Fifth Graders' Number Sense Profile of Fraction Subject Reviewed from Field-Dependent and Field-Independent Cognitive Style

**Abstract.** The purpose of this research was to understand the number sense profile of Fifth Graders reviewed from Field-Dependent and Field-Independent cognitive style of fractions subject. To support the research, we used a qualitative descriptive method that involved 58 Fifth Graders of an elementary school in Surabaya. To collect the data, various tests of Group Embedded Figure Test, Mathematics Ability Test, Number Sense Test, and interview were used. The result showed that students with Field-Independent cognitive style tend to use logical reasoning, process information actively, and are able to simplify complex problems well, Meanwhile, students with Field-Dependent cognitive style are difficult to separate and differentiate simple objects from the complex ones. The benefit of this research is that it can be referred to and inspire other relevant researches development in the future.

1. **Introduction**

Given the importance of the role of mathematics, it is appropriate to handle the mathematics learning process properly. One of the main studies in mathematics education is the science of numbers. The level of students 'mathematical abilities can be measured by knowing students' abilities in terms of number sensitivity. Underlying this preliminary study found that KTSP (2006) and Curriculum 2013 (2016) direct mathematics learning based on *Number Sense*.

Mathematics is not only a science of numbers and algorithms but also about the meaning of numbers. Dehaene (2001) states that: "*Number is a fundamental parameter by which we make sense of the world surrounding us*". One must understand about numbers if they want to use numbers not only to solve maths problems but also to use them in daily life correctly.

In addition, the selection of elementary students as the subject of research cannot be separated from the need to understand number sense at the elementary school level. The Number Sense framework can be presented into six strands, namely (1*) Understanding of the meaning and size of numbers*, (2) *Understanding and use of equivalent representations of numbers*, (3) *Understanding the meaning and effect of operations*, (4) *Understanding and use of equivalent expressions*, (5) *Computing and counting strategies*, (6) *Measurement benchmarks* (McIntosh, Bana, & Farrell, 1997). *Number sense* can vary in each individual, variations in *number sense* can be caused by mathematical learning experiences, mathematical abilities, and cognitive styles (Sengul, 2013; Chrysostomou, 2009; Yang, 2008).

Cognitive style can be used as a consideration to understand individual differences in students and use them to improve learning activities (Saracho, 1997). Cognitive style refers to specific characteristics and tendencies that a person has in processing information. A number of cognitive styles have been identified in several works of literature, for example, Witkin et al. (1977) stating that cognitive styles are differentiated into *Field-Independent (FI)* and *Field-Dependent (FD).*

This study was conducted to find out how the number sense profile or sensitivity to numbers influences the cognitive style of *Field-Independent (FI)* and *Field-Dependent (FD)* in fractional material. So that the teaching method can be adjusted to cognitive style according to the needs of students. This is expected to increase students' sensitivity or understanding of the material presented.

1. **Research Methods**

This type of research is descriptive research with a qualitative approach. The purpose of this study was to be able to determine the profile number sense of fifth graders' elementary school students on fraction material with Field-Dependent cognitive style, and Field-Independent cognitive style.

The subjects of this study were 58 students from Public Elementary School in Surabaya. The selection of subjects is done by several tests.

*2.1. Math Ability Test (TKM)*

The level of mathematics ability of students is equivalent, then given a math ability test (TKM). Subjects have an equivalent level of ability if the difference in the results of the TKM is in the range 0 - 5 for the value 0 - 80.

2.2 *Group Embedded Figure Test (GEFT)*

A *Group Embedded Figure Test* *(GEFT)* test to determine student thinking outcomes, which consists of 18 questions with a score range of 0% - 50% including the *field-dependent* category and more than 50% to 100% including the *Field-Independent* category.

2.3 *Test*  *Number Sense (TNS)*

*Number Sense (TNS)* test which consists of 6 fraction description questions which include six *number sense strands*. Then the interview was conducted with the aim of describing the profile number of students' sense.

Based on the tests that have been conducted obtained 2 students who meet the required criteria.

1. **Result Discussion**

Subjects of *Field Dependent* and *Field Independent*, each of whom has the same level of mathematical ability with giving the exact same question. The questions given include *Number Sense Strands*, then both subjects answer questions with abilities and understanding analysis based on the characteristics of each subject in capturing the information provided.

Based on the research that has been done, it appears that students who have the value of an adjacent TKM apparently have different cognitive styles. This is in accordance with the theory which states that there are differences in the classification of learning strategies in the cognitive styles of *Field-Dependent* and *Field-Independent* (O'Malley, Chamot, Stewner-Manzanares, Russo, & Kupper, 1985).

Tabel 2. Data Kognitive based on *Number Sense Strands*

|  |  |  |  |
| --- | --- | --- | --- |
| No. | *Number Sense Strands* | Kognitive Style | |
| *Field-Dependent* | *Field-Independent* |
| 1. | *Number Concepts* | Compare the values ​​of two fractions or decimals | Indicates that there are other fractions or decimals between two fractions or decimals |
| 2. | *Multiple Representations* | Declares fractions in equivalent decimal form | Declare the fraction in another form with the example drawing a circle into several parts |
| 3. | *Effect of Operations* | Hesitantly choose a reasonable answer option without doing calculations | Can estimate answers and state the reason for the operation of the two given numbers |
| 4. | *Equivalent Expressions* | t's a little difficult to manipulate to get the solution to the mathematical expression given | Easily manipulate and simplify solutions to the mathematical expressions that are given |
| 5. | *Computing & Counting Strategies* | Cannot do mental calculations | Perform calculations to express fractions to the desired decimal form and vice versa |
| 6. | *Measurement Benchmarks* | Only estimate the size of the length or height of the object given without comparison | Compare carefully estimate the size of the object given |

Individuals who have a cognitive style *Field-Independent* (*FI*) tend to actively process information by approaching hypothesis testing, analyzing, compiling organizations, working on relevant information, being able to simplify complex problems and can easily separate and distinguish simple objects and complex objects. While individuals who are *Field-Dependent* (*FD*) tend to have difficulty in distinguishing stimulus through the situation faced so that perceptions of information tend to be easily influenced by manipulation of the surroundings, and difficult to separate and distinguish simple objects and complex objects (Agustan, 2012).

1. **Conclusion**

The findings in this study, conducted on fifth graders' elementary school students on fraction material, we can find out the number sense profile between students who have the *Field-Dependent* cognitive style and students in the *Field-Independent* cognitive style.

Subjects in the study were given the same information, tests, and questions, but their understanding or number sense was different due to differences in cognitive style. Cognitive style can be conceived as a choice attitude or a strategy that stably determines a person's unique way of receiving, remembering, thinking, and solving problems. So, when a student has a different cognitive style, then their way of solving problems is also different (Slameto, 2010).

In addition, the definition of numbers reflects the tendency and ability to use numbers based on analysis of the data carried out for comparison between subjects who have the *Field-Independent* and *Field-Dependent* cognitive styles. Subjects who have a cognitive style *Field-Independent* show more absorbing information, using logical reasoning and more easily find solutions to problems compared to students who have a cognitive style *Field-Dependent*.

1. **References**

[1] Andreas, D.N. (2013). *Proses Berpikir Siswa SMA Dalam Menyelesaikan Masalah Matemaika pada Materi Turunan Ditinjau dari Gaya Kognitif Field Independent dan Field Dependent.* Surabaya: Universitas Negeri Surabaya.

[2] Chrysostomou, M., Tsingi, C., Cleanthous, E., & Pitta-Pantazi, D. (2011). *Cognitive styles and their relation to number sense and algebraic reasoning*. University of Cyprus: Proceedings of Seventh Conference of the European Research in Mathematics Education.

[3] Depdiknas. (2006). *Kurikulum Tingkat Satuan Pendidikan (KTSP)*. Jakarta: Departemen Pendidikan Nasional.

[4] Dehaene, Stanislas. (2001). *Precis of The Number Sense*. New Jersey: Willey Online Library.

[5] Kemendikbud. (2013). *Kerangka Dasar dan Struktur Kurikulum 2013*. Jakarta: Kemendikbud. [6] McIntosh, A., Reys, B. J., Reys, R. E., Bana, J. and Farrel, B. (1997). *Number sense in School*

*Mathematics: Student performance in four countries*. Perth, Australia: Edith Cowan University.

[7] Mohamed, M. And Johnny, J. (2010). “Investigating Number Sense Among Students”.

*Procedia Social and Behavioral Sciences*, Vol.8, pp.317-324.

[8] Mufidah, I. (2017). *Profil Number Sense Siswa SD pada Materi Pecahan Ditinjau dari Gaya*

*Kognitif Object Imagery, Spatial Imagery, & Verbal*. Surabaya: Universitas Negeri Surabaya.

[9] O’Malley, J.M., Chamot, A.U., Stewner-Manzanares, Russo, R.P., & Küpper, L. (1985). Learning strategy applications with students of English as a foreign language. *TESOL Quarterly, 19,* 557-584.

[10] S. Agustan. (2012). *Reflective thinking in solving an algebra problem: a case study of field independent prospective teacher*. Universitas Negeri Surabaya: Journal of Physics - Conference Series 893 (1), 012002.

[11] Saracho, O.N. (1997). *Teachers and Students Cognitive Style in Early Childhood Education*. US: Greenwood Press.

[12] Sengul, S., Gulbagci, H. (2012). "An Investigation of 5th-grade Turkish students' performance in number sense on the topic of decimal numbers". *Procedia Social and Behavioral Sciences*, Vol.46, pp.2289-2293.

[13] Sengul, S. (2013). *Identification of number sense strategies used by pre-service elementary teachers. Educational Sciences: Theory & Practice.* Vol.13, pp.1965-1974.

[14] Slameto, 2015. *Belajar dan Faktor yang mempengaruhinya*. Jakarta: Rineka Cipta.

[15] Yang, D.C., Li, M.F., and Li, W.J. (2008). Development of a Computerised Number Sense Scale for 3rd Graders: Reliability and Validity Analysis. *International* *Electronic Journal of Mathematics Education*. Vol.3, pp.110-124.

[16] Witkin, H.A., Moore, C.A., Goodnough, D.R., & Cox, P.W. (1977). *Field Dependent and Field Independent Cognitive style and Their Educational Implication. Review of Educational Research Winter.* Vol.47, pp.1-64.