The Process of Representation of Junior High School Students' in Solving Integers Word Problems

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DOI: 10.29322/IJSRP.10.01.2020.p9733
http://dx.doi.org/10.29322/IJSRP.10.01.2020.p9733

Abstract- Research has an intention to describe the process of a student's representation who has a high, medium, and low ability in solving integer word problems. The method used is qualitative. From 35 participants, three subjects are selected with each of them has either high ability, medium ability, and low ability. The data is retrieved by using ' think aloud ' method. After that, the data will be analyzed after the interview with the three selected students. The process of representation problem consists of problem translation and problem integration. After going through the problem of representation, the problem-solution will take the role of external representation of the students. The research result shows that the low-ability student described in a pictorial way with the incorrect answer. Medium-ability students used schematic in problem-solving with the incorrect answer. And the high-ability student used both pictorial and schematic in problem-solving with the correct answer. The students' answers are affected by the process of representation so it's possible to get either the correct answer and incorrect answer.

Index Terms- representation, integers, process

I. INTRODUCTION

Many students are afraid of math. Paradigm will be difficult to learn mathematics and will shadow creepy math teacher who is always in the minds of students. Thus making the students rigid in following math. Prediction will have difficulty in understanding mathematics students is the focus of teachers in mathematics [1]. Many students who take lessons and solving mathematical problems in a way that has been presented by the teacher without the use of a representation according to their own thoughts. Teachers should assign learning strategies for the success of learning [2]. Set of learning objectives NCTM [3] students to understand mathematical concepts and make the problem becomes easy to solve using the representation [4,5].

The representation consists of internal and external [6,7,8]. The internal representation is an image of the student's image stored in the mind [7,9]. As with the external representation of something written that students in the form of pictures, words or symbols [5,7,10].

Previous knowledge is required to build an internal representation of the students [7,10] and the information he had received [10]. The internal representation is unique because of the formation are not viewable by anyone else directly [7]. The representation shown is not the same students [11] and the students can show multiple representations [8,11,12].

In resolving the issue is the process through which the students. The first problem of representation and the second problem solution [13]. Translation problems consist of two phases: translation and integration [13]. Translational stages depend on the linguistic abilities of students, to understand the problem. [13] Stages of integration depends on the interpretation of the students in the form of visual representation. [1,13]. A visual representation of an advanced student is very important because it can determine the next step in solving the problem of students [1]. In problem solution, students can use some representation [8,11,12] as a visual representation [1,14,15,16,17] who have used students in the integration phase [13], verbal representations (written words) symbolic representation (mathematics expression) [8,11,12].

Researchers are particularly interested in the process of student representation. Because rarely examined regarding student representation. Starting from the representation of problems and problem-solving. Researchers chose the problem of word problems in the material integers. The integer is the basis used to further understand the material such as algebra, arithmetic, etc. [18]. So if essentially not strong then to proceed further material will also be difficult [18,19]. Students have difficulty in operating problems [14,15,16,19], word problems [13,19] and producing a model of integers with [14,15,16,18,19].

This study reveals the process of representation of students in problem-solving word integers. How students representation process of translation problems and the problems of integration. what are the representations used by students in problem-solving? This study is aimed at students who have math skills category is, low and high. So that raises the question of research, (1) how the representation of students with problems of mathematical ability is low, medium, and high? (2) what kind of representation that students use mathematics capable of the low, medium, and high in problem-solving?

II. Theoretical Background

This study was motivated by previous research and current authors will further investigate the process of representation for word problems on integers.

a. Representation of internal and external

The author describes the representation shown by the students to understand the problem and resolve the issue so that it shows the students' answers. Comprising representation internal representation and external representation [4,6,7,8] appearing in parallel without any replacement between the two. Internal representation expresses the ideas in the minds of students [4.7], a part of mental activity [12], the image you have in mind. It's hard to express the internal representation of students because other people can not catch someone with direct internal representation.

External representation includes a visual representation that is used to solve the problem [1,14,15,16,17] can be either (1) images (2) table or graph [1,7], (3) verbally expressed in writing using the phrase student or orally [4,7,12]. Houses are represented by everyone in different ways. Internal representation works with the knowledge of the house through the shadow of the real house. Some people imagine the house is not like a house building, but imagine the room in the house. Internal representation may also appear as an imagined harmonious relationship with residents who are in the house. External representation may appear with the words 'home', or to describe the representation of the object of building a home, or can also describing the building complete with the garden. Or also can draw a plan of the room. It may be different for each individual. The internal representation can only be understood by the subjects who experience the event itself unless he tells the internal representation to others. However, the external representation can be felt or seen the senses themselves or others.

The internal representation can only be accessed by the five senses themselves and can be understood by others using external representation [4]. Others can understand the internal representation of a person if it is delivered orally internal representation that he had. Teachers transfer knowledge using external representation on the board, powerpoint slide, or other means. Students capture this information can then perform an internal representation, then students using external representation to write in their book. It was revealed that the internal representation can not be separated from the external representation. And the interaction between them in understanding a problem [4,20].

b. The process of representation

Troubleshooting conducted to find the correct answer [21]. The problem is understood to find what the problems were solved with the knowledge [1]. Math speaking, the operation can be done if it had been through

the mental process with the aim of solving the problem [1]. To resolve the issue is the process through which (1) the problem of representation (2) problem solution [13,22]. Problem representation describes how students understand the problem correctly to make a solution plan. When understanding the problem, visualizing a reliable strategy to solve the problem correctly [22]. Problem representation is divided into two stages: (1) the problem of translation, determine how to understand the problem by paraphrasing the problem using own words that are easy to understand, (2)problem integration, making visuals to make it easier to understand the problem correctly and make plans.

The picture presented by the students is categorized into two types (1) pictorial, produces images without regard to the relationship between the components of the problem (2) schematics, producing images with attention to relations with the components of the problem [22]. Students who only see the quantity of a problem without considering the relationship that plays a role in solving the problem will produce pictorial images and more not generate schematic

III. . METHODE

a. Research design

This study uses qualitative research types. The aim is to describe how the representation process occurs in middle school students. A process referred to by the author are (1) the problem of representation (2) problem solution. Seeing the resulting images include pictures of students whether pictorial or schematic.

b. *Participant*

This study involved junior high school students in Surabaya who volunteered to play a role. 35 junior high school students participated in this study. Of the 35 students, the authors take each of the students with the ability level of high, medium, and low was made as a research subject. So there are three subjects in this study.

In determining the student's ability level is high, medium or low, the author first gives a mathematical ability test (TKM) to be able to classify in this category. Tests solving (TPM) are given after the students classified.

Students completing the TPM and solve problems according to their respective strategies. Researchers took the data using the think aloud. By using think-aloud researchers can tell what he was thinking by students. So that researchers know the internal representation of the external representation of the students then students write on paper. To obtain more information, researchers conducted interviews.

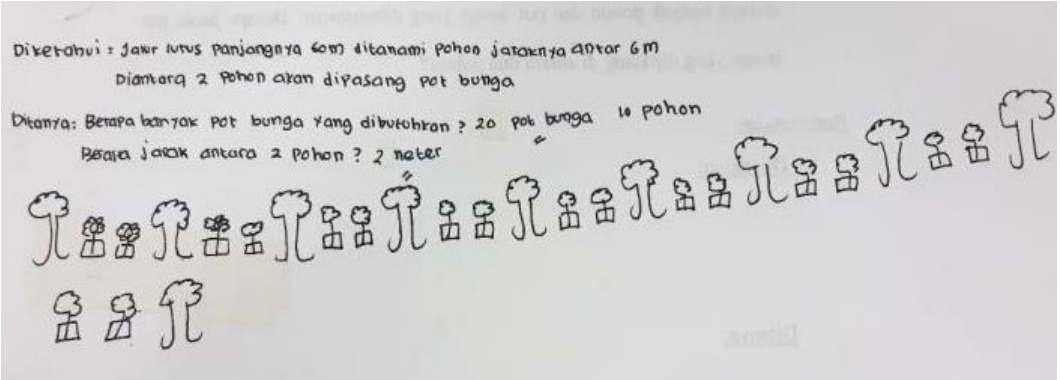
Once the data is obtained, the researchers analyzed the data with three-phase (1) condensing the data, select the data that is needed to be the focus and classify types of data obtained (2) data, (3) drawing conclusions, making inferences from the data analyzed [23]

IV. RESULT

35 students who participate to do TKM, researchers took three subjects to see the process of representation. The process of representation is described by the authors, as follows.

1.1. Subject SD with pictorial

Subject SD solving the problem by using pictorial and get the answer wrong. SD Subject belonging to the mathematical ability of students is low.



Picture 1

SD Subject depicting trees and flower pots overall. At the stage of problem translation, the subject reads the problem by looking at quantity and find the relationship that the 60-meter street trees will be installed with the same distance. Researchers concluded the subject focused on the 60 m long road and would be planted with trees and flower pots, but did not understands what to do for the next step.

P : after reading the questions, what do you think?
SD : road 60 m
P : is that all?
SD : there are trees and flower pots on the road
P : did you think of something else?
SD : no

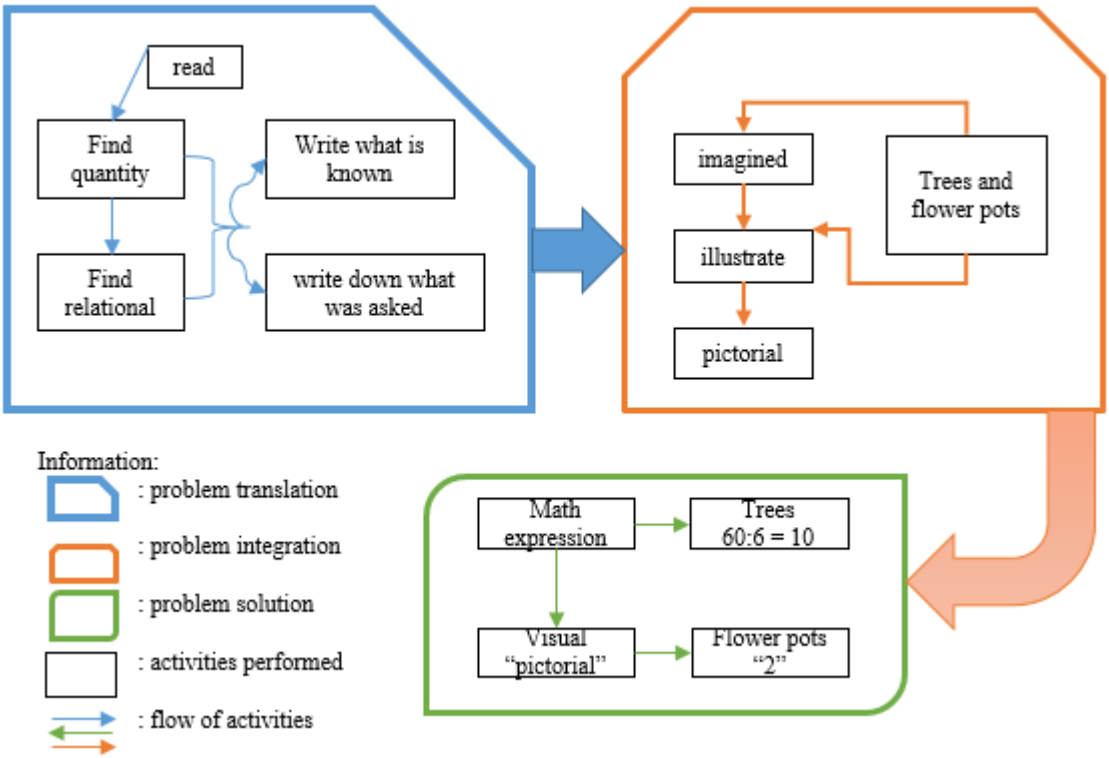
SD wrote down what he understood the problem and rewrite the paper about what is known on the matter. After understanding the matter, SD writes down the questions asked by the use of words.

P : what did you do after reading the question
SD : write down what is known and asked

To solve the problem, SD directly visualizes the tree that will be installed along the road and describe the trees into paper. SD drew 10trees and some of them contained flower pots. As follows the conversation.

P : do you imagine anything?
SD : yes
P : what have you imagined?
SD : trees
P : is there anything else that you imagine?
SD : flower pots
P : is there anything else?
SD : No
P : do you describe what you imagine?
SD : yes, like this

With the quantity of 60 meters and the distance between the trees of 6 meters, SD directly divides 60 by 6 to get the answer 10 trees. Then SD illustrates pictorially without recalculating whether the answers he did by drawing pictorial computationally are appropriate. To answer the distance between flowerpots installed between two trees, SD answered correctly that is 2 meters. Two pots of flowers drawn SD represents the distance that should be between two trees is 6 meters.



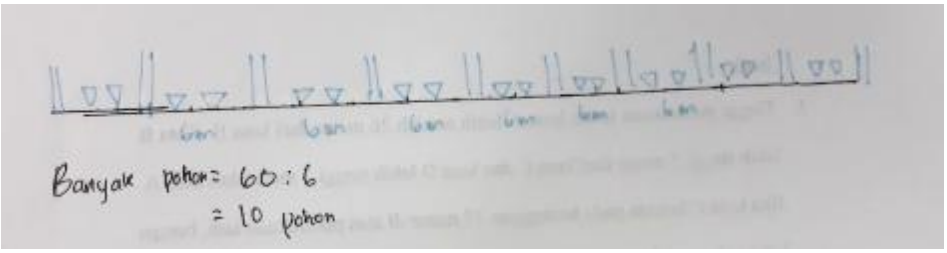
Picture 2
SD representation process scheme

4.4. Subject AZ with schematic

Subjects AZ using schematic in problem-solving and obtained a wrong answer. Subjects AZ are medium-capable students of mathematics.

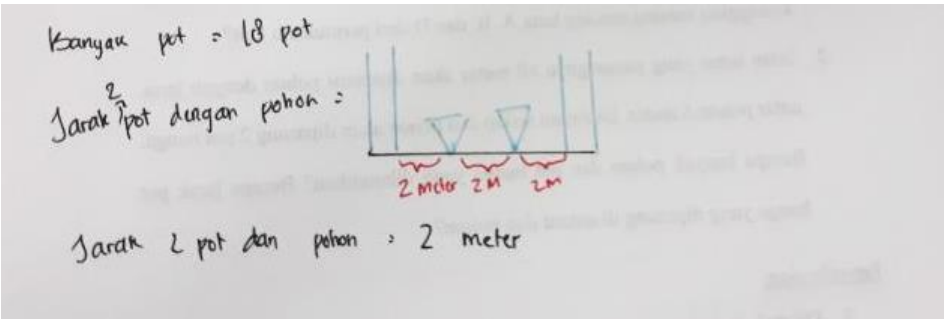
Picture 3

AZ read about and get that along the road 60 meters will be installed at a distance of a 6-meter tree, so he draws two trees with lines to represent what is known in the matter of the statement to be installed by trees. Then AZ draws a triangle to represent two flower pots between two trees. From these images, AZ identifies the quantity and relationship if the distance between two trees is 6 meters long and 60 meters of the road there, then AZ will describe the second image 10 times. AZ imagined a tree as big as 10 and discussed flower pots, therefore AZ imagined something like this.



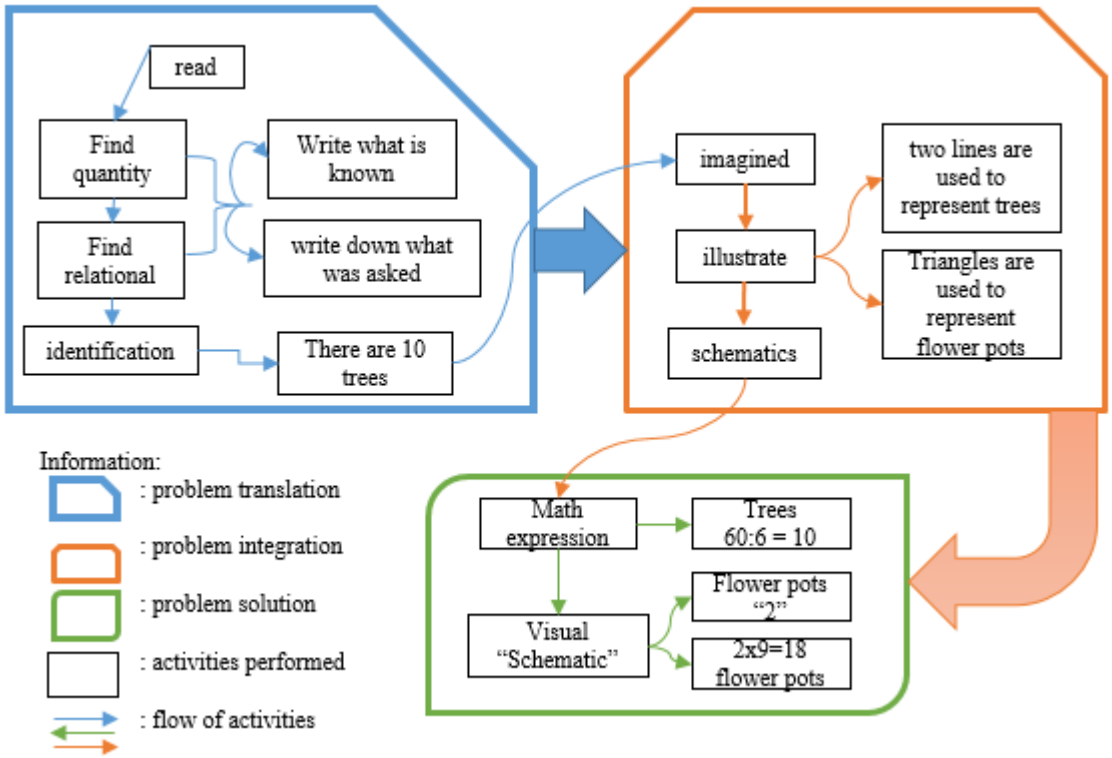
Picture 4

It is a pity it turns out that do AZ after knowing that there is 10 times the figure 2, AZ computing 60: 6 to obtain answers to 10. AZ did not realize that that figure 2 only he repeated 9 times. AZ did not double-check what he imagined about the image 2 will be 10 by the external representation of the image which he described only 9 times, and computing which he did.



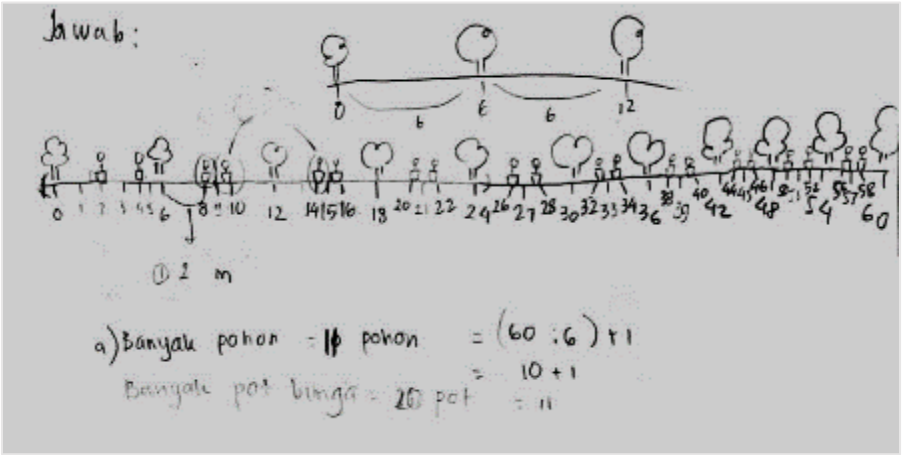
Picture 5

After AZ found that there were 10 trees, AZ calculates the distance between the trees as much as 9 and multiplying it by 2 to get the flower pots installed is 18. To determine the distance between the flowerpot, AZ calculates the distance between the flower pot by describing two trees as representative and describe triangle as a representative of the flowerpot, shines the pictorial perform calculations using to get the distance between the flower pot is 2 meters. He counted if the distance between the two pots of flowers are 2 meters he gets the correct answer to the other components, namely the relationship between tree 6 meters distance. The following is an illustration of the AZ representation process.



4.5. Subject SS with schematic

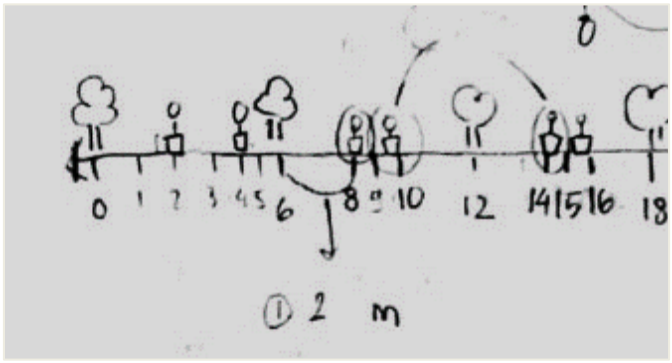
The Subject SS does the problem solving by describing the schematic problem obtained from the problem. SS getting the correct answer from the image that he created.



Picture 6

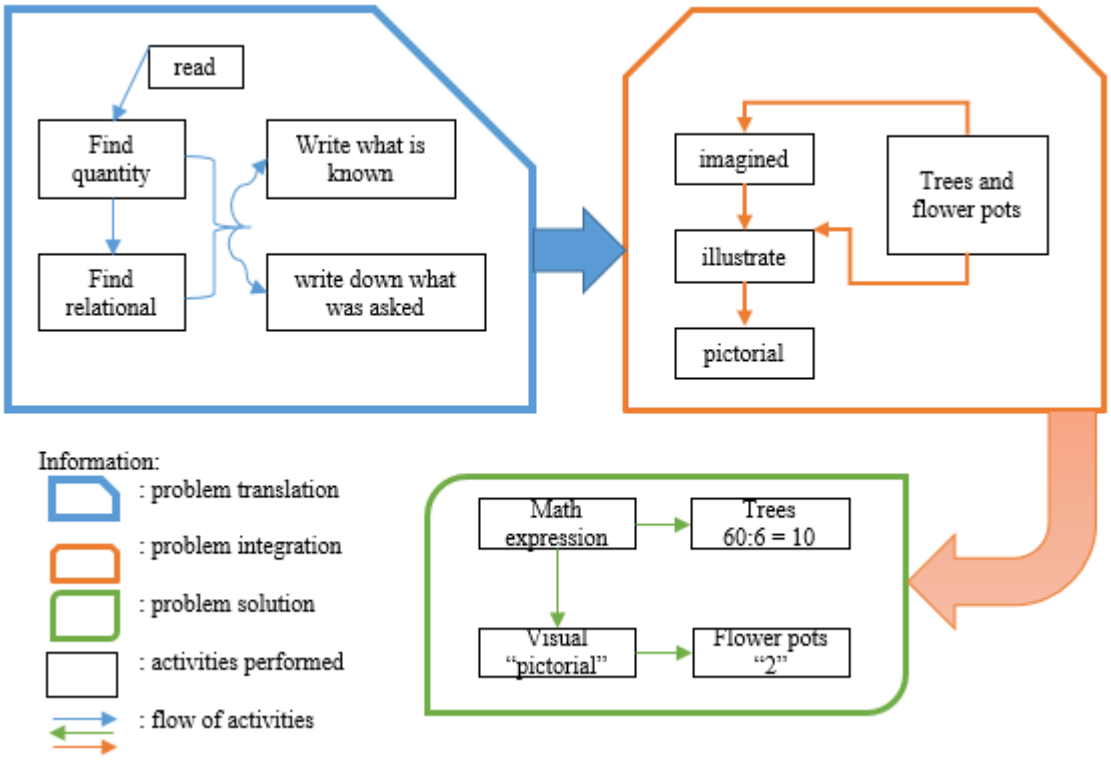
Subject SS read the problems with identifying the quantity and relationships between the components contained in the problem. The subject then SS wrote what he understood of the matter by writing with his own words he's easier to understand what is known. Then the SS subject writes what he understands from the problem by writing it in his own words which is easier for him to understand in the known. SS saw that the relationship between the 60-meters-long road would be installed by trees with a distance of 6 meters. For a distance of 6 meters drawn him get as many trees as 2, for a distance of 6 meters that he was drawing, he got three trees. So he gets every distance relationship that he had he would divide it by 2 and then he added with a 1. Therefore, he wrote that to get a lot of trees are mounted on 60-meter road he will get the calculation.

Afterwards he described the whole tree in all the way and get the correct answer as many as 11 trees.$60:6+1=11$



Picture 7

After getting 11 trees, SS calculates many flowerpots by drawing them in one of the pictures between two trees. He found that the distance between the flowerpots was is 2 meters by 6:3=2. Because he imagined flower pots will be installed at the same distance so that there were 3 breaks in the flower pots. After that he was drawing the appropriate flower pot flower pots hold a shadow she will be fitted with the same distance. And with the calculation that he can beforehand tree. He imagined there were 10 break in between two trees. So as to obtain the number of flower pots she computing. And preachers got the answer there 20 flowerpots installed along the road.$6:3=22\times10=20$. And he got the answer there were 20 flower pots installed along the road. The following is the flow of the SS representation process.



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V. CONCLUSION

From the representation process that students go through, students get external representation by the internal representation he imagined. The resulting representation depends on the problem representation that it goes through. Students will get the answers correctly if students not only see a problem form the quantity alone but from the relationship of the components contained in the problem. These relationships are correctly identified to produce the right schematic external representation and produce the right computation in getting answers.

The resulting representation of students can be pictorial, schematic or a combination of pictorial and schematic. Students check the answers of the results of the representation he has then compute the results of his representation.

Low-ability students produce a rich pictorial and still not be able to use the schematic in problem-solving. The resulting answer is still not quite right. Students are capable of being able to produce schematic but still there is a misunderstanding between the representation that he produces in the shadows and external representation, and computing in solving the problem. So there are still errors in getting the answers. High-ability students can combine a pictorial and schematic to get the correct answer. High-ability students using the internal representation and link the components and identify, prioritize what should he use to get the results of the correct answer.

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