Visualization Of Students In Constructing The Concept Of Fractions

Henry Kurniawan

Abstract: The fundamental aspect of fractional learning is to instill a profound fractional concept so that it can apply it to real situations and experience the fractional benefits in everyday life. Understanding the concept of fractions is the result of construction of the fractional objects. The construction of this fractional concept is done through visualization that manipulates the making of drawings, diagrams or animations for the appearance of fractional information. This research is a qualitative study that describes the construction of fractional concepts as equal parts of the whole and the construction of a fractional concept of value. Subjects in this study as many as 9 selected students from 22 students are grouped into 3 groups, namely (1) failed construction groups and true visualization; (2) failed construction group and failed visualization; and (3) true construction group and true visualization. The results of this study are group (1) the visualization has followed the appropriate pattern but is less precise in the calculation, the group (2) does not understand the concept of fraction so that it fails to visualize, and group (3) can already visualize the concept of fractions with different visualization form from the pattern.

Index Terms: Visualization, construction, fraction concept

1 INTRODUCTION

Fractions are abstract numbers that are abstract, because this abstract object is one of the reasons for the difficulty of fractions to be studied. The fundamental aspect of fractional learning is to instill a profound fractional concept so that it can apply it to real situations and experience the fractional benefits in everyday life. Students think more easily about fractions by using images or symbols. This student's mind tends to naturally visualize the fact [1] of that fraction. Visualization is the ability, process, and product of creation, interpretation, use and reflection of images, drawings, diagrams, in the minds of students, on paper or by means of technology, with the aim of describing and communicating information, thinking and developing unknown ideas advance and advance understanding [2]. According to [3] visualization is a means of understanding toward the end, not as a final destination. An example of the observations made on students in class 4 in illustrating the 2/8 fractions to an image taken from the fractional building activity.

Figure 1. Student illustration of 2/8 fractions into picture.

The results from Fig 1 in this activity indicate that students hold different concepts from the same fraction although the simplicity of the corresponding symbolic form and the image they form themselves are not the same as the knowledge received. The student builds visual images based on the visual memory that he remembers against the fragments by forming a new image that he has never actually seen.

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The three student responses in figure 1 above illustrate how the conceptual understanding of fractions which is the result of construction of the fractional objects. The construction of this fractional concept is done through visualization that manipulates the making of drawings, diagrams or animations for the appearance of fractional information. The modeling that students perform plays an important role in understanding and visualizing the problems at hand [4]. From the results of the investigation in school and the illustration of this figure 1 researchers tried to trace the visualization of the students on the construction of fractional concepts using different problems from Figure 1 and the initial investigation.

2 METHODS

This research reveals how the construction of fractional concepts by students in problem solving through visualization. So as to get picture of result of visualization done by student during fraction concept construction. According to [5], this kind of research belongs to qualitative research. Subjects in this study as many as 9 selected students from 22 students in SD N Blimbing 3 Malang, SD N Kauman 1 Malang and SD Al-kau'tsar Bandar Lampung with the consideration of students meet the criteria that have been set into three groups that do visualization in construction fractional concepts in problem solving. The given problem consists of a matter of a square ABCD consisting of 4 small squares with one in a red shade (said square unit), 2 medium squares (one shaded in blue) and 2 square squares. From the square ABCD is asked students to write a red fraction then presents the red shard was to the image of the equilateral triangle that is already available. Then students are also asked to write a blue fraction and redeploy it to the equilibrium triangle available. Finally, the students are asked to write down the combined shapes of the unit square (which are red) and the blue square of the ABCD square. Then the student is asked to re-present it to an equilateral triangle. The given problem is done with think alout. Then the students are interviewed according to the flow of the students. The nine students were grouped into three groups, namely: (1) failed construction group and true visualization; (2) failed construction group and failed visualization; and (3) true construction group and true visualization.

3 RESULTS AND DISCUSSION

Referring to the construction of fractional concepts through visualization [2] conducted by the nine students, the construction of fractional concepts through visualization were grouped into three groups, namely: (1) failed construction group and true visualization consisting of 2 students (S1); (2) failed construction group and visualization failed consisted of 4 students (S2); and (3) true construction group and true visualization consisted of 3 students (S3). Here is the exposure of each group.

3.1 Failed Construction and true visualization

The process of visualization S1 (the first subject) in constructing the concept of fractions that starts from understanding the problem from the picture to the symbol continued from the symbol to the new image to finish can be seen in Figure 2

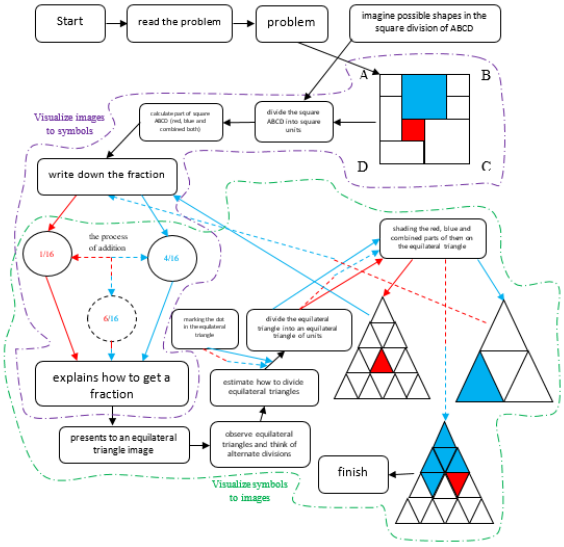

Figure 2. *The process of visualization S1 in fractional construction*

Figure 2 shows the process of visualizing S1 in constructing fractional concepts that begin with visualizing images to symbols. The activity begins with reading the problem that there is a problem, the problem is envisaged possible forms in the square division ABCD (problem). After imagining the form of division, the square ABCD is divided into square units and the results of the division were counted. Then write the fractions (1/16, 4/16 or 1/4, and 6/16) and an explanation of how to get the fraction. After visualizing the image to a symbol, S1 continues with the visualization of the symbol to the image. This follow-up activity is done after the fractional explanation where S1 observes the equilateral triangle and thinks about its alternative division and estimates how to divide equilateral triangles. Once convinced by the division form, then divide into equilateral triangles of units in the image of equilateral triangles and shading on the triangle. The first shot is done on the fraction 1/16 (one part for the red color), continued to the 4/16 or 1/4 shoot (one part for the blue color) which will each divide in the beginning by giving a dot on the right, left, and bottom on the equilateral triangle. Then the 6/16 fractions (six sections for red and blue combined) are dotted on the right, left, and bottom of the triangle before division. S1 constructs the ABCD rectangle image problem to fractions (1/16, 4/16 or 1/4) continued fractions (1/16, 4/16 or 1/4) to equilateral triangle images done correctly (indicated by line arrows without dashed in figure 2) through the visualization of the symbol (1/16, 4/16 = 1/4) which can be seen in Figure 3.

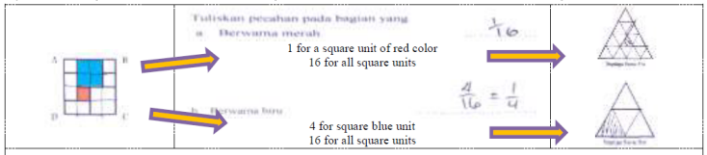

Figure 3. The process of visualization S1 on the red or blue.

Figure 3 shows the visualization of the symbol to an equilateral triangle that has been cut into the same triangular original pattern. While on fractions 6/16 S1 visualize the ABCD square image to the symbol of a mix of red and blue colors with less precision in the calculations. The composite calculation on the 6/16 fractions obtained can be seen in figure 4.

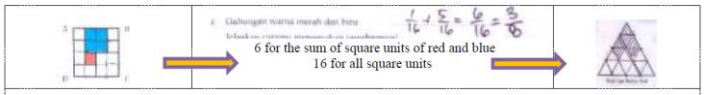

Figure 4. The process of visualization S1 on the red and blue.

The scheme that S1 has in 5/16 (1/16 + 4/16) in Figure 4 is connected to the scheme in the face of the problem [6]. So the scheme is integrated by a larger scheme (red part). The 6/16 result is obtained from the sum in red with the blue portion already in the first with the red part. So the construction of the student is wrong / failed (indicated by the dashed line line line in figure 2). Although its construction is wrong (failed) but its visualization process is correct and follow the pattern of equilateral triangle origin.

3.2 Failed construction and failed visualization

The process of visualization S2 (second subject) in constructing the concept of fractions that starts from understanding the problem from the picture to the symbol continued from the symbol to the new image to finish can be seen in Figure 5.

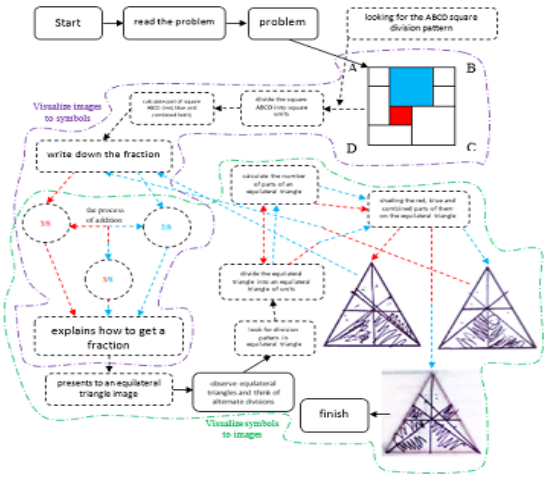

Figure 5. The process of visualizing S2 in the construction of fractional concepts

Figure 5 shows the process of visualizing S2 in constructing a fractional concept that begins with visualizing the image to a symbol. This visualization activity begins with reading the problem that there is a problem, the problem is sought pattern distribution on square ABCD (the problem). After obtaining the division pattern, the square ABCD is shared and the result of the division is counted. Then write fractions (3/8, 2/8, and 5/8) and an explanation of how to obtain the fraction. Then proceed with the visualization of the symbol to the image that was done after the explanation of the fraction. S2 observes an equilateral triangle and thinks about an alternative division and looks for its division pattern. Once convinced of the pattern, then the division is done in the equilateral triangle image into an equilateral triangle of units and calculate the number of sections in the equilateral triangle and shading on the triangle. The first shot is done on 3/8 fractions (three parts for red), continued to 2/8 (two parts for blue) and last on 5/8 (five parts for red and blue combined). On visualization in all three sections red, blue, and blue combined with blue S2 do not visualize correctly (indicated by dashed arrow lines in figure 5). So the fractional concept construction that went wrong (failed). Failure in sections 3.1 and 3.2 can be improved by further search [7] and provide limited intervention [8] by teachers to students while working on the problem. Scaffolding by teachers to students is a form of support to students to achieve learning objectives where they can not achieve without the help of others [9] and students are not frustrated [10]. S2 construct ABCD image problem to fractions (3/8, 2/8, and 5/8) continued fractions (3/8, 2/8, and 5/8) into equilateral triangle images through visualization confused. The confusion resulted in failure to construct fractional concepts through visualization. The construction of fractional concepts through this visualization can be seen in Figure 6.

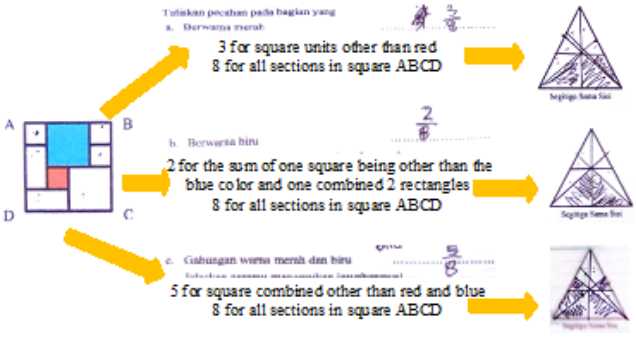

Figure 6. The process of visualizing S2 in red, blue, and blue combined with blue.

Figure 6 shows the visualization of the initial symbol of the fraction in the red section in write 1/7 (1 part of red and 7 other parts). Then change it to 3/8 (3 parts square unit other than red color and 8 for all inside square ABCD). While on the 2/8 fraction in get from 2 parts consisting of 1 part of medium square besides blue color and 1 part again from merging 2 rectangle in square ABCD. Furthermore, at the 5/8 fraction is the accumulation done by the students from the red part sum with the blue part. This S2 activity resulted in failure to construct fractional concepts through visualization. S2 should master the notion and the basic concept of the fraction so as not to get stuck on the procedural aspect without prior to performing the operation (compound) on the fraction [11].

3.3 True construction and true visualization

The process of visualizing S3 (third subject) in constructing the fractional concept that starts from understanding the problem from the picture to the symbol is continued from the symbol to the new image until finished can be seen in figure 7.

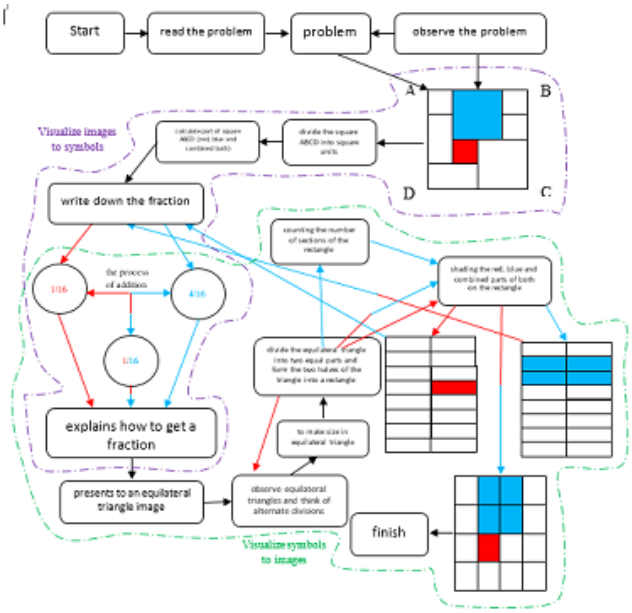

Figure 7. The process of visualization S3 in fractional concept construction

Figure 7 shows the S3 visualization process in constructing fractional concepts that begin with visualizing images to symbols. the activity begins with reading the problem that there is the problem, the problem is observed. After observing, the problem (square ABCD) is divided into square units and the result of the division is calculated. Then write fractions (1/16, 4/16, and 5/16) and an explanation of how to get the fraction. Next S3 to visualize the symbol to the image that was done after the explanation of the fraction earlier. S3 observes equilateral triangles and thinks about alternatives. Then create a size in equilateral triangle that is divided into two equal parts and the right triangle is placed on top of the left to form a rectangle. The rectangle is divided into unit rectangles and calculated the number of divisions as well as shading on the rectangular section. The first shot is done on the 1/16 fraction (one part for the red color), proceed to the 4/16 shoot (four sections for blue without counting the number of pieces). Then on fraction 5/16 (five parts for red and blue combined without counting the number of pieces). On the visuals in the three red, blue, and blue red and blue S3 portions have performed the visualization correctly (indicated by the unbroken arrows in figure 7). So the construction of fractional concepts that occurred true (successful). S3 does not have difficulty in memvisaulisasikan fractions as part of the whole because the fractions often appear in textbooks that are read and do [12]. S3 construct ABCD image problem to fractions (1/16, 4 / 16 and 5/16) continued fractions (1/16, 4/16, and 5/16) to an

equilateral triangle image through a different visualization to the initial shape of the equilateral triangle seen in Fig. 8.

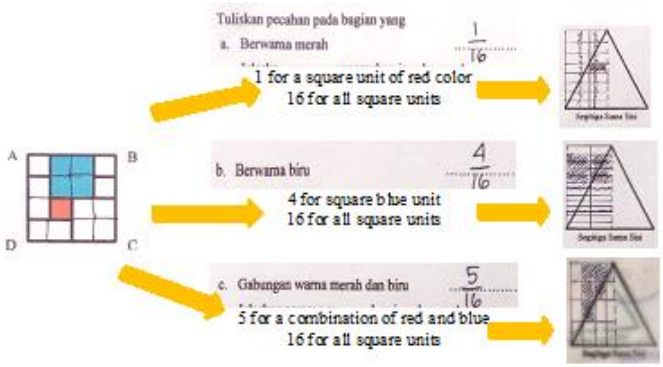

Figure 8. The process of visualization S3 in red, blue, and blue combined with blue.

Figure 8 shows the visualization of the symbol to an equilateral triangle image by cutting the equilateral triangle into two equal parts of the shape. Then the two parts are combined into a rectangle. The rectangle is cut into 16 pieces with 1 part which is shaded for the red part to 1/16, the 4 parts are shaded for the blue part to be 4/16, and the 5 parts in the shading is the accumulation of the color combinations red and blue with 5/16 fractions.

4 CONCLUSION

The construction of fractional concepts through student visualization is grouped into 3 groups, namely (1) failed construction group and true visualization; (2) the construction group fails and the visualization fails; and (3) correct construction group and true visualization. The group (1) has been following its visualization to follow the appropriate pattern but is less precise in the calculation, the group (2) does not understand the concept of fractions to fail to visualize, and group (3) can visualize the concept of fractions with different visualization forms of the pattern.

REFERENCES

[1] Fischbein E 1977 Educational Studies in Mathematics. 8 pp 153–165
[2] Arcavi A 2003 Educational Studies in Mathematics. 52 pp 215–241
[3] Zimmermann W and Cunningham S 1991 Visualization in teaching and learning mathematics MAA Notes Series 19 Washington, DC: Mathematical Association of America
[4] Johanning D I and Mamer J D 2014 Mathematics Teaching in the Middle School. 19 pp 344-351
[5] Creswel J W 2012 Educational Research : planning, conducting, and evaluating quantitative and qualitative research Fourth Edition. Boston, USA: Pearson
[6] Kurniawan H, Sutawidjaja A, As'ari A R, and Muksar M 2018 J. Phys.: Conf. Ser. 983 012173
[7] Kurniawan H, Sutawidjaja A, As'ari A R, Muksar M, and Setiawan I 2018 J. Phys.: Conf. Ser. 1008 012064
[8] Kurniawan H, Nusantara T, Subanji, Susiswo, Setiawan I, Sutawidjaja A, As'ari A R, and Muksar M 2016 Int Educ. Stud. 9 145
[9] Yu F Y, Tsai H C, and Wu H L 2013 Australasian Journal of Educational Technology. 29 pp 416-433
[10] Van de Pol J, Volman M, and Beishuizen, J 2010 Educational psychology review. 22 pp 271-296
[11] Aksu M 1997 The Journal of Educational Research. 90 pp 375-380
[12] Charalambous C Y and Pitta-Pantazi D 2007 Educational Studies in Mathematics. 64 pp 293–316