skeptics always doubt every claim of knowledge so that it encourages someone to seek the truth.

From the Stages of National Science Olympiad Students, male and female have differences in analyzing data and the stages of working on it are also different, skepticism of male National Science Olympiad students in solving Logical problems-III questions is to stop work and calculations so that complete and correct answers are not obtained. This shows that the category of skepticism in male students is skepticism to stop. Skepticism Female students in solving Logical problems-III are able to answer problems correctly even though they have doubts about the results of the work that was initially wrong, given alternative solutions so that it becomes correct and what is correct is evaluated to increase confidence in the truth of the answer. Female students try to solve problems with good alternative solutions and justify answers that were initially wrong or contradictory. what was done by this female national science olympiad student is a form of seeking truth because someone who is skeptical always doubts every claim of knowledge so that it encourages someone to seek the truth (Saifulloh, 2013). A similar thing was also expressed by (Carrie Cuttler, 2013) who stated that doubt triggers efforts to produce the urge to re-examine the work that has been done. So that the skeptical category in female students is skeptical to justify. When writing answers, male students are incomplete in expressing their mathematical ideas and in solving problems, students do not write down the purpose of their solutions (Nursayyidah, 2020). While female students are different from male students, female students tend to write completely in expressing their mathematical ideas, and in solving problems they tend to write down the purpose of their solution (Narpila, 2019). This is equivalent to what was expressed by (Bharata, 2017) that female students are very capable of conveying ideas and are able to communicate well what has been completed, with a form of writing that can be said to be clear.

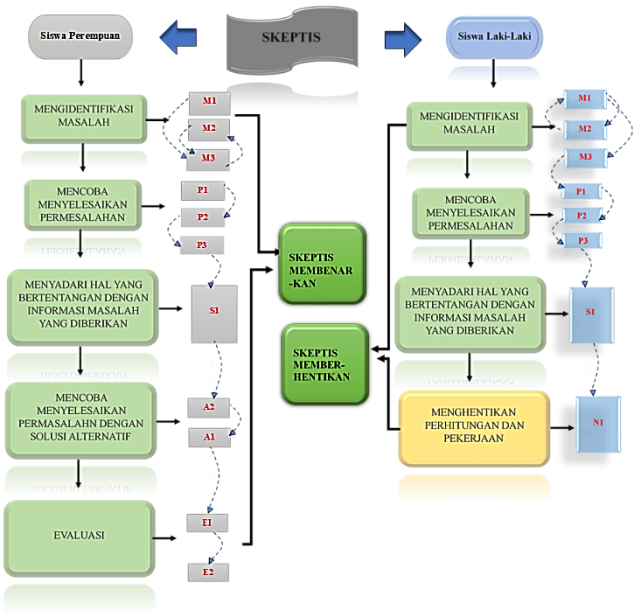


Figure 7. Skeptical illustration for male and female students

From this study, there were also indications of differences in skepticism in female and male students in answering question III logical problems. Reviewed from the introduction of this study, in men the left brain is more developed so that they are able to think logically, think abstractly, and think analytically (Markus, 2018), while in women the right brain is more developed, so they tend to be active artistically, holistically, imaginatively, think intuitively, and some visual abilities (Hodiyanto, 2017). The results of data analysis from female and male students can be concluded as shown in Figure 7.

▪ CONCLUSION

Based on the results of this study, there are differences in skepticism between female and male students in solving Logical problems-III. Male students tend to show higher skepticism than female students, especially in terms of solving problems, male students prefer to stop the answer and stop the work, which can be called skeptical dismissal. On the other hand, female students tend to be more careful and conservative in their approach, which can lead to lower skepticism but are more consistent in following the instructions for alternative solutions to problems and providing alternative solutions to problems to get calculation results, which can be called skeptical justification. This finding is important because it shows gender differences in solving illogical problems, which can affect the learning strategies and guidance provided to national science olympiad students. By understanding these differences, educators can develop approaches that are more in line with the needs of students, both male and female, in improving their thinking and analytical skills.

The impact of this study on education is the importance of considering gender differences in designing effective learning strategies for the development of thinking and logical skills. Teachers and mentors need to be aware that male and female students may need different approaches to stimulate their skepticism and critical thinking. This study also suggests that specific training emphasizing the development of problem-solving skills and skepticism may help students, especially in the context of competitions such as national science olympiads. However, this study has several limitations, including the sample size being limited to students who already have a high interest in national science olympiads, so the results may not be generalizable to a wider population of students. In addition, this study only focused on one type of logical problem III or illogical problems in geometry material, so further research is needed to see if the same gender differences emerge in the context of illogical problems in other materials.

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