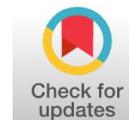


## Analysis of Geometry Misconceptions In The BSE Book As A 2013 Curriculum Book Reference



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### Abstract

This study aims to find out empirical data from the analysis of Electronic School Books (BSE) for students of Class IX Middle Semester I. There are 3 (three) triangles elements, namely the vertex, angle and length of the sides of the triangle, each consisting of 3 (three). But to determine the existence of a triangle requires only two elements, namely the angle and length of the sides of the triangle. However, not the two elements that are used to determine the existence of a triangle, but each must be known. To determine it enough to know 3 (three) elements of the two elements, namely: a. The length of the three sides, b. The length of both sides and one of its angles, c. The length of one side and the size of both angles. The results of the study based on literature review found an error that the BSE Student Mathematics book for class IX contained a triangular image error with 5 elements of two elements (3 side lengths and 2 angles) which proved impossible after analysis using painting and trigonometric calculations.

**Keywords:** Analysis, Geometry, Misconceptions, BSE Book

## INTRODUCTION

Teaching and learning in class that is well planned and implemented is the hope of every teacher, so that ultimately students who have an active role in the learning process can achieve learning objectives, namely students with abilities or learning achievements.

As a teacher we should realize that the learning process is a system that consists of several components, namely: raw input or raw input in the form of students from previous schools, the transformation process in the form of the learning process itself, instrumental input in the form of man, material and management , output or output in the form of students with additional abilities which can be in the form of memory of understanding and application of knowledge gained during learning, and the last component that is no less important than the 4 components mentioned earlier is the environment or environment.(Bernard & Senjawati, 2019)

The learning system has the goal of providing facilities for students to be able to learn optimally. Furthermore, the purpose of this system is referred to as the objectives of the learning process. A system is said to be good if each system component functions properly. Furthermore, the system is said to be not good if at least one component of the system does not function as it should.

In the learning process that occurs in the classroom, there is actually a process of communication between students and students, students and teachers. This communication process is the process of delivering messages (message) from the source (resourch) (information) to the recipient (receiver), in the process of communication between the source and the recipient the exchange of roles can occur. Likewise in the learning process in the classroom there is a communication process between learning resources to the recipient, namely students. Learning



resources can be in the form of books, internet, teachers, classmates in a class, while the message delivered in the form of knowledge that has been prepared according to the curriculum in force. For schools in Indonesia the curriculum is prepared by the Government or the Ministry of Education and Culture.

The knowledge that students will learn by the Ministry of Education and Culture has been prepared in a book that is loaded on the internet. Furthermore, these books are named as Electronic School Books (BSE). BSE is an initiative program from the Indonesian Ministry of National Education that aims to provide electronic learning books for all levels of education ranging from elementary, junior high, to high school and vocational school. Every book that is part of BSE is obtained by way of its copyright being officially purchased by the Ministry of National Education from the author or publisher concerned. The textbooks are subsequently changed to become electronic books (e-books), with the aim to be used by all people who need books with national standards of Indonesian education. This Electronic School Book can be downloaded for free from the internet via a computer and is used for learning purposes. In its use, not only students can download and use it, but it can also be used as a teaching guide for teachers.

At the beginning of its appearance, BSE is an alternative learning media that provides a new atmosphere in the learning process. This program provides convenience when learning because there are complete materials for each level of education. This BSE program is intended so that during the learning process students are not bored, provide motivation so that enthusiasm and are active in learning and make students easy to accept the material provided. It is hoped that this BSE program can help improve the generation of young generation and educate the nation's children.

Besides the positive side of the BSE program, of course there are also drawbacks. In this case what will be discussed is the BSE mathematics subject. Some disadvantages include:

1. Typing errors
2. Error in giving information to the picture
3. Mathematical concept errors

From the results of the study of researchers through group research by Rusgianto H.S., et al. with the title: "Analysis of 2013 Mathematics Junior High School Student Mathematics Book" (2015, p.43) conclusions include: a. Errors in pictures and illustrations, b, mathematical concept errors, such as determining the gradient of straight line graph equations, function graphs, location of points in Cartesian coordinates, right triangle size, real problems in life.

The mistakes that occur even though it is actually quite disturbing but it is still possible for teachers who have high competence is not a problem in helping their students in learning. But this is not the case for teachers who do not have very high mathematical competence they have. In this study revealed all parts of Mathematics, which includes Algebra, Geometry, Statistic, Arithmetic, while in this study only specialized in the field of Geometry and it was focused only on the concurrency of two triangles. That is because the researcher feels that there is something unnatural in the discussion of sample problems in the BSE book, and after the researcher has examined and analyzed it is true that there are mistakes that do not need to be done again by the teacher.

Benjamin (2005, p. 2-8) states that the plane geometry objects are points, lines, surfaces, segment lines, angles, triangles, etc. Next. Alders (1961) states that geometry is a branch of mathematics that studies points, lines, fields and objects and their properties, measurements, and relationships between one and the other.

Another explanation related to geometry is that one of the subjects taught at the junior high school level is stated by the National Education Standards Agency (BSNP) (2006, p.346) in the Content Standards in accordance with the Education Unit Level Curriculum in subjects at the SMP level including aspects of numbers, algebra, geometry and measurement, and statistics and opportunities.

NCTM (2000, p.41) states that "geometry has long been regarded as the place in the school mathematics curriculum where students learn to reason and to see the axiomatic structure of mathematics". The statement explains that geometry has long been included in the school mathematics curriculum which presents students in their learning to express reasons and determine the truth without going through structured evidence on mathematics.

## METHOD

This research is a continuation of the previous research, entitled: "Analysis of Mathematics Students of 2013 Curriculum Junior High School", from the findings of errors in Geometry especially the concordance material of researchers using painting analysis in Geometry and Trigonometry Calculations to study errors presented in one of the BSE volumes. IX.

## RESULTS AND DISCUSSION

### Error Findings

From one of the BSE book the researcher found a complete sample problem with the solution as follows:

Example Problem 6:

Pay attention to  $\Delta ABC$  and  $\Delta KLM$  in the Figure 1 and Figure 2 below!

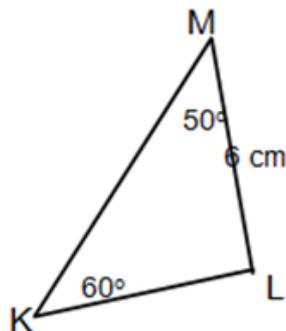


Figure 1.  
KLM triangel

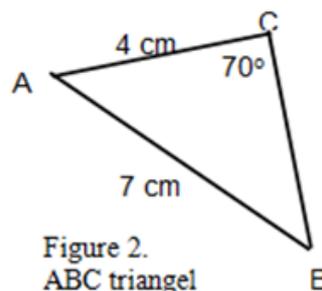


Figure 2.  
ABC triangel

Known  $\Delta ABC \cong \Delta KLM$ , specify:

- big of  $\angle L$ ,  $\angle A$  and  $\angle B$ !
- length of  $KM$  and  $KL$ !
- length of  $BC$ !

Answer:

Known:  $\Delta ABC \cong \Delta KLM$

- $\angle L = 180^\circ - 50^\circ - 60^\circ = 70^\circ$   
 $\angle A = \angle K = 60^\circ$   
 $\angle B = \angle M = 50^\circ$
- $KM = AB = 7$  cm (located in front of  $\angle 70^\circ$ )  
 $KL = AC = 4$  cm
- $BC = 6$  cm

From the example 6, it can be seen that:

$$\left. \begin{array}{l} \angle K = \angle A \\ \angle L = \angle B \\ \angle M = \angle C \end{array} \right\} \text{ the corners are same}$$

$$\left. \begin{array}{l} \frac{KM}{AB} = \frac{7}{7} = \frac{1}{1} \\ \frac{KL}{AC} = \frac{4}{4} = \frac{1}{1} \\ \frac{ML}{BC} = \frac{6}{6} = \frac{1}{1} \end{array} \right\}$$

(Source: Wagiyo A, Sri Mulyono, and Susanto. (2008). Mathematics Learning Handles (BSE) For SMPs MTs Class IX. Jakarta: National Book Center. Ministry of Education, Page 5)

### Discussion

In the picture required  $\Delta ABC \cong \Delta KLM$ . If we pay attention to the order of naming K - L - M and A - B - C, then the same pair of angles should be:  $\angle K = \angle A$ ,  $\angle L = \angle B$ , and in the figure it is known that  $\angle M = 50^\circ$  and  $\angle C = 70^\circ$  Obviously the two triangles cannot be congruent.

But if what is meant by the author is  $\Delta ABC \cong \Delta KML$ , there is still a possibility because  $L = 180^\circ - (\angle M + \angle K)$  atau  $\angle L = 180^\circ - (50^\circ + 60^\circ) = 70^\circ$

So  $\angle C = \angle L = 70^\circ$

Then the two triangles,  $\Delta ABC$  and  $\Delta KML$ , are required to be concurrently drawn first. (This text is painted in its actual size).

Painting  $\Delta ABC$  as Figure 3.

Paint.

1. Draw line g, and determine any point C on line g,
2. Using a protractor painted  $\angle C = 70^\circ$ ,
3. Draw a circular arc with the center of point C and a radius of 4 cm that will intersect the leg  $\angle C$  which is not line g at point A,
4. Draw a circular arc with the center of point A and the radius of 7 cm that will cut the line g at point B.
5. Connect point A with B, so that the triangle ABC is painted.

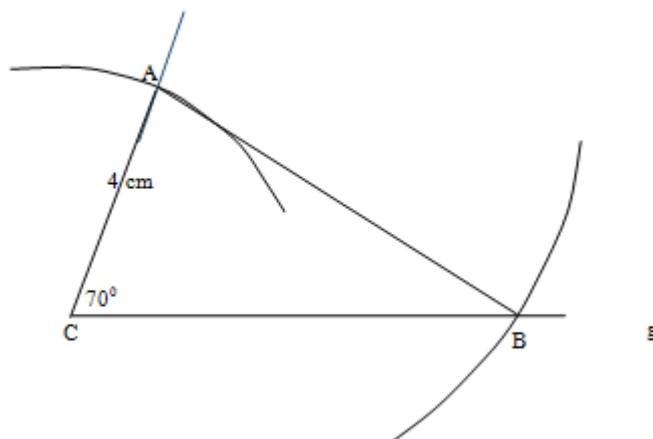


Figure 3.  $\Delta ABC$

Painting  $\Delta KLM$  as Figure 4.

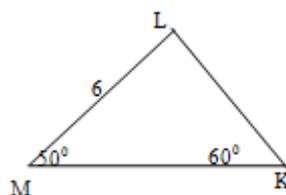
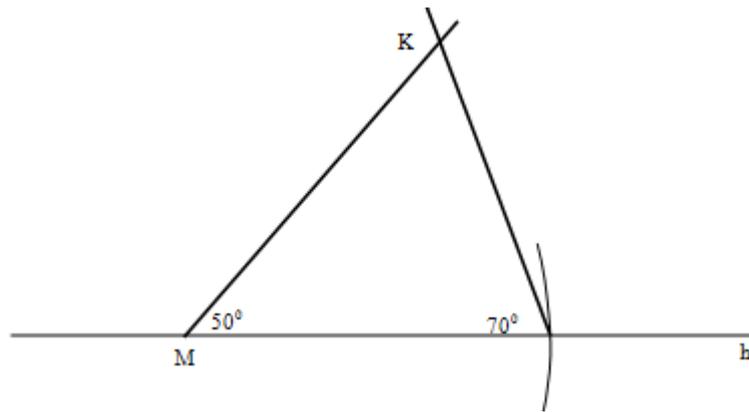


Figure 4.  $\Delta KLM$

Therefore  $\angle M = 50^\circ$  dan  $\angle K = 60^\circ$ , then

$$\angle L = 180^\circ - (\angle M + \angle K)$$

$$\angle L = 180^\circ - (50^\circ + 60^\circ) = 70^\circ$$

Figure 5.  $\triangle KLM$ 

Paint  $\triangle KLM$

1. Painted line h, and determine any point M on line h,
2. Using a protractor painted  $\angle M = 50^\circ$ ,
3. Draw a circular arc with the center of point M and a radius of 6 cm that intersects the line h at point L,
4. At point L Painting  $\angle L = 70^\circ$ , the leg  $\angle L$  which is not LM intersects the leg  $\angle M$  which is not LM at point K.
5. KLM triangle is painted.

Results The two triangles are placed close together for comparison on Figure 6.

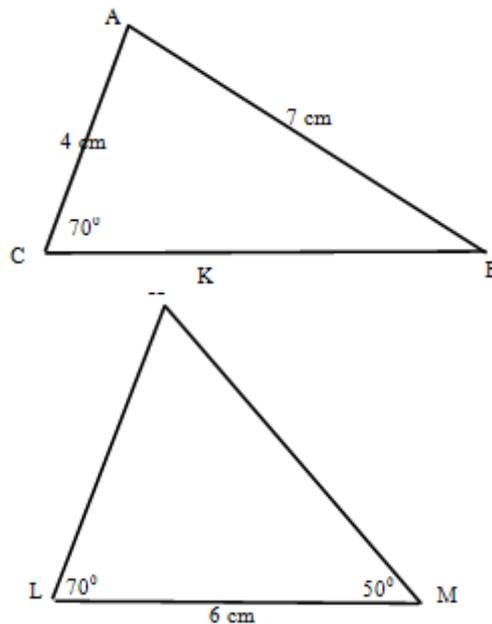
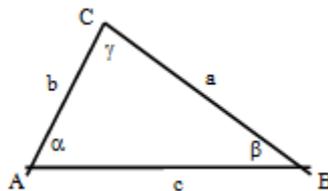


Figure 6. Two triangles for comparison

When compared to the two triangles, there appear to be large pairs of angles and the length of the sides which are not the same layout. But it needs to be reviewed further angle pair size.

### Proof using the sine formula in trigonometry

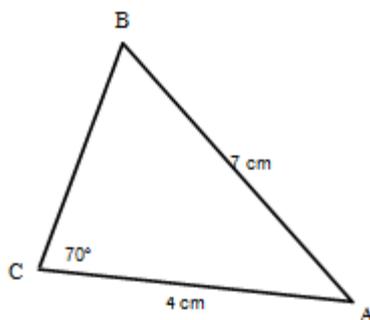
Look at the Figure 7.

Figure 7.  $\Delta ABC$ 

According to Rusgianto H.S. (2012: 51) in a triangle the length of the three sides are respectively  $AB = c$ ,  $AC = b$  and  $BC = a$  and the magnitudes of the three angles are respectively:  $\angle$

$A = \alpha$ ,  $\angle B = \beta$ , and  $\angle C = \gamma$ , applies relationship 
$$\frac{a}{\sin \alpha} = \frac{b}{\sin \beta} = \frac{c}{\sin \gamma}$$

So if it is required that  $\Delta ABC \cong \Delta KLM$ , then in the calculation of the corresponding angles and the corresponding lengths of the sides are the same. We try to investigate through the calculation of how big each angle is on the ABC triangle and also how long the three sides of the KLM triangle are.

Figure 8.  $\Delta ABC$ 

In Figure 8.,  $\Delta ABC$ , it is known that the length of the  $AB = 7$  cm, and the length of the  $AC$  side = 4 cm, and the size of  $\angle C = 70^\circ$ . Using the Sine rules can be written:

$$\frac{AB}{\sin \angle C} = \frac{AC}{\sin \angle B}$$

$$\frac{7}{\sin 70^\circ} = \frac{4}{\sin \beta}$$

$$\sin \beta = \frac{4 \sin 70^\circ}{7}$$

$$\beta = 32,48^\circ$$

$$\text{Besar } \angle B = \beta = 32,48^\circ$$

$$\angle A = \alpha = 180^\circ - (\angle B + \angle C)$$

$$= 180^\circ - (32,48^\circ + 70^\circ)$$

$$\angle A = 77,52^\circ$$

From the third pair of angles  $\Delta ABC$  and  $\Delta KLM$  only one is the same, namely  $\angle C = \angle M$ , while the other pairs are not the same.

So  $\Delta ABC$  and  $\Delta KLM$  cannot be concurrent.

## CONCLUSION

The author of the book has drawn two triangles, namely  $\Delta KLM$  and  $\Delta ABC$ , each of which has three known elements. From  $\Delta KLM$  we know the length of one side and 2 angles, namely  $ML = 6$  cm,  $\angle K = 60^\circ$  and  $\angle M = 50^\circ$ , while from  $\Delta ABC$  we know that there are 2 sides and one of its angles, namely  $AB = 7$  cm,  $AC$  side = 4 cm and  $\angle C = 70^\circ$ .

Both triangles already meet the requirements for painting, that is, a triangle will be certain if all three elements are known except for the three angles. In accordance with the elements of each triangle can be painted  $\Delta$  KLM and  $\Delta$  ABC, from the appearance of the painting it is not possible both of the triangles are congruent.

It turns out that the writer insists that the two triangles are congruent in the problem, by making side comparisons of the two 1: 1 triangles. So there is a misconception from the author of the book that needs to be corrected, because if it is read by many students it will have fatal consequences.

### RECOMMENDATIONS

Some suggestions that can be raised by researchers in connection with the results of the study:

1. To the government cq the Ministry of Education and Culture, especially the National Book Center to be careful in choosing the author of the book as a reference for students.
2. Books that have been circulating need more careful study by experts who are indeed experts in their fields, and are immediately revised so as not to damage the understanding of students' mathematical concepts.
3. Higher Education LPTK must be sensitive to the needs of the community in providing quality learning resources and in accordance with the level of thinking of students

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