Analysis of Cognitive Conflict with Intervention on the Understanding of Geometry Concepts in SMA

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Abstract
This research aims to obtain information about students' cognitive conflict analysis with interventions on understanding the concept of geometry. The research method used is descriptive qualitative. This research involved students who experienced cognitive conflict with a sample of 6 students of class XII consisting of 5 female students and 1 male student. To show the data, the instruments used were interview and written questions. Each student has finished delivering answers, which will provide new information that can fill the conflict. Based on the results of the research, it shows that: (1) Cognitive conflict in the nature of a two-dimensional figure occurs in understanding the concept of a square with a rectangle and the concept of a rhombus with a square (2) Cognitive conflict for how to find the area of a two-dimensional figure occurs in the concept of finding a line area with a rectangle and the concept. The area of a triangle that has a height line inside with an area of a triangle that has a height line outside (3) Cognitive conflict occurs in the concept of calculating the area of a given shape (4) Cognitive conflict occurs in understanding the concept of the relationship between area and perimeter of a two-dimensional figure, students understand that a shape that has the same shape but different shapes will also have different circumference.

Keywords: Cognitive Conflict; Intervention; Geometry.

INTRODUCTION
The problems that are understood by understanding mathematics as a cognitive process are contradictions in students' understanding of a particular concept in mathematics. A mathematical concept can be implemented based on a variety of received information related to the concept. If these understandings do not integrate with each other in the thinking process of students or even contradict each other, it can cause mental imbalance in the thought process. Not integrating or conflicting with these understandings is a condition known as cognitive conflict (Ruslan, et.al. 2011).

Cognitive conflict has become a part of discussion in psychological theory, especially in the theory of cognitive development (Cantor, G. N., 1983). Ernest in Piaget, has introduced the concept of cognitive conflict. According to Ernest, cognitive conflict occurs when there is a conflict between two knowledge schemes in a cognitive structure in the form of inconsistencies or contradicting each other. (Piaget, J., 1985). According to Ernest, the conflict between the two knowledge schemes can be said to be two knowledge schemes that do not integrate with each other. Thus it can be said that cognitive conflict is a situation where the consciousness of an individual experiences an imbalance. Triggering cognitive conflict can be helped by giving intervention, namely providing new information related to concepts understood by students in learning with the purpose of strengthening students' understanding of mathematical concepts through guidance or scaffolding in overcoming conflicts. Cognitive conflict in this research is a cognitive conflict between conceptions, namely between students'
initial concepts / understanding with new information as a form of intervention. Thus the cognitive conflict used in this research is the condition of a child / student who experiences doubts, confusion, is not fixed in stance, and is anxious when faced with giving new ideas / information as a form of intervention related to previous student understanding. As, cognitive conflict is a conflict in the mind of a person who has not integrated understandings of a concept or its application which can be observed in his thinking activities. (Asdar, 2012). In his research, he also states that cognitive conflict strategies can be used to strengthen the understanding of high school students' geometric concepts. This strategy is applied by providing new information and knowledge that creates conflicts in students 'understanding, then training them to solve these conflicts in order to strengthen students' conceptual understanding.

An example of a case during an observation at a school in Makassar, students are shown a two-dimensional figure like the picture above, which is a square. Then the students were asked to provide an explanation of what they understood about these two-dimensional figures. If students are able to explain that this part is a square because it has 4 sides that form right angles and 4 equal sides, it means they understand the concept of a square. When given the intervention in the form of a question, namely how to rotate a square 90° and add a diagonal line, can it still be said to be a square or a rhombus based on the characteristics of the shape? If the student's response begins to appear doubtful, confused or anxious to state that the rhombus shape is square, this condition indicates that the student is experiencing cognitive conflict.

RESEARCH METHODS

This research is classified as a qualitative descriptive research which means to describe or explain cognitive conflict analysis with intervention to understanding the concept of geometry. It is said that this research is descriptive because the researcher does the analysis only to the level of description, namely analyzing and presenting facts systematically. This research was conducted by collecting data in the form of information obtained from informants / subjects. This research is intended to describe or express in words (qualitatively). The subjects of this research were class XII students of SMA Negeri 8 Makassar in the academic year 2020/2021.

The second data analysis in this research was carried out at the time the data collection took place and after completing the data collection within a certain period. Analyzes were carried out on each number of test questions they were working on. If the answer to the interviewee after being analyzed is considered unsatisfactory, the researcher will continue the question again until a certain stage in order to obtain data that is considered saturated. The data obtained were analyzed descriptively.

According to Miles, et.al (2014: 31) suggest that activities in qualitative data analysis are carried out interactively and continue to completion, so that the data is saturated. The steps in data analysis are: (1) data condensation, (2) data presentation (data display), and (3) conclusions.

Research techniques and procedures for initial activities, namely observation at school, observation of the research location were carried out to obtain information from the school regarding the research agreement, to find out the mathematics teacher of class XII, the number of students and the ability of the students. Second, designing research instruments. As a data collection tool, the researcher designed a research instrument consisting of structural geometry questions (TKKG) and interview guidelines. The third is to prepare research data recording tools. The research aids that are meant are tools in recording data. This tool is an audio recording device, namely by using a tape recorder or mobile phone equipped with a recording device. Data recording with this tool was carried out at the time of data collection, both focused at the time of the interview (giving intervention) and during the implementation of the TKKG. The use of this tool aims to enable researchers to record oral statements and respondent behavior carefully at the time of data collection.

The main activity, Providing Written Cognitive Geometry Conflict Test (TKKG) to students who will be selected and select students who are able to provide correct answers and understand concepts. Conducting interviews (giving intervention) based on the TKKG that the student has done. With this intervention we can observe the occurrence of cognitive conflict in students. And only students who experience cognitive conflict are the research subjects.
Final Activity, After conducting the research, the data collected from the results of TKKG giving and interviews (giving intervention) are students' answers or responses that indicate a cognitive conflict, namely when their understandings related to two-dimensional geometry do not integrate with each other (incompatible, inconsistent, contradictory) and students also seem to experience doubts, confusion, do not remain in their stance, and are anxious when faced with giving new ideas / information or by giving interventions related to the understanding they understand / have. Furthermore, the data obtained were analyzed qualitatively, then discussed the research results and drawn conclusions, then compiled a report based on the research results.

**RESULT AND DISCUSSION**

Analysis of the data on understanding of geometry is described based on students' understanding of:

1) Understanding the concept of a shape through its properties
2) Explaining how to determine the area of a two-dimensional figure
3) Calculating the area of a two-dimensional figure
4) Explaining the relationship between area and perimeter of a two-dimensional figure

At the time of distribution of TKKG questions, some students had reasons "aiihhh kulupa-lupa mi ini caranya kak'.." some say "masih kuingat ji saya kak'.." so this is where the determination of which students can be used as prospective research subjects and are able to correctly answer questions while being able to explain the answers properly.

This section will also explain about uncovering cognitive conflicts through intervention by means of direct dialogue with subjects related to the concepts they understand on TKKG questions and providing interventions or new information about the concepts they understand. The research data and the results of data analysis are described below:

1. **Student Understanding Data About Understanding the Concept of a two-dimensional figure Through their Properties**

Based on written data, it is obtained a description of PAR understanding about understanding the concept of two-dimensional figures through their properties in problem number (1), is obtained: According to PAR understanding based on the picture, the properties are the 4 sides are the same, have right angles, have 4 angles and 4 edges, and the opposite angle is equal.

Based on the data from the intervention results at the time of the interview above, a description of cognitive conflict in understanding PAR in question number (1) was obtained as follows:

1) PAR explains that there are only a few properties that a square has and a rectangle has.
2) PAR experiences cognitive conflict in its understanding of the properties of two-dimensional figures. According to PAR the properties of the square also apply to the properties of the rectangle.
3) Signs of mental imbalance in cognitive conflict experienced by PAR are:
   a) Confused, that is PAR is confused when given the example that AB = CD is 4cm while BC = AD is also 4cm but this property is a rectangular property but if you pay attention to it, this is a square characteristic because the four sides are the same length, namely 4cm.
   b) Doubt, namely PAR doubts that a square is also a rectangle because only a few of its properties are the same and also when given an example of the side length of a shape, it is doubtful that it is between rectangular or rectangular shapes.
   c) Does not keep on the establishment, PAR seemed inconsistent with his answers. When given a new understanding / intervention.
   d) Contradiction, PAR contradicts after being given interventions regarding different side lengths of squares and rectangles. So, at first he felt sure, the next statement suddenly contradicts his previous statement.

Based on written data, a description of the MRS understanding of understanding the concept of two-dimensional figures is obtained through their properties in question number (2), is obtained: According to the MRS understanding based on the image, the characteristics are the angles facing the same size, the opposite side being the same length, having 2 rotational symmetries, and folding, diagonal 1 and diagonal 2 are the same. Based on the data from the intervention results at the time of the interview
above, a description of cognitive conflict in understanding MRS in question number (2) was obtained as follows:

1) MRS explains that the properties of the rhombus at the angle are not 90 degrees so that there are those that do not include square properties into rhombic properties.

2) MRS experiences cognitive conflict in understanding if a square image is given diagonally so that it looks like a rhombus image.

3) Signs of mental imbalance in cognitive conflict experienced by MRS are:
   a) Doubt, MRS appears hesitant in determining whether the image is square or rhombus if the rectangular image is diagonal like a rhombus.
   b) Confused, MRS was confused when he answered that it was a square on the square which was added with a diagonal line like a rhombus. He was confused because it was shaped like a rhombus.
   c) Contradiction, MRS contradicts itself after being given an intervention regarding giving a diagonal to a square. What he initially said was different because the angle of the rhombus was not 90 degrees. After being given the intervention the statement he mentioned contradicts the previous statement.

2. Student Understanding Data about Explaining How to Determine the Area of a two-dimensional Figure

Based on written data, a description of KhM's understanding of explaining how to determine the area of a two-dimensional figure in question number (3) is obtained: According to the understanding of KhM based on the picture, in determining the area of the range, using the formula \( L = a \times t \). KhM has not determined which base is which as high. Based on the data on the results of the intervention at the time of the interview above, a description of cognitive conflict in the understanding of KhM was obtained in question number (3) as follows:

1) KhM explained that the cascade form is different from a rectangle, so it cannot be said that the tier formula is the same as the rectangular formula.

2) KhM experiences a cognitive conflict in its understanding of the form of lines that can be converted into rectangles and also with the formula.

3) The signs of mental imbalance in cognitive conflicts experienced by KhM are:
   a) Confused, KhM is confused when the levels are converted into rectangles and then pay attention to the relationship between the base of the cascades with the length of the rectangle and the height of the cylinders with the width of the rectangle.
   b) Doubt, KhM looked doubtful when he answered that the cubic area formula was not the same as the rectangular area formula because according to him the area of each section was found one by one because the cubic sections contained a triangular part.

Based on written data, a description of AZA understanding is obtained about explaining how to determine the area of a two-dimensional figure in question number (4), is obtained: According to the understanding of AZA based on the image, find the area of a triangle using the formula \( L = \frac{1}{2} \times base \times height \). This student has not determined which base is his height. Based on the data from the intervention results at the time of the interview above, a description of cognitive conflict in understanding AZA in question number (4) was obtained as follows:

1) AZA explains that DC is the base but after that the result will be subtracted by triangle ADB so that the area of triangle ABC is obtained. And also the width is different because one height is inside the other outside.

2) AZA experiences cognitive conflict in its understanding of the area between the triangles whose height is outside and the height is inside.

3) Signs of mental imbalance in cognitive conflict experienced by AZA are:
   a) Doubt, AZA seemed doubtful when determining that the base is DB but the area will have to be subtracted from the ADB triangle.
   b) Confused, AZA is confused in determining whether the area is the same if the first triangle and its height are inside while the other triangle is outside.
3. Student Understanding Data About Calculating the Area of a two-dimentional Figure

Based on written data, it was obtained a description of AnP understanding of calculating the area of a two-dimentional figure in question number (5), is obtained: According to AnP's understanding based on the figure, calculating the area of this area is solved by calculating the area of a large square, namely 14 x 14 = 196, then because the shaded area is put together so that it becomes half of the area of the square, then the area is divided in half. So get 98. Based on the data on the results of the intervention at the time of the interview above, a description of cognitive conflict in understanding AnP in question number (5) is as follows:
1) AnP explained that first combined the shaded area into one part, then the area that is half of the square will appear so that the area shaded is the total area divided by two
2) AnP experiences cognitive conflict in understanding when a form is changed into a modified form.
3) The signs of mental imbalance in cognitive conflict experienced by AnP are:
   a) Doubt, AnP he experiences doubts when he answers the same or not the modified form.
   b) Confused, AnP looks confused when asked to calculate the area but the area is the same as the picture in the problem.

4. Student Understanding Data about Explaining the Relationship Between Area and the Circumference of a two-dimentional Figure

Based on written data, a description of the MFA understanding is obtained about explaining the relationship between area and perimeter of a two-dimentional figure in question number (6), is obtained: According to the understanding of the MFA based on the picture, this student explained that the circumference would be different if the size was different but if multiplied it could be the same but if added the results were different. Based on the data from the intervention results at the time of the interview above, a description of cognitive conflict in understanding MFA in question number (6) was obtained as follows:
1) MFA explained that the circumference is different because of the different sizes. Because if you multiply it, it can produce the same number, while adding it must be different.
2) MFA experiences cognitive conflict in understanding when determining the greatest perimeter because it only considers that the side length of a shape is only an integer.
3) Signs of mental imbalance in cognitive conflict experienced by MFA are:
   a) Doubt, MFA also looked doubtful when asked about his biggest tour.
   b) Confused, MFA is confused when he finds out that the side length of a two-dimentional figure is not just an integer.

DISCUSSION

In the first part, which is about understanding the concept of two-dimentional figures through its properties in question number (1) with students whose initials MFA and PAR have experienced cognitive conflicts after being given intervention in the form of new ideas. According to their understanding that not all proper ties of a square belong to a rectangle. But they run into conflict when given an example image where the sample fulfills the properties of a rectangle but also fulfills the properties of a square. They experience confusion, doubt and begin to be inconsistent with their answers. This is indicated by the presence of a facial expression that suddenly changes like a frown and scratching his head. They themselves also said “… Confused…” when given the example. They also contradict their understanding after the intervention regarding the side lengths of squares and rectangles. At first they were sure of their answers but suddenly their answers / statements after being intervened were different or contradicting their previous statements.

Whereas in question number (2) with students with the initials MRS and AnP also experienced cognitive conflicts. According to their understanding that there are rhombuses that do not have a 90 degree angle so that there are several properties that are owned by a rhombus which is not owned by a square. But they run into conflict when given the example of a square added to the diagonal. Here they are confused about determining whether the image is a rhombus because it has a diagonal but the sides are all the same so that it can be said to be square. Here they seem inconsistent and they also say “… confused…” when asked whether a square is a rhombus. They also contradict their understanding after being given the intervention of giving a diagonal to a square. At first they were convinced by their answer which
said that the image was a square, some based on the angle of the 90 degree square, while not all rhombuses. There are also those based on their symmetry but suddenly their answers / statements after being intervened differ or contradict their previous statements.

In the second part, which is about explaining how to calculate the area of a two-dimentional figure in question number (3) with students whose initials KhM and AZA have experienced cognitive conflicts. According to their understanding that the shape of a line is different from a rectangle, the area formula is different too. But they ran into cognitive conflict when given an example where the length of a rectangle equals the base of the cylinders and the width of the rectangle equals the height of the cylinders. They seemed confused and hesitant when given this example and also when asked whether the line was a rectangle.

Whereas in question number (4) with students with the initials MRS and AZA also experienced cognitive conflicts. According to their understanding, to find the area of triangle ABC, the height line AD is inside the triangle. But they experience cognitive conflict when the high line is outside. and also they are confused and feel hesitant to determine the base used in calculating the area of triangle ABC whose height is outside. And they are also confused whether the area of a triangle whose height is inside is the same as if the height is outside of triangle ABC.

In the third part, which is about calculating the area of a two-dimentional figure in question number (5) with students with the initials KhM and AnP also experiencing cognitive conflicts. According to their understanding in this problem, to calculate the area of the shaded area, namely combining all the shaded areas to form half of a square, you can also break up the parts and then calculate the area of each part. But they experience cognitive conflict when the wake is changed into a new form but it is still the same form, only it has been modified. Because when the shading is the same as the previous image, they seem confused why the shaded area is the same but the shape is different.

In the fourth part, namely explaining the relationship between area and the circumference of a two-dimensional figure in question number (6), students who have the initials MFA and PAR also experience cognitive conflicts. According to their understanding even though the area is the same if the size is different then the circumference will be different. But they run into cognitive conflicts when determining the greatest perimeter if the area of the rectangle is 100cm². They only think that the sides of a shape are only integers. So that they seem hesitant to determine the largest circumference which is not limited

CONCLUSION

Based on the results and discussion, it can be concluded: (1) Cognitive conflict on the nature of a two-dimensional figure occurs in understanding the concept of a square with a rectangle and the concept of a rhombus with a square (2) Cognitive conflict for how to find the area of a two-dimensional figure occurs in the concept of finding a line area with a rectangle and the concept of the area of a triangle that has an inside height line with an area of a triangle that has a height line outside (3) Cognitive conflict occurs in the concept of calculating the area of a modified plane (4) Cognitive conflict occurs in understanding the concept of the relationship between area and perimeter two-dimensional figure, students understand that a shape that has the same area but different shape will also have different circumference

Students' understanding based on cognitive conflict can be categorized as follows: (1) For students who experience cognitive conflict, which is inconsistent, it can be said that the understanding of these students is still lacking. (2) For students who experience cognitive conflict, namely feeling confused, it can be said that their understanding is sufficient (3) For students who experience cognitive conflict, namely feeling doubtful, it can be said that the understanding that the student has is quite good.

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