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Development of Geometry Problem-Solving Task Instrument to Identify Critical Thinking of Junior High School Learners

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ABSTRACT
The problem that often occurs is the lack of effective instruments to measure the critical thinking skills of junior high school students in solving geometry problems, so it is necessary to develop measuring tools that can identify the level of critical thinking. This research aims to produce a math task instrument to identify students' critical thinking. The research subjects were junior high school students in Ambarawa.. The development method in this study uses a theoretical development model, namely a model that describes a framework of thinking based on relevant theories and supported by empirical data with the development stages: 1) conducting theoretical studies to formulate aspects or indicators of critical thinking, 2) preparing task grids, 3) compiling task items, 4) conducting task validation, 5) revision, 6) conducting trials, 7) analyzing trial results, and 8) formulating the final instrument of research results. The results concluded that the 2 task items developed according to the validators were suitable for use with revisions and could be used to identify students' critical thinking processes.

Keywords: *Critical Thinking; Task instrument; Geometry; Problem-solving; Junior High School*

ABSTRAK
Permasalahan yang sering terjadi yaitu kurangnya instrumen yang efektif untuk mengukur kemampuan berpikir kritis siswa SMP dalam menyelesaikan soal-soal geometri, sehingga diperlukan pengembangan alat ukur yang dapat mengidentifikasi tingkat berpikir kritis. Penelitian ini bertujuan untuk mengembangkan alat ukur tugas matematika guna mengidentifikasi kemampuan berpikir kritis siswa. Subjek penelitian adalah siswa sekolah menegah pertama di Ambarawa. Metode pengembangan dalam penelitian ini menggunakan model pengembangan teoretis, yaitu model yang menggambarkan kerangka berpikir berdasarkan teori-teori relevan dan didukung oleh data empiris dengan tahapan pengembangan sebagai berikut: 1) melakukan studi teoretis untuk merumuskan aspek atau indikator berpikir kritis, 2) menyiapkan grid tugas, 3) menyusun item tugas, 4) melakukan validasi tugas, 5) revisi, 6) melakukan uji coba, 7) menganalisis hasil uji coba, dan 8) merumuskan instrumen akhir hasil penelitian. Hasil penelitian menyimpulkan bahwa 2 item tugas yang dikembangkan sesuai dengan validator cocok untuk digunakan dengan revisi dan dapat digunakan untuk mengidentifikasi proses berpikir kritis siswa.

Kata kunci: Berpikir Kritis; Alat Tugas; Geometri; Pemecahan Masalah; Sekolah Menengah Pertama

INTRODUCTION

Education shapes students' critical thinking skills, especially in solving complex problems(Tang et al., 2020). Learning mathematics in junior high school has its challenges in developing students' critical thinking skills, especially in the context of geometry. One of the areas that requires critical thinking skills is geometry. Geometry involves understanding concepts and formulas and applying those concepts in various situations (Setiana et al., 2021);(Sumarwati et al., 2020). Therefore, it is essential to develop an instrument that can

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measure how students can think critically when solving geometry problems.

The development of this critical thinking task instrument aims to provide a valid and reliable tool that can be used by educators to identify and develop students' critical thinking skills (Reynders et al., 2020a);(AMİN et al., 2020). This instrument is expected to help measure various aspects of critical thinking, including the ability to analyze, evaluate, and synthesize information (TEMEL, 2022);(Cáceres et al., 2020). With a structured and standardized instrument, educators can provide more targeted feedback and design more effective teaching strategies(ARISOY & AYBEK, 2021).

The instrument developed will include tasks that challenge students to think critically, such as problem-solving tasks that require logical reasoning, tasks that involve making decisions based on geometric evidence, and tasks that demand creativity in finding alternative solutions (Alghadari et al., 2020);(Rahman et al., 2021). Through the use of this instrument, it is expected that students can be more trained in critical thinking and be able to apply it in the context of geometry and other fields. Based on the results of previous research, it is known that students often experience difficulties in solving geometry problems and are less able to use critical thinking skills optimally (Reynders et al., 2020b). Therefore, developing a task instrument to identify students' critical thinking in solving geometry problems is necessary to deeply understand students' abilities and evaluate the effectiveness of geometry learning at the junior high school level.

This study aims to develop a task instrument that can identify the critical thinking skills of junior high school students in solving geometry problems (Iswara et al., 2021);(Monrat et al., 2022). In mathematics learning, critical thinking is an essential skill that students must develop to deal with issues analytically and logically (Minarti et al., 2023). The novelty of this research lies in the development of a geometry problem-solving task instrument that is specifically designed to identify the critical thinking abilities of junior high school students, which is different from previous research which generally has not integrated the measurement of critical thinking aspects in the context of solving geometry problems in a structured manner. The developed task instrument will provide a clear picture of the extent to which students can apply critical thinking in the context of geometry so that it can provide helpful information for teachers and researchers in designing more effective learning(Lestari et al., 2021). In addition, there is a lack of literature. This article will discuss the stages of developing a critical thinking task instrument, starting from formulating critical thinking ability indicators, item preparation, instrument validation, and testing and analyzing the results. Hopefully, this article can improve the quality of geometry learning and develop students' critical thinking skills in Indonesia.

METHOD

This research aims to produce a product in the form of a mathematics task instrument to identify students' critical thinking. The development method in this study uses a theoretical development model, which describes a framework based on relevant theories and supported by empirical data. The stages of development carried out are 1) conducting theoretical studies to formulate aspects or indicators of critical thinking, 2) preparing task grids, 3) compiling task items, 4) conducting task validation, 5) revision, 6) conducting trials, 7) analyzing trial results, and 8) formulating the final instrument of research results(Borsboom et al., 2021). The *flowchart* in Figure 1 shows the stages of developing tasks that can trigger students' critical thinking in solving problems.

Data collection was done through interviews and tests (written assignments). The main instrument in this study was the interviewer (the researcher himself), who was assisted by a written task and interview guidelines. Written tasks contain geometry problem-solving task items. Written tasks are used to identify the critical thinking process of junior high school

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students in solving geometry problems. In contrast, interview guidelines are used to direct the interview in exploring the critical thinking process of students. The instrument was validated by three validators: one mathematics education lecturer, one mathematics lecturer with expertise in geometry and one mathematics teacher. The selected validators have taught for over ten years and have an educator certificate. The instrument is valid if it meets several criteria, namely the instrument's suitability with indicators and research objectives, the language used uses excellent and correct language, and the sentences used follow the research subject.

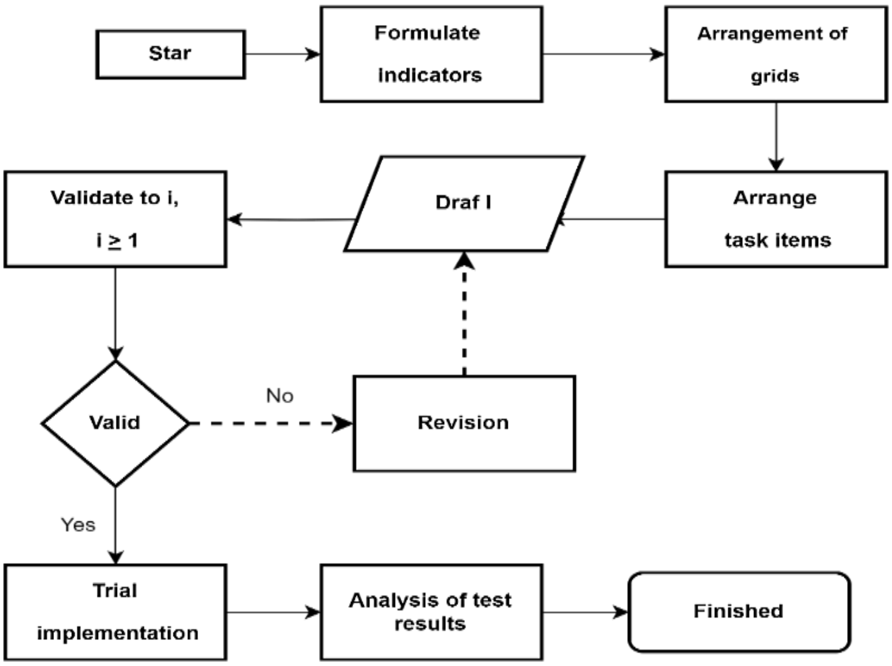

Figure 1. *Flowchart of* task development stages

The research subjects were selected using a *purposive sampling* technique: VIII grade junior high school students who received material on angle magnitude, triangles, circles, and the Pythagorean Theorem. Subjects were taken to have good communication skills to express what is in their mind, and the subjects were willing to take the time in research activities.

RESULTS AND DISCUSSION

The results and discussion of the development of the task instrument to identify critical thinking of junior high school students are described as follows:

a. Conduct theoretical studies to formulate aspects or indicators of students' critical thinking

Based on the theoretical study shows that the task to identify the critical thinking process of junior high school students in solving geometry problems must fulfil several characteristics as follows: (1) in the form of problem solving; (2) divergent in answers and ways of solving; (3) related to more than one student's mathematical knowledge/concepts and in accordance with the level of ability, in this case junior high school students grade IX; (4) the task asked contains questions that can explore the critical thinking process of students which includes 7 aspects, namely: clarity, precision, relevance, depth, breadth, logicality, significance; (5) geometry problem solving tasks in exploring students' critical thinking processes (As'ari, 2016) problems that present incorrect information, problems that present contradictory information, problems

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whose information is changed, problems whose solutions are more than one kind, problems that contain erroneous conclusions, problems that meet certain conditions, problems that contain incomplete information, in this study uses problems with the type of problem that has more than one kind of solution.

b. Develop instrument grids

Compiling the task instrument is preceded by studying the curriculum content standards for class VIII, namely the Merdeka Curriculum. In addition, the preparation of questions also pays attention to some of the characteristics of critical thinking questions/tasks that have not been mentioned yet. The question developed consists of 2 description questions, which are ready drafts to be validated on the essential competencies (KD) of 1) Solve problems related to the central angle, circumference angle, arc length, and circumference area of a circle, and their relationship; 2) The lattice of critical thinking questions developed is presented in Table 1. two questions that have been prepared as a means to explore the critical thinking process of students. Why is it said to be a means to explore students' critical thinking processes? The seven indicators of the critical thinking process can be explored and known not only through assignments alone but also more deeply through interviews with students. The leading critical thinking indicators, namely clarity, precision, relevance, depth, breadth, logicality, and significance, can be explored through assignments and interviews. In other words, each critical thinking question posed to students is used to reveal/measure the seven main critical thinking aspects as mentioned. Table 1 is the lattice of the task instrument.

Table 1. Grid of Instruments

KD	Material	Aspect. DBK	Question No.	About
4.7 Solve problems related to the central angle, circumference angle, arc length, and circumference area of circles and their relationships	Circle • Circle • Elements of a circle • Relationship between central angle and perimeter angle • Arc length • Area of a jurying • The inner tangent of two circles. • The tangent of the outer tangent of two circles	Clarity, Precision, Relevance, Depth, Breadth, Logic, Significance	1	A circle has points A, B, C and center O. Point on the circle's circumference. If the angle BAO is known to be 70°. Then determine: a. ABO angle magnitude b. Angle magnitude AOB c. What is the angle of ACB d. What is the relationship between the magnitude of angle AOB and the magnitude of angle ACB?
			2	It is known that tubular pipes with a length of 2 m and a radius of 14 cm will be tied with a rope. a. The length of rope needed to tie the two pipes. b. The length of rope needed to tie three pipes. c. If the number of pipes is 4, determine the length of rope needed to tie the four pipes.

c. Developing instrument items

The questions developed consisted of 2 description questions according to the grids made before this (see questions and question grids in Table 1), taking into account the characteristics of critical thinking questions in mathematics material and content standards in the independent curriculum for class VIII material. Class VIII because the material tested is taught in class VIII, even during the semester. Henceforth, this developed problem is Draft 1, ready to be validated. The task instrument is used to determine the aspects of students' logicality in solving issues, clarity in expressing questions or asking unclear questions, precision in solving complex problems, depth in determining the focus of attention, significance in solving issues, and relevance in selecting and applying criteria in solving problems.

d. Perform task validation

The instrument was validated by three validators: one mathematics education lecturer, one mathematics lecturer with expertise in geometry and one mathematics teacher. The selected validators have taught for over ten years and have an educator certificate. The instrument is valid if it meets several criteria, namely the instrument's suitability with indicators and research objectives, the language used uses excellent and correct language, and the sentences used follow the research subject. The three validators stated that the instrument was suitable for use with revisions. The suggested revisions are related to the question editor; the question items are suggested to be added to suit the research objectives, namely knowing the students' critical thinking process to conclude the relationship that occurs between concepts, in this case, the relationship between the central and perimeter angles facing the same arc. In addition, in the second question item, students are led to be able to conclude the length of the tangent line of 2 circles, comparing which line is longer if three circles, four circles, up to n circles are arranged in a row and combined,

e. Revised

Instrument revisions were made based on suggestions from validators; the following validator suggestions and the results of revisions to the instruments are presented in Table 2 and Table 3.

Table 2. Suggestions from Validators

Question No.	Validator 1	Validator 2	Validator 3
1	In the sentence "*A circle has points A, B, C and center O,*" in order not to contain double meaning, the sentence should be changed to "*A circle with center O and has different points A, B and C located on the circle.*"	• Question points a,b,c and d do not explore the critical thinking aspects of students. It is better to add a sentence, for example ... "*in point a. The size of the angle ABO and explain how to get the size of the angle*?". • Apply to points b,c, and d. • Add a question to *point* e: "*If point C is shifted to point D on the circumference of the circle and does not coincide with point A and point B, while the positions of point A and point B are fixed. Then what is the angle BDA*?". • Add to point f: "*If point C is shifted to point E on the circumference of the circle and does not coincide with point A and point B, while the positions of point A and point B are fixed. Then what is the angle BEA*?". • Point to the question, "*What is the relationship between angle AOB and angle BEA?*"	• Improve the sentence in the question item so that it is not confusing, namely the location of points A, B, and C in a row, or replace it with the location of points A, B, and C differently on the circle. • Add the question, "Conclude the **previous** point."
2.	Correct punctuation in questions, and end	• Add the sentence "*Explain how you found it*?" to question items a, b, and c.	Add the question, "Conclude the **previous** point."

Question No.	Validator 1	Validator 2	Validator 3
	each with a question mark (?)	• Add a question to point d. "*Compare the results on which of the* three *pipes is the longer rope needed if stacked in a row or together? Explain how you got it?*" • In point e, add the following question: *Compare the results on which of the four pipes is the longer rope needed when stacked in a row or combined? Could you explain how you got it?*	

Based on the suggestions from the validators, the following are the revised questions.

Table 3. Question Revision

Question No.	Before revision	After revision
1.	A circle has points A, B, C and center O. Point on the circle's circumference. If the angle BAO is known to be 70°. Then determine: a. ABO angle magnitude b. Angle magnitude AOB c. What is the angle of ACB d. What is the relationship between the magnitude of angle AOB and the magnitude of angle ACB?	1. A circle has a center point, O. Points A, B and C are distinct and lie on the circle's circumference. If the angle BAO is known to be 70°. Then determine: a. The magnitude of the ABO angle and explain how to get the magnitude of that angle? b. Find the angle AOB and explain how you got it. c. How large is angle ACB, and how do you find it? d. What is the relationship between the magnitude of angle AOB and the magnitude of angle ACB? e. Suppose point C is shifted to point D on the circumference of the circle and does not coincide with point A and point B, while the positions of points A and B are fixed. Then what is the magnitude of angle BDA? f. What is the relationship between the magnitude of angle AOB and the magnitude of angle BDA? g. Suppose point C is shifted to point E on the circumference of the circle and does not coincide with point A and point B, while the positions of points A and B are fixed. Then what is the angle BEA? h. What is the relationship between angle AOB's magnitude and angle BEA's magnitude? i. Conclude point d, point f and point h!
2.	It is known that tubular pipes with a length of 2 m and a radius of 14 cm will be tied with a rope. a. The length of rope needed to tie the two pipes. b. The length of rope required to tie three pipes. c. If the number of pipes is 4, determine the length of rope needed to tie the four pipes.	2. It is known that tubular pipes with a length of 2 m and a radius of 14 cm will be tied with a rope. a. The length of rope needed to tie the two pipes. Could you explain how you found it? b. The length of rope needed to tie three pipes. Could you explain how you found it? c. If the number of pipes is 4, determine the length of rope needed to tie the four pipes. Could you explain how you found it? d. Compare the results on which of the three pipes is the longer rope needed if stacked in a row or together. Could you explain how you got it? e. Compare the results to see which of the four pipes needs the longer rope if they are lined up or joined together. Could you explain how you got it?

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f. Trial implementation

The test of the task instrument was carried out outside of class hours; the researcher gave the subject free space to express his thoughts in accessible language. The subject also determined the problem of place and time of data collection so that the subject felt comfortable and could express himself freely. In the problem-solving process, students were asked to explain the reasons for each stage of the solution they did, and then the researcher reviewed the problem-solving results. The researcher interviewed students about their answers and what they did to obtain their answers. The tasks tested were two items with a duration of 1 hour for each problem. The code writing for the interview is S1 (Subject 1), S2 (Subject 2) and P (Researcher).

g. Analyse trial results

The following is a description of the test results of the task instrument related to critical thinking characteristics from the aspects of Clarity, Precision, Relevance, Depth, Breadth, Logicality, and significance.

Subject S1 Problem number 1

Figure 2 presents S1's problem-solving in problem number 1

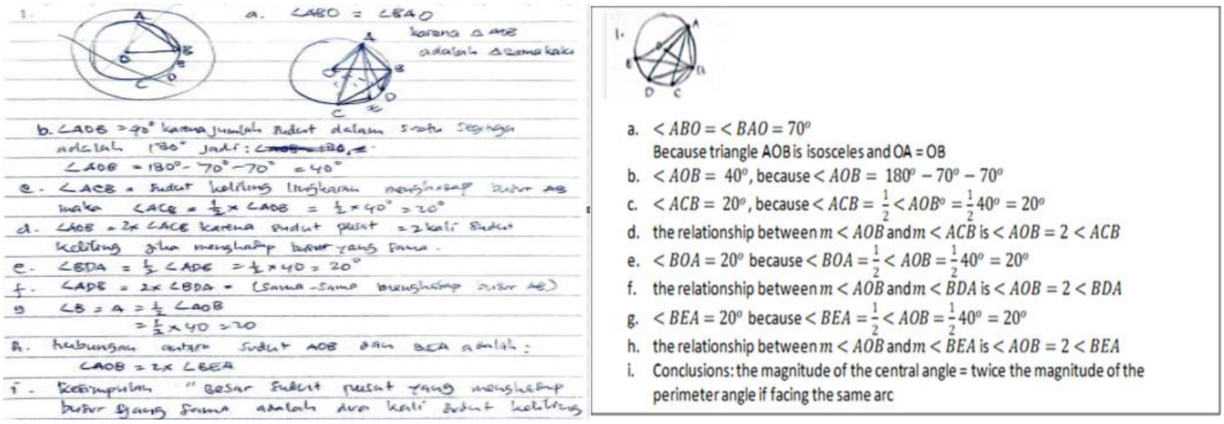

Figure 2. S1's response to question number 1

From Figure 2, S1 in problem number 1, when solving geometry problems, fulfills the aspects of clarity, relevance, logicality and significance. This is explained in Figure 1, which shows that S1 can solve the problem because it can identify important information, namely the circle size, point O being the center of the circle, and points A, B, and C being located on the circumference. $< BAO = 70^o$Point O is the center of the circle, and points A, B and C are located on the circle's circumference and are different. S1 also understands the goal, which is to determine the size of $< AOB$, $< ACB, < BDA, < BEA$, determine the relationships between angles, and contain conclusions. In the aspect of relevance, S1 can identify the triangle formed from points A, O, and B and then calculate the magnitude of the angle ABO and the magnitude of the angle AOB using the properties of an isosceles triangle and explain the relevance by saying because the line segments OA and OB are the radius of the circle then triangle AOB is an isosceles triangle this is because the length of the line segment OA = The length of the line segment OB.

S1 knows that the length of line segment OA is equal to the length of line segment OB because S1 understands that all points on the circumference of the circle have the same distance from a fixed point; the fixed point is called the center of the circle, point O. and the fixed distance from the center of the circle is called the radius. This indicates that S1 fulfills the logicality aspect. While in the significant element, in addition to identifying essential information, students can quickly focus on the most important and relevant information in the problem, namely remembering the relationship between the size of the central angle and the circumference angle facing the same arc. In addition, S1 is also able to understand the various components to solve the problem. S1 communicates that the properties of the central angle apply in the circle. Namely the magnitude of the central angle is equal to the magnitude of the arc of the circle that is flanked by the angle, and the relationship between the central angle and the perimeter angle facing the same arc with the central angle being half the magnitude of the central angle facing the same arc, namely the relationship between $< ACB\ dan\ < AOB$, the relationship between $< BOA\ dan\ < AOB$, the relationship between $< BDA\ dan\ < AOB$, and the relationship between $< BEA\ dan\ < AOB$.

Subject S1 question number 2

The problem in number 2 is known to be tubular pipes with a length of 2 m and a radius of 14 cm will be tied with a rope then asked the length of the rope used to tie two pipes, three pipes, four pipes, and compare the length of the rope if the tying method is different. S1 in question number 2 can show aspects of clarity, which S1 marks: 1) able to identify relevant information quickly and significantly, S1 wrote the length of the pipe as 2 meters and the radius of the pipe as 14 cm. 2) S1 can understand the purpose of determining the length of rope used to tie two pipes, three pipes and four pipes in 2 ways. This can be seen from Figure 3:

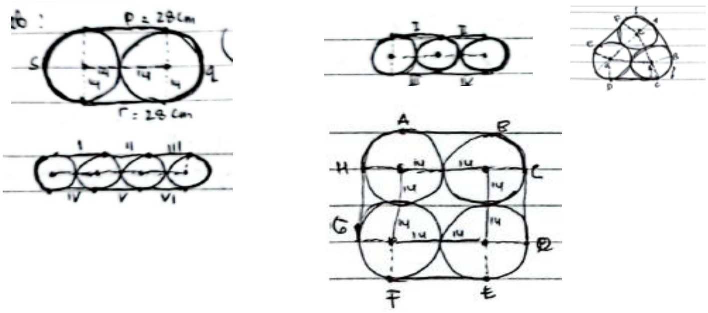

Figure 3. S1 represents the problem

S1 also mastered the precision aspect in solving this problem, indicated by the use of the right formula in determining the length of the rope, namely using the formula of the circumference of the circle, the size of the arc and the length of the diameter of the circle. S1 also performs calculations accurately, including calculating the length of the rope to remember three pipes to get the correct calculation of 200 cm, as shown in Figure 4. $(4\ x\ diameter) + (\ 2\pi r)$ get the correct calculation of 200 cm as shown in Figure 4:

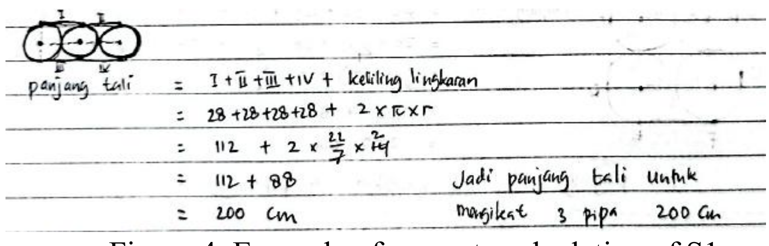

Figure 4. Example of accurate calculation of S1

The relevant aspects that S1 mastered can be seen from the correct use of data, namely: 1) understanding that it is necessary to know the circumference value of the semicircle, which is

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part of the formula used to determine the length of the rope used, 2) the diameter of the circle obtained from the distance between the centers of the circles to determine the length of the rope between the two closest circles. In the depth aspect, one of them is marked by students being able to do detailed calculations, namely determining the length of the rope that binds two pipes, three pipes with two events arranged in a row and stacked and calculating the length of the rope used to tie four pipes correctly. Significant aspects found in S1 being able to identify important information by recognizing that tying pipes is represented by a picture of several circles that intersect each other so that S1 can choose the right concept to solve the problem, namely the idea of diameter to calculate the distance between two circle centers with the same radius. At the same time, the breadth aspect of S1 in solving geometry problems can be found in S1's ability to use various concepts, methods and approaches. In this case, S1 can explore how to tie pipes by lining and stacking, as represented by S1 in Figure 3. So it is concluded that problem number 2 S1 in solving problems shows clarity, precision, depth, relevance, breadth, logicality and significance.

Subject S2 question number 1

S2 in question number 1, when solving geometry problems, fulfills the aspects of clarity, relevance, logicality and significance. This can be seen from Figure 5, where S2 can solve the problem. The first thing S2 does is represent it because it can identify important information, namely the circle size. $< BAO = 70^o$Point O is the center of the circle, and points A, B and C are located on the circle's circumference and are different. Figure 5 is the problem representation made by S2.

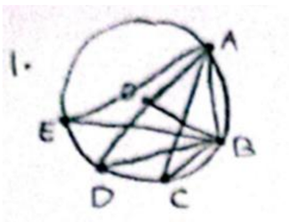

Figure 5. Problem representation on question number 1

S2 also understands the goal of determining the size of $< AOB$, $< ACB, < BDA, < BEA$, determine the relationships between angles, and include conclusions. In the relevance aspect, S2 can identify the triangle formed from points A, O, and B, then calculate the magnitude of the angle ABO and the magnitude of the angle AOB using the properties of an isosceles triangle and explain the relevance by saying Length of line segment OA = Length of line segment OB because line segments OA and OB are the radii of the circle than triangle AOB is an isosceles triangle.

Some of S2's clarifications about the clarity of problem number 1 at points b s.d i do not bring out aspects of critical thinking; this can be seen from the results of student problem solving and strengthened from the following interview results:

P: Sis, can you explain why you answered question b like that?
S1: The picture is a triangle, while the other two angles, namely the BAO angle and the angle ABO has known the result of 70 each, both if summed up 140. Then
$m < AOB = 40^o$.
P: can you explain getting $m < AOB = 40^o$*?*
S1: Yes, ma'am, the sum of the three angles in the triangle is 180^o^,
so $m < ABO = 180^o - 140^o = 40^o$.
P: Okay, thank you, now try to explain the next point that was asked, too

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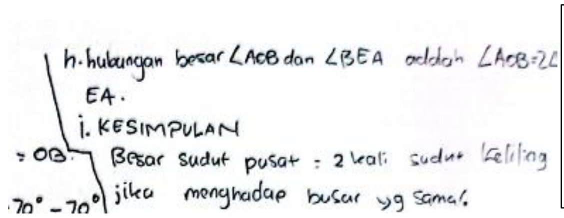
Could you explain how you got it? Why did you answer that?
S1: question c, d, e, f, g, h, I already have the formula. So, answer using the formula.
P: Can you please explain how to get it?
S1: Which one is it?
P: For example, what is question c? $m < ACB =?$
S1: I got this answer using the formula. Right, there is a formula for the amount of the circumference angle of a circle if it faces the same arc, which is half of the central angle.
P: Are there any other events?
S1: I can't bu
P: well, thank you

From the interview excerpt above, it can be concluded that S2 in question number 1 was able to answer the problem correctly from points A to I but could not explain the process of getting the answer. S2 only relies on memorizing formulas, so they tend to struggle when faced with problems that do not match precisely with the issues they have practiced. They may not know how to apply the formula they have memorized to a different context or problem.

S2 knows that the length of line segment OA is equal to the length of line segment OB because S2 understands that all points on the circumference of a circle have the same distance from a fixed point; the fixed point is called the center of the circle, point O. and the fixed distance from the center of the circle is called the radius. This indicates that S2 fulfills the logicality aspect. In the significant element, besides identifying important information, students can also quickly focus on the most critical and relevant information in the problem, namely remembering the relationship between the size of the central angle and the perimeter angle facing the same arc. In addition, S2 can also understand the various components to solve the problem. S2 communicates that in a circle, the properties of the central angle apply; namely, the size of the central angle is equal to the size of the arc of the circle that is flanked by the angle, and the relationship between the central angle and the perimeter angle facing the same arc with the central angle being half the size of the central angle facing the same arc, namely the relationship between $< ACB\ dan\ < AOB$, the relationship between $< BOA\ dan\ < AOB$, the relationship between $< BDA\ dan\ < AOB$, and the relationship between $< BEA\ dan\ < AOB$. The following Figure 6 shows that S2 fulfills the significance aspect.



h. the relationship between $m < AOB$ and $m < BEA$ is $< AOB = 2 < BEA$
i. Conclusions: the magnitude of the central angle = twice the magnitude of the perimeter angle if facing the same arc

Figure 6. Fulfillment of the significance aspect of question no. 1 subject S2

Subject S1 question number 2

The problem in problem number 2 is known to be tubular pipes with a length of 2 m and a radius of 14 cm will be tied with a rope then asked the length of the rope used to tie two pipes, three pipes, four pipes, and compare the length of the rope if the tying method is different. S1 in question number 2 can show aspects of clarity, which S2 marks as 1) able to identify relevant information quickly and significantly, S1 wrote the length of the pipe as 2 meters and the radius of the pipe as 14 cm. 2) S2 can understand the purpose of determining the length of rope used to tie two pipes, three pipes and four pipes in 2 ways. This can be seen from Figure 7:

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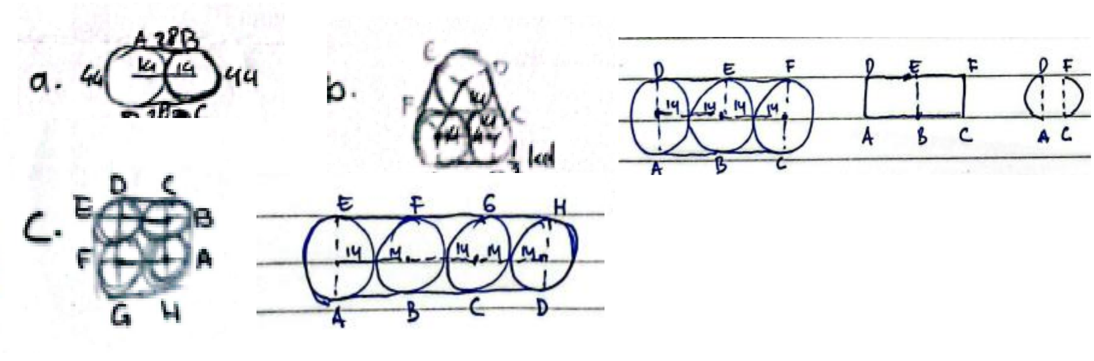

Figure 7. S1 represents the problem

The precision aspect of S2 in solving this problem is shown by using the right formula to determine the length of the rope, namely using half the circumference of the circle and the size of the circle's diameter. S2 also performs calculations accurately, one of which is calculating the length of the rope to remember four pipes. $(6\ x\ diameter) + (\ 2\pi r) = (\ 6\ x\ 28) + (2\ x\ 44) = 256\ cm$ as shown in Figure 8:

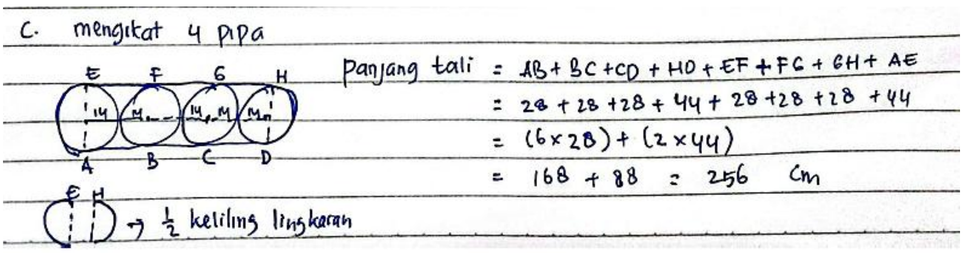

Figure 8. Example of accurate calculation of S1

In the relevant aspects that S2 mastered the same as S1, which can be seen from the correct use of data, namely: 1) understanding that it is necessary to know the circumference value of the semicircle, which is part of the formula used to determine the length of the rope used, 2) the diameter of the circle obtained from the distance between the centers of the circles to determine the length of the rope between the two closest circles. In the depth aspect, one of them is marked by students being able to do detailed calculations, namely determining the length of the rope that binds two pipes, three pipes with two events arranged in a row and stacked and calculating the length of the rope used to tie four pipes correctly. The significant aspect found in S1 can identify important information by recognizing that tying pipes is represented by a picture of several circles that intersect each other so that S2 can choose the right concept to solve the problem, namely the idea of diameter to calculate the distance between two circle centers with the same radius. The breadth aspect of S2 in solving geometry problems can be found by S2 being able to use various concepts, methods and approaches. In this case, S2 can explore how to tie pipes by lining and stacking, as represented by S2 in Figure 2. So it is concluded that problem number 2 S2 in solving problems shows aspects of clarity, precision, depth, relevance, breadth, logicality and significance.

Table 4 presents a summary of the emergence of S1 and S2 critical thinking indicators in solving problems:

Table 4. Recapitulation of Critical Thinking Identification

Aspects of Critical Thinking	S1 Question No 1	S1 Question No 2	S2 Question No 1	S2 Question No 2
Clarity	√	√	√	√
Precision	-	√	-	√
Relevance	√	√	√	√
Depth	-	√	-	√
Extent	-	√	-	√
Logicality	√	√	√	√
Significance	√	√	√	√

Based on Table 4, it can be concluded that both S1 and S2 were identified as mastering the same critical thinking aspects. Problem number 1 is a classic problem because the problem is presented directly with a focus on mathematical calculations without a real-world context. Problem number 2 is presented as a story or situation relevant to everyday life so that students can see the application of geometry. Related to the problem of students' critical thinking based on Table 3 above, it can be concluded that question number 1 is less able to identify students' critical thinking; only four aspects of essential indicators of thinking are recognized both in S1 and S2. At the same time, in question number 2, all elements of both subjects were identified.

Problem number one is a classical type of problem that requires good theoretical understanding and the ability to perform mathematical calculations. So, with classical maths problems, it is important to build solid mathematical knowledge among students (Schoenfeld, 2020). While question number 2 is contextual, contextual-type questions can see the relevance of geometry in everyday life and are more motivated to understand and learn geometry concepts. In short, question number 2 can identify students' critical thinking in geometry problem-solving well. This follows contextualized questions' purpose to develop students' ability to apply geometry concepts to solve real problems (Verschaffel et al., 2020); (Pongsakdi et al., 2020).

Critical students tend to be more engaged and participatory when faced with relevant and challenging problems. Contextual problems attract their attention because they demand deeper thinking and apply to everyday life (Trinidad, 2020); (Wong & Liem, 2022). In addition, by working on contextual issues, students must apply geometry concepts to one problem. This helps strengthen their understanding of the concepts as they see how they are interconnected and used together (İbili et al., 2020). Critical students also usually have good analytical skills(Rios et al., 2020). Contextual problems challenge them to use these abilities in more complex and varied situations, developing more holistic and adaptive problem-solving skills (Shiraev & Levy, 2020).

CONCLUSION

This study aims to develop a geometry task instrument that can identify junior high school students' critical thinking skills in solving geometry problems. The instrument developed has gone through several stages of development, including theoretical studies, task grid preparation, task item preparation, validation, revision, trial testing, and analysis of trial results. Based on the trial results, the developed task instrument is able to identify several aspects of students' critical thinking, such as clarity, precision, relevance, depth, breadth, logic, and significance. However, in classical type questions, only a few aspects of critical thinking can be identified, while contextual type questions are able to identify all aspects of students' critical thinking. These

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results indicate that contextual questions are more effective in measuring students' critical thinking skills in the context of geometry.

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