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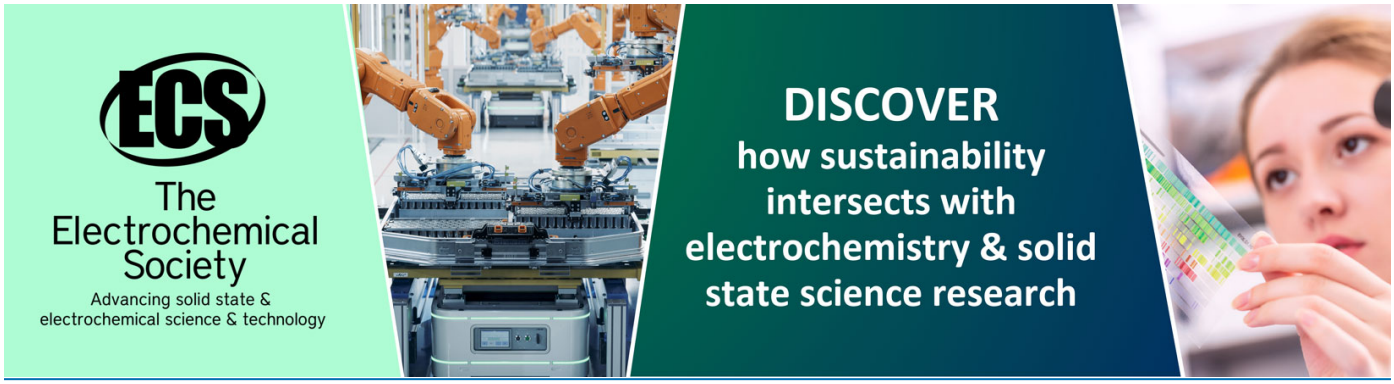

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Understanding hearing impairment students at SMPLB in rectangle based gender

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Abstract. This study illustrated the understanding of hearing impairment students based on gender differences in the rectangle. The subjects of this study were students of SMPLB class VIII (male and female). This study employed a qualitative research, there were four questions given to two students of eighth grade Junior High School who had the same mild hearing and ability. The data of this study were analyzed by using time triangulation. The result of the research analysis of hearing impairment students understanding are: firstly, both subjects can mention the characteristics of the rectangle, secondly, Female student was unable to give definitions, while the male student wrote the definition based on the characteristics of rectangle, third,, the female student did not think creatively in giving example and non-example of the rectangle around her, while the male student was more creative could even imagine the objects in his house that resemble rectangle; and Fourth male student was more thoroughly in placing objects based on the name of the flat geometry, while female students was still precise in placing objects by name.

1. Introduction

Mathematics is one of the fields that are closely related to the activity of human life [1-4]. Mathematics is seen as a science that has abstract object that requires a good understanding of capabilities towards mathematical symbols contained [5]. Every individual has his/her own style to make it easier to understand the material to be studied. One of the factors can be seen is the way male and female students understands mathematical material. Hyde, Fennema, and Lamon [6] state that men outperform women in terms of solving complex problems. One of result study shows the differences in the mathematical ability of male and female students who certainly different ability of understanding [7]. Therefore, there are no single students have same style in leaning mathematics.

Several studies related to mathematical understanding and research on gender differences by national and international mathematics educators are numerous, but similar research on deaf students' understanding based on gender is still very limited, especially in Indonesia [8-10]. However, very few mathematics educators in Indonesia are interested in researching disabled students especially hearing impairment students. It is one of the foundations for researchers to do research on students with special needs, especially hearing impairment students. The problem

in this study is how the hearing impairment students' understand profile of rectangle based gender differences.

Understanding is a part of the cognitive process which is very important; a good understanding of something will give better results as well [11]. Mathematics is one of the concepts that need a good understanding, not to be memorized but to be understood [12-14]. Students have to understand how to connect between concepts which are one of the processes of understanding [15]. For instance, if the student wants to know the proof of the formula area of triangle, of course he/she must understand rectangular or square.

Understanding was illustrated from several points of view of a study conducted. They state that understanding mathematics means developing relationships between mathematical concepts being studied and understanding is when we can generate important ideas from what has been learned related to the concept of mathematics [16]. Understanding is one aspect that plays an important role in the learning process of mathematical concepts. The understanding possessed will make it easier for students to construct what they learn.

The important of understanding is also potentially powerful and enduring mental process in human memory as the foundation that will build individual knowledge [15, 17]. Understanding the concept and procedural abilities in learning and teaching mathematics, how students connect between mathematical concepts are also important [18]. Therefore, the understanding of mathematics is defined as a person's mental activity in relating the mathematical concepts that are being studied with schema that have been previously owned so as to generate networks between mathematical concepts.

Geometry is one of the many mathematical concepts related to everyday life [19-21]. Crompton [22] and Luneta [23] stated that geometry is one of complex mathematical material. Since geometry is a complex concept, in studying and in teaching geometry, it is important to understand the level of geometry thinking as Van Hiele's theory of geometry level [24, 25]: level (0), Visual: based on visual forms students learn to understand geometry such as the shape of rectangles like door, window etc.; level (1) Analysis: students at this stage have been able to understand the properties of flat geometry, and can explore and prove formulas; level (2), Inferences related to experience Students at this stage begin to analyze the interrelationship between flat geometry characteristics by using informal deduction; level (3) Inference Resolution. At this stage students can understand the concept of geometry in a deductive system, can build theorems from a system of axioms, and can make logical arguments and logical conclusions; level (4) Advanced Period. It means, without any reference model students can learn geometry. Clement and Battista [24] states that to develop students' understanding of geometry requires a lot of experience engaging in geometric ideas. Therefore, the learning requires experience based on the thinking level of Van Hiele geometry.

From the series of definitions that have been discussed above, the intended goal of this study is understanding as mental process of a person in constructing the meaning of the concept: by mentioning the characteristics, expressing the definition, the student can give an example and non-example, and also classifying rectangular and square from Bloom Taxonomy revised [11]. Hearing impairment students are students who have hearing disorders [26], the result of which is the lack of vocabulary heard by those who will inhibit their ability to communicate with others. They use Indonesian language sign in short SIBI with their fellow community but if they talk to hearing mostly using body language.

Some researchers on the ability of students with hearing impairment in mathematics such as Kritzer [8] found that some of the hearing impairment student's weaknesses include comprehension of numbers, measurements, and problem solving. Other In addition, the low ability of hearing impairment students to generalize the nature of geometry [27], as well as research results demonstrated that from the subtest which includes calculations, geometries and rational numbers, students with hearing impairment were weaker compared with hearing students [28]. The research results on the causes of low-grades among deaf students in solving

mathematical problems are of the due to lack of preparation of mathematics education teachers [10]. Finally, deaf students' creativity is still limited in divergent thinking [9]. It is indicating lack of teacher attention on students' conceptual understanding in the learning process [7].

Gender comes from English. The term gender is generally used to distinguish between male and female sex. But the gender concept is different from the concept of gender. Sex is naturally a provision of God related to the differences between men and women biologically [29]. Meanwhile, gender is a characteristic inherent in men and women and is shaped by social and cultural factors. Thus, Gender in this study is a distinguishing characteristic between men and women formed by sociocultural factors and biologically formed. Research findings related to gender differences vary greatly. Beller and Gafni [30] and Hergovich, *et al* [31] states in their research found that in general, male mathematics achievement is better than female. Else-Quest, *et al* [32] concludes that men outperform women in terms of solving complex problems. Therefore, in this study, the subject are hearing impairment students based on the characteristics they possess, not just gender differences but there are characteristics that are considered.

2. Method

Subjects of this study consisted of two students. Subject selection was based on the level of mathematical ability possessed through the results of mathematics learning and on the advice of the mathematics teacher. So one male and one female subject were selected, both subjects were from the same schools that specializes in teaching students with hearing impairment located in the South Sulawesi province of Indonesia. The first subject is male (fifteen year old) and the second subject was female (thirteen-year-old). Both were having mild hearing impairment.

They were chosen to participate in this research by their class teachers based on their math difficulties they were experiencing in class and their willingness to work with the researcher. Ethics/permission: before conducting research, the researcher first requested the introductory letter from the graduate program addressed to each principal, and then selected the subject by permission of math teacher in class.

This research was qualitative using a descriptive and explorative method. This approach was selected because explorative data must be natural and deep in the form of words or using sign language, gestures, facial expressions, and written answers. This study was conducted to explore how and what hearing impairment students can display through sign language, images or symbols when expressing their understanding of the concepts about rectangles and squares. Furthermore, the data was described to obtain a realistic view of students hearing impairment understanding of concepts relating to rectangles and squares. The data was collected through interviews at each section using sign language. The data from interviews where the research subjects used sign language were transcribed by the researcher into written form.

The instruments used in this research included achievement, interviews, and video recorder. The achievement test consisted of essay format question that had been validated by one math specialist from the university of Muhammadiyah South Sulawesi province of Indonesia and a math teacher from Secondary school at SLB consisted of 4 questions: mentioning characteristics, defining attributes of rectangles and squares, requesting examples and non-examples, and classifying plane geometry that include rectangles and squares.

Data collection was done by using task-based interviews and the thinking aloud method. The subjects worked on a quadrilateral problem by writing the answers on the answer sheets provided while expressing what their thought processes. If the students did not express their thought clearly, the researcher would ask question to clarify what the subjects was thinking in answering the question to explore the process of students understanding.

Data analysis was conducted during and after the math lesson. Data and during the lesson of probing questions to gather detailed information of how and what the subject was thinking during the problem solving process. The data analysis conducted post lesson used the subject completed work, the participant from video recordings and interpretations of the subject

behaviors with student participating in the lesson. The data was categorized link into interview questions Bloom's Taxonomy Reviewed by [11]. Data reduction, data display, and conclusion drawing/verification [33]. These three data analysis activities were not hierarchical, but interactive activities from during and after data collection.

3. Results and discussion

Results of the research results will be presented as follows for each subject. The researcher gave a number of objects made of cardboard covered with colored marble papers.

3.1. Interview researcher to the first subject (male student)

The first subject is one of the male student who have a mild hearing-impairment was more active in the learning process than the other students.

Researcher : Can you mention the names of flat shapes in the picture, whether he still remembered the name of the geometry?
Subject : Yes I can, rectangle, square, triangle, parallelogram, trapezium, and rhombus.
Subject : Lifted one by one to answer the object. Some names of the flat geometry that he knew even though he mentioned it sometimes reversed but it could be understood. For example, he said 'setiga' for triangle, or 'belah tekupat' for rhombus.
Researcher : Mention as many characteristics as possible of the rectangle.
Subject : He says while fingering the cardboard-made object that the rectangle features have two lengths and two widths, having four right angles. Subject is only able to answer according to what is observed in the picture, he cannot generalize what things are more abstract, for example having parallel sides. When asked if there were other characteristics of the rectangle, he answered there was no longer.
Researcher : In your opinion what is a rectangle, (what definition of rectangle)
Subject : Rectangle is having two lengths and two widths, having four right angles

From the results of the interview, the subject only gave the same answer with the rectangular characteristics expressed earlier. Asked repeatedly, is there anything else the same answer is always said, researchers assume that the ability of the subject is just like that. The subject difficulty in expressing, this can be caused by the lack of vocabulary the subject has, according El-Zraigat and Smadi [34] that the lack of language skills due to the lack of vocabulary of hearing impairment students results in low academic achievement, emotional social interaction, and cognitive.

Researcher : Give examples and non-examples of rectangles.
Subject : Examples rectangle is windows, glass, whiteboards, class doors, closet doors, non-example are ceramic and socket and told the electric.

When the researcher asks further, show the object you mean. He pointed to objects in his class in the form of a rectangle are windows, glass, whiteboards, class doors, closet doors, even he think of objects in the house like TV, bedroom (which he meant the door of his room), and not example of rectangle, he pointed to the ceiling of the class but he just said do not know its name, then the ceramic class while pointing to the floor, socket and told the electric. Then the

researcher asked why the object he mentioned was not a rectangle, he answered because it was in a square.

Researcher : Grouping the object by name and characteristic.
Subject : Ok I will group it according to its name.

There were some items made of cardboard flat geometry with different sizes and mixing with other geometry then ask subject to group up the rectangle. He carefully separated rectangles especially if the size difference just a little bit, he sometimes used his finger, the index finger and thumb then attach the object, but if he doubts he uses the ruler but more often use two fingers to measure an object. But if the difference size is so far away he immediately grouped.

3.2. Interview researcher to the second subject (female student)
Second subject is one of the female student who have a mild hearing-impairment was more active in the learning process than the other students.

Researcher : Can you mention the names of flat shapes in the picture, whether she still remembered the name of the geometry.
Subject : Yes I can rectangle, square, and triangle.

She could mention some of their names, such as triangle, rectangular and square, but forgot the others. Subject lifted one by one to answer the object. If she did not know the name of geometry shape, she nodded as he glared at the researcher and said that she forgot. When asked again why did not know the name of this flat geometry, he only answered forgetting and did not know.

Researcher : Mention as many characteristics as possible of the rectangle.
Subject : She says while fingering the cardboard-made object that the rectangle features have two lengths and two widths, having angles. She said the answer while feeling what she meant.

Subject is only able to answer according to what is observed in the picture, like male subject, she cannot generalize what things are more abstract, for example having parallel sides. When asked if there were other characteristics of the rectangle, she answered there was no longer. But in general the both subjects are still limited in providing answers to the characteristics of rectangles; this is consistent with the results of the study [18] states, the low ability of hearing impairment students to generalize the nature of geometry

Researcher : In your opinion what is a rectangle, (what definition of rectangle).
Subject : She said, I did not know.

According to subject, she did not know the answer, different from the male subject, he still gives answers even if the answer is the same when answering the characteristics of the rectangle. According to research result Beller and Gafni [30] and Hergovich [31] states in their research found that in general, male mathematics achievement is better than female.

Researcher : Give examples and non-examples of rectangles.
Subject : Examples, rectangle is windows, whiteboards, and door. Non example is ceramic.

When the researcher asks further, show the object you mean. She pointed to objects in her class in the form of a rectangle are windows, whiteboards, door, female subject only gave an example of what she could find in the class, cannot think of outside. Different with male subject, he think of objects in the house like TV, bedroom (which he meant the door of his room), likewise in answering the non-rectangle example she only answer the ceramic. While the first subject can give answers to more than one answer and can give reasons. As follows, not example of rectangle, he pointed to the ceiling of the class but he just said do not know its name, then the ceramic class while pointing to the floor, socket and told the electric. Then the researcher asked why the object he mentioned was not a rectangle, he answered because it was in a square.

Researcher : Grouping the object by name and characteristic
Subject : Yes, i will group it according to its name

To grouping the object by name, she carefully separated rectangles and others flat geometry especially if the differences in length size was only a little, she used a ruler that had been provided and she sometimes repeatedly measure it if she was doubtful especially if there was very small size between rectangles with square. Unlike the male subject, he sometimes used his finger, the index finger and thumb then attach the object, but if he doubts he uses the ruler but more often use two fingers to measure an object. But if the difference size is so far away he immediately grouped.

In giving answers, they provide answers with different styles. Both subjects were classified as lightweight hearing students, both were still able to make a sound and still have some residual hearing even though it was not the same as the students who were able to hear. Sometimes there were letters that were not clear what they call but can be understood if they were asked repeatedly and followed by Indonesian sign language (SIBI). Both subjects were very limited in giving answers, it could be due to the limited vocabulary that they often hear, this is according to research results demonstrated that from the subtest which includes calculations, geometries and rational numbers, students with hearing impairment were weaker compared with hearing students [28].

When compared the ability to give answers male subject showed more interactivity at the time of the interview, he was more open when asked back why answer it so, he can give a little excuse than female. Beller and Gafni [30] and Hergovich [31] states in their research found that in general, male mathematics achievement is better than female. Else-Quest, *et al* [32] concludes that men outperform women in terms of solving complex problems.

4. Conclusion

The hearing impairment students male were more creative in providing answers than female hearing impairment students. In the way of giving any answer male are easier to understand than female students. Although, there are differences between providing answers and both subjects have tried to give the best answer according to their ability.

There is an interesting finding in the researchers' findings that students with hearing impairment in measuring small, reachable objects are more interested in using the index finger and thumb, even though the ruler has been provided. It is a unique thing according to researchers because previously never been seen in hearing students; they are more likely to use the ruler. Therefore, male subject showed more interactivity at the time of the interview, he was more open when asked back why answer it so, he can give a little excuse than female, it can be concluded that the understanding of male subjects is better than female subjects but the finding in this study cannot be generalized to the whole population (since based on relatively small sample size of only two students), but it could provide a guideline in planning for remediation

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