Mathematics Learning Difficulties of Slow Learners on A Circle

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Abstract. Slow learners are children who have low intelligence in which these children need more time to study than normal children. The aim of this research was to analyze some mathematics learning difficulties of the slow learner on a circle and the strategies to overcome the difficulties. This exploratory study research used qualitative approach. The subjects were two of the 8th grade’s slow learner students in Islam Diponegoro Junior High School Surakarta. Data collection was done using documentation, testing, and interview method. Based on the data analysis, the results showed that the subjects dominantly had mathematics difficulties on a circle that were categorized in ideognostic dyscalculia, in which they had difficulties in understanding mathematical ideas and relationships towards the circle especially in the new situations (variety of problems), because of difficulty in recalling mathematical ideas after learning it; and operational dyscalculia, in which they got difficulties in performing arithmetic operations and mathematical principle, because they did not comprehend the algebraic concepts. The strategies to overcome these difficulties were encourage the students have clear conception by using teaching aids such as paper-circular or cylindrical cans so that the students could find out the value of phi, circumference, area, radius, diameter of the circle.

1. Introduction
Education has the important role in giving knowledge of the world around us. Education for all is education for all people even for a student with special needs have a right to an appropriate education.

Mathematics is all around us in our daily life. Mathematics is a basis for understanding the world, especially for technological progress [1]. It is needed in everyday life. Mathematics is the science involving logic and quantitative calculation, and its development has increased the degree of abstraction and idealities subject [2]. It is the science of human thought patterns that form the logical thinking, analysis, creative, systematic, critical, and active.

Slow learners are children who have low intelligence in which these children need more time to study than normal children. They have intelligence quotients about 76-89, and their slowness make them always slow on uptake [3]. They are being characterized as functioning at ability significantly below grade level and consistently scoring low on achievement level. Teaching mathematics to students who are slow learners is one of the greatest challenges for mathematics teacher.

Slow learners probably have many combination of disabilities such as attention deficit disorders, dyslexia, dysgraphia, dyscalculia, dyspraxia or dysnomia or hyperactivity and more [4]. One of the disabilities associated with mathematics is dyscalculia. Dyscalculia is difficulty in comprehending arithmetic such as difficulty in understanding numbers, learning how to manipulate numbers, and learning mathematics facts that includes all types of mathematics problems ranging from inability to
understand the meaning of numbers to inability to apply mathematics principles to solve problems [5]. Students may be able to remember the facts but unable to carry out the procedures. Generally, students with dyscalculia will be unable to grasp number concepts, will have problems learning number facts, will have trouble performing simple calculations, and will be unable to apply their mathematical knowledge to solve problems. There are many types of dyscalculia. The types of dyscalculia based on Kosc are verbal dyscalculia, praetognostic dyscalculia, lexical dyscalculia, graphical dyscalculia, ideognostic dyscalculia, and operational dyscalculia.

Some students have mathematics learning difficulties, even for the slow learners. Most of the mathematic problems are very hard to understand for slow learners [6]. Slow learners have lack in understanding abstract concepts and they usually use their poor memory resources (rote) than on logic [7]. Mathematics learning difficulty can affect basic number concepts and hinders the understanding and application of number facts and procedures for the students [8]. Difficulties with working memory, long-term memory, and processing speed can be encountered by students with mathematics learning difficulties [9].

Slow learners with mathematical difficulties should be seated near the focus of instruction and should actively engage in lessons. These children are likely to become more confused and insecure as time goes on if they are not given the meaningful mathematics lesson [10]. These students tend to be resistant to good instruction and may be unable to retain and apply what they have learned [11]. Mathematics learning difficulties involve deficit in mastering one or many of the domains of mathematics, from basic number skills to advanced areas of algebra and geometry [12]. Difficulty with geometry reminds us of the importance of teaching geometry concepts and skills to mitigate the effects of mathematics learning difficulties in later grades [13]. If the concepts are not clear for the students, so this directly impact to the students understanding to study the next chapter.

There are so many studies about mathematics learning difficulties (dyscalculia) have done in mathematics, but most researches were conducted for seeing mathematics learning difficulties of normal students. This research is aimed to analyze mathematics learning difficulties of the slow learner on a circle based on Kosc’s Types of Dyscalculia and analyze the strategies to overcome the difficulties. Based on the slow learner mathematics difficulties and the causes, it will be found out strategies to overcome the difficulties.

2. Methodology

This exploratory study research used qualitative approach. The subjects of this research were two of the 8th grade’s slow learner students in Islam Diponegoro Junior High School Surakarta that selected by purposive sampling, in which selected from three slow learner students from that schools. Two of three slow learner students had received a lesson about circle.

This research used four procedures of data analysis. Firstly, data collection was done using documentation, testing, and interview method. The documentation was the result of the subject’s IQ that obtained from the assessment of a psychologists. The testing used the problem of a circle that was used for knowing the difficulties of the subjects based on the types of dyscalculia belongs to Kosc. The interview was task-based semistructured interview that was conducted after the subjects conducted a test. Secondly and thirdly, analyze the data by presenting and reducing data. Lastly, made conclusions. In this research used triangulation of data sources and methods to check the validity of the data.

3. Results and Discussions

Slow learner are children labeled as borderline mentally retarded, and they are slower to grasp whatever is being taught if it involves abstract or conceptual symbols in the subject matter that should be within easy reach of most children their age [14]. Dyscalculia is a learning difficulties that involved mathematics that are diagnosed with the disorder can either have problems of understanding the meaning of numbers, their qualities difficulty using mathematical symbols and concepts, and inability to apply mathematical principles to solve problems [15]. Slow learners may experience dyscalculia.
Kosc 1974 [15] was the researcher who identified six types of dyscalculia within the general area of mathematical disability. The types of dyscalculia may occur individually or together. These types are 1) verbal dyscalculia, which refers to problems in naming the amount of things; 2) practognostic dyscalculia, which refers to problems in manipulating things mathematically; 3) lexical dyscalculia, which refers to problems in reading mathematical symbols, including operation signs; 4) graphical dyscalculia, which refers to problem in writing mathematical symbols and numerals; 5) ideognostic dyscalculia, which refers to problem in understanding mathematical concepts and relationships; 6) operational dyscalculia, which refers to problems in performing arithmetic operations. The researcher made indicators of some types of dyscalculia that presented in Table 1.

Table 1. Indicators of Each Type of Dyscalculia.

| Types of Dyscalculia        | Indicators                                      |
|-----------------------------|------------------------------------------------|
| Ideognostic Dyscalculia    | • Inability in identifying problem             |
|                             | • Do not understand the concepts               |
|                             | • Inability in using the given information     |
| Operational Dyscalculia    | • Inability in doing process/procedure of     |
|                             |       mathematical calculation                  |
|                             | • Inability in doing algebraic operation      |
|                             | • Inability in applying mathematics principle |

The circle subject was used in this research that consisted of two items of the circle’s problem. The type of the first item was the word problem that just applied the mathematics principle of the circle. The type of the second item was the modified problem of the circle.

Task-based interviews were conducted on slow-learner students of Islam Diponegoro Junior High School Surakarta. The subjects of this research were AH and RR that categorized as slow learners. Based on their IQ assessment, they had low numerical ability, poor memory, low visual-motoric ability, and low concentrations.

3.1. Mathematics Difficulties (Dyscalculia) of The Slow Learner Students

The discussion to analyze mathematics learning difficulties was based on the types of dyscalculia belong to Kosc. Based on the given test for the subjects, it was found that the subjects encountered difficulties presented in Table 2 and Table 3.

Table 2. First Item.

| Problem                                      | A mom is going to make a round glass tray that has a diameter of 14 centimeters made of patchwork. determine the glass tray’s area! |
|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Student’s answer                             | ![Image of student's answer]                                                                                                 |
| Student’s answer                             | Figure 1. AH’s answer.                                                                                                        |

After given the test, the slow learners are interviewed. The citation of the transcript of the interview as follows (R as researcher):

\[
R : \text{is it the correct formula of a circle’s area? Why did you write this formula?} \\
AH : \text{i thought this is the formula. I dont know exactly. I studied last night, so i tried to remember.}
\]
R: let’s check your calculation. You wrote $r^2$, why did you substitute $r$ with 14?
AH: i just wrote it down.
R: do you know the relation between radius and diameter?
AH: the diameter is twice the radius.
R: why did you write number 2 off? So you wrote it off with 2?
AH: yes ma’am, it is divided by 2
R: the result of your calculation is wrong.
R: is it the correct formula of a circle’s area? Why did you write this formula?
RR: this is the formula.
R: what is the $\pi$? do you know $\pi$?
RR: 14? I do not know ma’am
R: how did you get 36 by multiplying 14 with 14?
RR: i just counted it, and then i got 36.

The first item is a problem that just need serving concepts in the form of mathematical representation, using and choosing a certain procedure/operation. The subject AH and RR encountered difficulty in remembering the circle’s area. The subject AH knew the relation between the radius and the diameter but he could not apply in solving the problem. The subject AH only substituted the known number into the formula that the subject’s wrote. The subject AH experienced difficulty in using multiplication and division concepts. The subject AH did error calculation. The subject RR do not know the value of $\pi$. The subject RR only substituted the multiplication of 14x14 and did error calculation.

| Problem | The circumference of a circle is 88 centimeters. What is the circle’s radius? |
|---------|--------------------------------------------------------------------------------|
| Student’s answer | $C = \pi r$ |
| Figure 3. AH’s answer. | 
| Figure 4. RR’s answer. | 

The citation of the transcript of the interview as follows (R as reasearcher):
R: do you know the command of this problem? What you have in this problem?
AH: it is known the circumference of circle is 88 and the command is to determine the radius
R: you wrote the correct formula. Why did you multiply 88 with 88?
AH: then, what should i do? Where did i put the circumference? I couldnt solve this.
R: is it the correct formula?
RR: i am not sure
R: it should be the area’s formula of circle.
RR: i confused and i did not know. I am surrender.

The subject AH wrote the correct formula, but he did not substitute the known information properly. The subject AH substituted the value of circumference into “$\pi$” and “$d$”. The subject AH do not know how to use the circumference for looking for the radius. Inability of the slow learner to understand mathematics is shown by their weakness in manipulating algorithmic computation [16]. The subject RR wrote incorrect formula. The formula of circle’s area and circumference that the subject wrote was switched. The subject RR used his memory but do not comprehend the concepts, the facts, and the principle of the circle. Slow learners often make mistakes due to not having any
multiplication skill and not remembering the formula of area [17]. Again, the subject AH and AR did error calculations.

The subjects had operational dyscalculia, in which difficulties in performing arithmetic and mathematical calculations. The subject AH and AR could not do the calculation properly and could not do algebraic operation. As the red mark, sometimes the subject wrote the circumference’s and the area’s formula of the circle properly, but the subject did error substituting number. Although the formulas or the number were substituted incorrect, from the multiplication they wrote, the subject often did wrong calculations. Based on the interview of the subjects, they do not comprehend the formulas they wrote and encountered confusion in substituting radius and diameter, because they do not comprehend algebraic concepts. Slow learners are children with below cognitive capacity, poor memory [3], capability of having distraction, lack of concentration and inability to express ideas [18], lack of abstract thinking [14], have a short attention span [6], and lack of concentration [19].

The subjects had ideognostic dyscalculia, in which difficulties in understanding mathematical and arithmetic concepts and relationships. The subject AH and AR could not identify the problem of the circle and were not being able to use the given information. They had difficulty remembering basic mathematical facts and principles toward the circle, even after many hours of practice or rote learning, because they had poor memory [3]. Due to their poor concentration skills, the slow learners had difficulties in transferring and connecting the given information to solve the problems [20]. These children demonstrated weak thinking; finding out relationships, familiarity, similarity, reasoning; poor development of concept, language, and number concepts memory [21].

They had no idea how to solve the problem in the new situations even though it only required the same ways/formulas, such as the word problem like first item and modified problem with known the circumference then determine the radius like the second item. They just could perform a simple task/problem but difficulty imitating process rapidly and precisely when they were given examples.

3.2. Strategies for Mathematics Difficulties

There are a few treatments to overcome mathematics learning difficulties for the slow learners. For these difficulties, the strategies were to encourage the subjects have a clear conception about algebraic operations and give the drill method about the principles, facts, and formula of the circle which have to be memorized. Drilling and practice are one of the most effective techniques, widely used devices and practices in the teaching-learning situations of mathematics [15]. The subjects have to be given a remedial teaching or a lesson repetition of the circle. They have to be given practices in multiplying numbers. The stakeholders should create fun atmosphere learning and give a real example for the slow learners [22]. The teachers should ask the students to make the teaching aids of the circle’s subject, such as making a circle by using paper that will be searched the circumference, area, radius, diameter of the circles. The students could bring cylindrical cans and then they could find out the value of phi by measuring the circumference and the diameter. These students tend to have a lack of confidence and frustrated easily [20]. The stakeholders should encourage the student’s confidence to make correct calculations have enough capabilities to solve arithmetical problems.

4. Conclusions

The subjects had mathematics difficulties on a circle that were categorized in ideognostic dyscalculia, in which they had difficulties in understanding mathematical ideas and relationships towards the circle especially in the new situations (variety of problems), because of difficulty in recalling mathematical ideas after learning it; and operational dyscalculia, in which they got the problems in performing arithmetic operations and mathematical principle, because they do not comprehend about the algebraic concepts. The strategies overcoming these difficulties were to encourage the students to have clear conception about algebraic operations, principles, facts, and concepts of the circle by using teaching aids such as paper-circular or cylindrical cans so that the students could find out the value of phi, circumference, area, radius, diameter of the circles. Teachers or researchers should make learning innovations by using teaching aids that can improve the understanding of the circle’s concept for the
students. By knowing the student’s difficulties on a circle, the mathematics teacher and the shadow teacher can make some collaborations to give remedial teaching for the slow learner students at the outside of the learning hours. The teacher can make some teaching aids to make these slow learner students understand.

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