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7th Grade Students' Number Sense Based on Reflective and Impulsive Cognitive Styles

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***Abstract*— Understanding of numbers refers to number sense. Number sense is basic for learning numbers. The aims of this study are to describe 7th students' number sense who have reflective and impulsive cognitive styles fraction. The subjects were students of the 7th grade. All students' were given Matching Familiar Figure Test (MFFT) and mathematical ability test. Two students with reflective and impulsive cognitive styles and same mathematical ability were chosen based on reflective and impulsive cognitive styles and same mathematical ability and had to answer number sense test and they interviewed by the researcher based on their work. The research results showed that in general, reflective and impulsive students appear to have difficulties with all strands of number sense except those associated with the use of multi-representation and operating effects. The fact that other strands require a deeper understanding, but reflective student is better than an impulsive student who is shown with the results of this study.**

Keywords*—N*umber sense; cognitive styles; reflective and impulsive.

I. INTRODUCTION

Learning mathematics is an obligation for students, especially in mastering about the meaning of numbers. Number mastery not just knows and skillfully calculate, but must have understanding and knowledge about the numbers in solving math problems. Dehaene stated that the number is a fundamental parameter by which we make sense of the world surrounding us [1]. So students not only use the means intended to get the right answers, but they also learn about the meaning of numbers and their operations. Mathematics learning in junior high school is certainly inseparable from the numbers and counting operations, one of which is a fraction material. The fraction is material that is considered difficult to understand students. In fact, there are still found many difficulties of students in solving mathematics problems, such as fraction problems [2]. In addition, fractions are one of the most challenging cognitive lessons, that is difficult to teach [3]. This is due to the lack of students' understanding of the basic concepts of numbers and their operations. in seeing the early picture of developing number sense ability is useful to identify the students with difficulty in mathematics later on [4]. Understanding of numbers or sensitivity to numbers is number sense. Jordan et al stated that the understanding of number sense is important because it has a unique and meaningful contribution to the mathematics learning [5]. Number sense is basic for learning numbers and an ability that if it practiced and develop correctly will use for the students, especially about the number. Yang et al stated that the number sense refers to an individual's general understanding of numbers and it's operations, with the ability to develop usefully. Flexible and efficient strategies for handling numerical problems [6]. Number sense is different for each individual. Differences from number sense can be caused by experience learning mathematics, math skills, and cognitive style [7]. Cognitive style can be a number sense indicator [8]. Cognitive styles relating to the use of student time to answer questions and the number of errors made by students and show the tempo or speed in thinking that is cognitive styles reflective and impulsive. Abubakar stated that "Kagan defined reflectivity and impulsivity domain as a conceptual tempo, or decision time variable, two criterions to classify the subjects: response time and errors"[9].

The study was carried out to address the following question: how is the number sense of junior high school students who have cognitive styles reflective and impulsive? Thus, based on research questions, the purpose of this study is to describe the number sense of junior high school students who have cognitive styles reflective and impulsive.

II. METHOD

This research is a qualitative descriptive research that aims to describe the number sense of junior high school students in terms of cognitive styles reflective and impulsive. Subjects in this study consisted of 2 students of class VII SMP consisting of 1 reflective cognitive style students and 1 student of impulsive cognitive style as well as having equivalent mathematical abilities. Research begins by giving the instrument of Mathematics Capability (TKM) and Cognitive Style Test (TGK) for selection of research subject and followed by giving the Number Sense Test (TNS) along with the interview to describe the student sense number. Data TKM and TGK are assessed based on guidelines for TKM and TGK scoring. Data TNS and interviews were analyzed based on the number of sense strands presented in Table 2.1 below.

TABLE I: THE NUMBER SENSE STRANDS WITH EACH INDICATOR

No.	Number sense strands	Indicator
1.	Number Concept	1.1. Able to determine decimal place value 1.2. Able to compare values of two ordinary or decimal fractions 1.3. Able to sort ordinary fractions and decimals 1.4. Able to show ordinary or other decimal fractions between two ordinary or decimal fractions.
2.	Multiple Representation	2.1. Able to show ordinary or decimal fractions to other equivalent forms 2.2. Able to state fractions to a shaded area.
3.	Effect of Operations	Able to determine the results of operations on ordinary and decimal fractions.
4.	Equivalent Expressions	4.1. Able to understand two equivalent expressions. 4.2. Able to determine two mathematical expressions equivalent to the given mathematical expression.
5.	Computing and Counting Strategies	Able to use strategies (estimation, counting on paper, mental calculations) in math problems.

McIntosh et al, 1997: 326-328

III. RESULTS AND DISCUSSION

Based on the results of TKM and TGK given to a group of students of class VII SMP obtained two research subjects each reflective and impulsive cognitive style with equivalent TKM values. Each subject was given a TNS and an interview to describe the student sense number based on the indicator of the number sense strands in Table 1.

A. Subject number sense students cognitive style reflective

The number sense of reflective student was described as follow. In number concept, Students can determine the place value for each number in the given decimal, that is at 45,296 number 4 occupies tens, 5 units, 2 tenths, 9 hundredths, and 6 thousandths. Students can compare the value of two ordinary or decimal fractions, that is to determine fractions greater than 3/4 but less than 1 that is 4/5. Students can sort ordinary or decimal fractions, from the smallest to the largest that is 0,3; 2/4; 0,595; 3/5 and 61%. Students can't indicates there are other ordinary fractions or decimals between two ordinary or decimal fractions, (see figure 1).

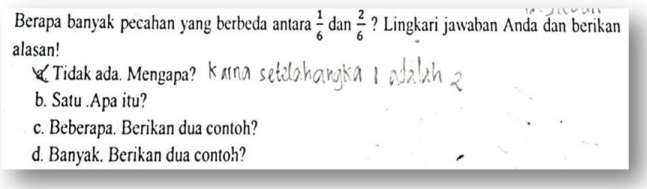
Berapa banyak pecahan yang berbeda antara $\frac{1}{6}$ dan $\frac{2}{6}$? Lingkari jawaban Anda dan berikan alasan!
a. Tidak ada. Mengapa? karna setelahnya 1 adalah 2
b. Satu .Apa itu?
c. Beberapa. Berikan dua contoh?
d. Banyak. Berikan dua contoh?

Figure 1. Results of the cognitive style subject reflective number concept

Translate:

How many different fractions between $\frac{1}{6}$ and $\frac{2}{6}$? Circle your answer and write the reason!

a. None. Why?
b. One. What is it?
c. Few. Give Two Examples?
d. Many. Give Three Example?

Subject reflective's answer: No one, because later 1 is 2.

In multiple representations, students can show ordinary or decimal fractions to other equivalent forms, that is 0.25 to 1/4 and 5/8 to 0.625. Students can state fractions to a shaded area (see figure 2).

Figure 2. Results of the cognitive style subject reflective multiple representations

In effect of operations, students can determine the results of operations on both ordinary and decimal fractions, if a number is multiplied by a number less than 1, it will produce a number smaller than the initial number and estimate the product of 546 × 0.089 will yield much less than 546.

In equivalent expressions, students can understand two equivalent expressions, that is 208 × $\frac{1}{4}$ = 208: 4. Students can't determine two mathematical expressions equivalent to mathematical expressions given (see figure 3).

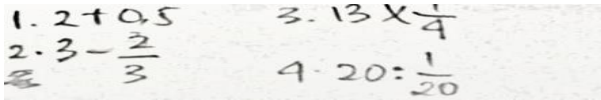

Figure 3. Results of the cognitive style subject reflective equivalent expressions

In computing and counting strategies, students can use strategies (estimates, counting on paper, mental calculations) that in math problems (see figure 3).

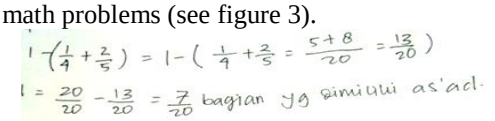

Figure 3. Results of the cognitive style subject reflective computing and counting strategies

B. Subject number sense student cognitive style impulsive

The number sense of reflective student was described as follow. In number concept, students can't determine the place value for each number in the given decimal, that is at 45,296 number 4 occupies tens, 5 units, 2 tenths, 9 hundredths, and 6 thousandths (see figure 4). Students can compare the value of two ordinary or decimal fractions, that is to determine fractions greater than $\frac{3}{4}$ but less than 1 that is $\frac{4}{5}$. Students can sort ordinary or decimal fractions, from the smallest to the largest that is 0,3; 2/4; 0,595; 3/5 and 61%. Students can't indicate there are other ordinary fractions or decimals between two ordinary or decimal fractions (see figure 5).

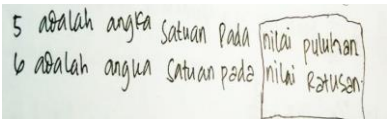

Figure 4. Results of the cognitive style impulsive number concept

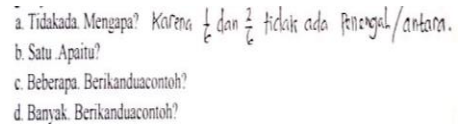

Figure 5. Results of the cognitive style subject impulsive number concept

In multiple representations, students can show ordinary or decimal fractions to other equivalent forms, that is 0.25 to 1/4 and 5/8 to 0.625. Students can stated fractions to a shaded area (see figure 6).

Figure 6. Results of the cognitive style subject reflective multiple representations

In effect of the operations, students can determine the results of operations on both ordinary and decimal fractions, if a number is multiplied by a number less than 1, it will produce a number smaller than the initial number and estimate the product of 546 × 0.089 will yield much less than 546.

In equivalent expressions, students can understand two equivalent expressions, that is $208 \times \frac{1}{4} = 208 : 4$ (see figure 7). Students can determine two mathematical expressions equivalent to mathematical expressions given (see figure 7).

In computing and counting strategies, impulsive cognitive-style students, students can't use strategies (estimates, counting on paper, mental calculations) that are effective in solving math problems (see figure 8).

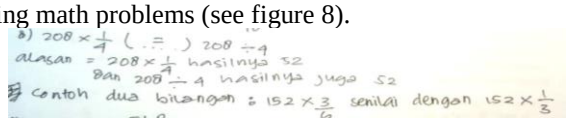

Figure 7. Results of the cognitive style subject impulsive *equivalent expressions*

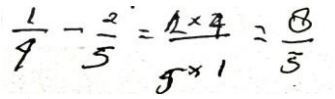

Figure 8. Results of the cognitive style subject impulsive computing and counting strategies

It was found that, in general, reflective and impulsive students appear to have difficulties with all strands of number sense except those associated with the use of multiple representation and effects of operations. Students' understanding was very related to the procedural understanding. If there was no conceptual understanding, it would be hard to observe and evaluate the error in the process of solving problems. This would lead to the error potential in developing the intuitive and conceptual understanding [10].

IV. Conclusion

From the results of this study, the answer of a subject with reflective cognitive style students belongs to the category able enough in the number of concepts, able to in the multiple-representation, able to in the effect of operations, less able to in the equivalent expressions and able to in the computing and counting strategies. The answer of subject impulsive cognitive students belongs to the category less able to in the number of concepts, able to in the multiple-representation, able to in the effect of operations, able to in the equivalent expressions and unable to in the computing and counting strategies. Generally, children are able to do very well when asked for strands of number those associated with the use of multiple representation and effect of operations.

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REFERENCES

[1] S. Dehaene, "Précis of the number sense", Mind & Language, vol. 16(1), 2001.

[2] K. Mamonto, D. Juniati, & T. Y. E. Siswono, "Understanding fraction concepts of Indonesian junior high school students: A case of field independent and field dependent students", J. Phys: Conf. Ser., vol. 947, pp 1-7, 2018.

[3] S. J. Lamon, Teaching Fractions and Ratios for Understanding: Essential Content Knowledge and Instructional Strategies for Teachers. New York: Routledge Taylor & Francis Group, 2012.

[4] N. C. Jordan, D. Kaplan, M. Locuniak, & C. Ramineni, "Predicting first-grade math achievement from developmental number sense trajectories", Learning Disabilities Research & Practice, vol. 22(1), pp. 36-46, 2007.

[5] N. C. Jordan, J. Glutting, & C. Ramineni, "The importance of number sense to mathematics achievement in first and third grades", Learning and Individual Differences, vol. 20(2), pp. 82–88, 2010.

[6] [6] D. C. Yang & C. J. Hsu, "Teaching Number Sense For 6th Graders In Taiwan", International Electronic Journal of.Mathematics Education, 2009.

[7] S. Sengül & H. Gülbagci, "Evaluation of number sense on the subject of decimal numbers of the secondary stage students in Turkey", International Online Journal of Educational Sciences, vol. 4(2), pp. 296-310, 2012.

[8] M. Chrysostomou, C. Tsingi, E. Cleanthous, & D. Pitta-Pantazi, "Cognitive styles and their relation to number sense and algebraic reasoning", The Seventh Congress of the European Society for Research in Mathematics Education, 2011.

[9] H. Abubakar, "Influence of Reflective and Impulsive Cognitive Styles on Academic Self-Efficacy among Senior Secondary Student", Dissertation. Nigeria: Ahmadu Bello University, 2006.

[10] P. Singh, "An assessment of number sense among secondary school students", International Journal for Mathematics Teaching and Learning, vol. 155, pp. 1-29, 2009.