ME - 8

THE PROFILE OF PRIMARY SCHOOL STUDENTS' CONCEPTUAL UNDERSTANDING OF EQUIVALENT FRACTIONS BASED ON KOLB'S LEARNING STYLES

Agnita Siska Pramasdyahsari, M. Pd., M. Sc.
IKIP PGRI Semarang
Jl. Sidodadi Timur No. 24 - Dr. Cipto, Semarang, Indonesia

Abstract

Fraction equivalence is one concept within the extensive fraction schemata. The understanding of fractions concepts is very important in understanding equivalent fractions. Therefore, it is essential for students to acquire the conceptual understanding of mathematical ideas in order to develop higher order mathematical thinking skills. Even though, have not yet found past research that specifically focus on relationship between Kolb's learning styles and primary students' conceptual understanding of equivalent fractions, the piloting study was conducted to know the relationship between those variables. Considering this fact, it is important to know further, how students' conceptual understanding of equivalent fractions will be varied depending on their different Kolb's learning styles.

This research describes the profile of primary school students' conceptual understanding of equivalent fractions based on Kolb's learning styles. The results showed the way of represent the symbolic representation into pictorial representation and vice versa. Two students in fifth grade from SD Laboratorium Unesa which have different Kolb's learning style and have already taught the topic were administered as the research subjects. The gender, mathematical ability, and age were considered as control variables. This research used qualitative approach, where the data were collected from written test and interview. It was completing each other and was gathered in different time with similar questions. The data were triangulated with time triangulation. Each profile, the differences and the similarities between two subjects in their conceptual understanding of equivalent fractions were highlighted in this research.

Keywords: profile, conceptual understanding, equivalent fractions, Kolb's learning styles.

INTRODUCTION

Background

Understanding of equivalent fractions is important because it develops a base for understanding addition and subtraction of fractions and allows students to compare and order fractions. Moreover, they would have better understanding if they have a concrete understanding of equivalent fractions (Kamii & Clark, 1995). Students have considerable difficulties with fraction equivalence, the notion that different fractions can represent the same amount (Stephens, & Lewis, 2003 as cited in Anderson & Wong, 2007). There is abstract thinking and constant connections that need to be made while learning it. Therefore, students need the concrete model to represent the abstract concepts of equivalent fractions.

An initial research conducted in SD Laboratorium Unesa to see students' conceptual understanding of equivalent fractions. The results show the different way to answer questions varying on the different learning styles.

Keefe (1985) defined learning style as "the composite of characteristic cognitive, affective and physiological behaviours that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment". Kolb as cited in Manolis, Burns, Assudani, and Chinta (2013) proposed the *Experiential Learning Model*. It became the base of Kolb's learning styles which portrays two dialectically related modes of grasping experience concrete experience (CE) and abstract conceptualization (AC) and two dialectically related modes of transforming experience reflective observation (RO) and active experimentation (AE). It identifies four statistically prevalent learning styles namely assimilating, converging, accommodating, and diverging.

It can be seen the coincidental fact that Kolb's learning styles also propose the way of learning which more focus on the experience learning model. This fact is in line with the students' needs to have good conceptual understanding by getting worthy experience. Even though, have not yet found past research that specifically focus on relationship between Kolb's learning styles and primary students' conceptual understanding of equivalent fractions, the piloting study has been conducted to know the relationship between those variables.

Considering this fact, it is important to know how students' conceptual understanding of equivalent fractions will varied depending on their different learning styles. In this paper, the discussion will be focused on assimilating and converging subjects.

Research Questions

Regarding to the research background above, the research questions of the study are as follows:

1. How is the profile of conceptual understanding of equivalent fractions for a student who has an *assimilating* learning style?
2. How is the profile of conceptual understanding of equivalent fractions for a student who has a *converging* learning style?
3. How is the similarities and the differences profile of conceptual understanding of equivalent fractions among students who have *assimilating* and *converging* learning styles?

Research Objectives

Regarding to the research questions above, there are four purposes of this study as detailed below. The study will:

1. Describe the profile of conceptual understanding of equivalent fractions for a student who has an *assimilating* learning style.
2. Describe the profile of conceptual understanding of equivalent fractions for a student who has a *converging* learning style.
3. Describe the similarities and the differences profile of conceptual understanding of equivalent fractions among students who have *assimilating* and *converging* learning styles.

Significance of Research

The study is expected will provide theoretical and practical benefits as follows.

1. Theoretical Benefit

Theoretically, this study is expected become added value of literature related to the students' conceptual understanding of equivalent fraction in term of their preferred Kolb's learning styles and also the similarities and the differences profile among subjects.

2. Practical Benefit

Practically, the results are expected will be beneficial for teacher, student, and researcher as follows:

a. Teacher

As a guidance for the teachers to accommodate students' needs in teaching and learning process confronted with the various students' preferred learning styles.

b. *Student*

As a reference for the students to know their learning style such that they will be more aware of their strengths to mastering such a concept.

c. *Researcher*

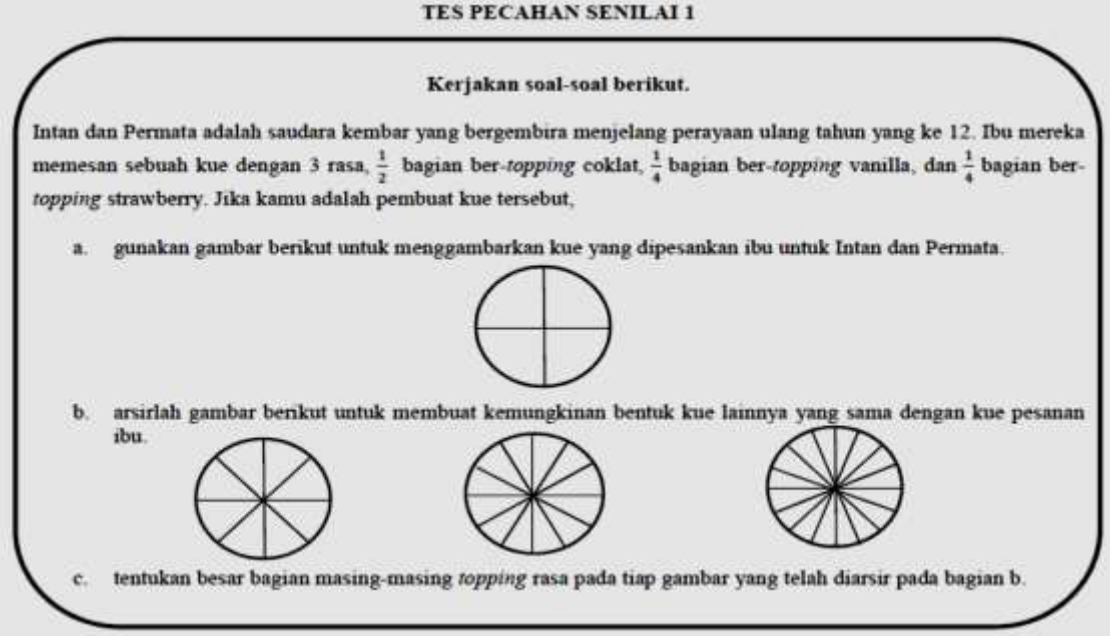
As an overview for the researcher regarding to the several of students' preferred learning styles and the information how the profile of students' conceptual understanding of equivalent fractions in term of their preferred learning styles.

RESEARCH METHOD

This study is categorized as an explorative research with qualitative approach, which relevance with research objectives and enables to reach those purposes. The research subjects were two male fifth grader students of SD Laboratorium Unesa, which have different Kolb's learning style. As control variables are considered such as gender, mathematical ability, and age in similar condition. They have already taught about equivalent fractions.

The researcher will select one of students from each learning styles. However, the researcher will consider others variable such as gender, mathematics ability, and age to be controlled. The data regarding to the variable of mathematics ability were gathered from the information of mathematics teacher. It will be decided from the students' general achievement in mathematics based on mathematics score in assessment report. The criteria to decide whether the students have the similar mathematics ability or not is defined by researcher that is if the interval of mathematics score between research subject's is not greater or equal than 10 with scale 0-100. As a result, all of the subjects are controlled such that these subjects have the similar conditions of those variables.

The instrument that was used in this research namely Honey and Mumford's LSQ to classify the students' learning style based on Kolb, fraction test and interview protocol. The data were collected from written test that was fractions test then continued with interview. The purpose was to explore more the students' answer and reason which were not seen on the answer sheet. Those techniques are completing each other. It was collected twice to check its validity. The data were gathered in different time with similar questions and triangulated by the time triangulation. The procedures of data analysis based on Miles and Huberman (1994:10) which consist of data reduction, data display, drawing conclusion and verification.


TES PECAHAN SENILAI 1

Kerjakan soal-soal berikut.

Intan dan Permata adalah saudara kembar yang bergembira menjelang perayaan ulang tahun yang ke 12. Ibu mereka memesan sebuah kue dengan 3 rasa, $\frac{1}{2}$ bagian ber-*topping* coklat, $\frac{1}{4}$ bagian ber-*topping* vanilla, dan $\frac{1}{4}$ bagian ber-*topping* strawberry. Jika kamu adalah pembuat kue tersebut,

a. gunakan gambar berikut untuk menggambarkan kue yang dipesankan ibu untuk Intan dan Permata.

b. arsirlah gambar berikut untuk membuat kemungkinan bentuk kue lainnya yang sama dengan kue pesanan ibu.

c. tentukan besar bagian masing-masing *topping* rasa pada tiap gambar yang telah diarsir pada bagian b.

Figure 1. Instrument Fraction Test

RESULT AND DISCUSSION

On this section, the description profile of conceptual understanding among subject will be elaborated and compared the similarities and also the differences. It will be described based on the indicators of research. The indicators of conceptual understanding of equivalent fractions originally were adapted from Kaur & Pumadevi (2009). Then, the indicators of this study as follows:

1. Shade the fractions of a given proper fractions on a given diagram with or without converting the given prosper fraction to a suitable equivalent fraction (representing the symbolic representation into pictorial representation).
2. State the proper fractions of the shaded regions in the given diagrams with and without converting to its simplest form representing the pictorial representation into symbolic representation).

A. The Description Profile of Conceptual Understanding of Equivalent Fractions for Assimilating Subject

Regarding to the first indicator related to the ability to shade a given proper fractions on a given diagram with or without converting the fraction to a suitable equivalent fraction *(representing symbolic representation into pictorial representation)*, there are several data that describe the profile of assimilating subject. In general, assimilating subject understood the information on the questions entirely after read the test given. Since, he was able to re-explain the question with his own language. The procedure that he used to represent the pictorial representation from the symbolic representation is that shading by labelling on it to differentiate each part. He tended to shade the part in a group, even though he knew the reason it is not should be like that, but he did not realize beforehand.

While understanding the questions, he was able to create a correct connection between the different representations. He made a connection between fractions models by understanding

the sameness and the distinctness of pictorial representation. It also showed his understanding the concept of finding the equivalent fractions. As cited from DiMuro & Terry (2007), that assimilator student uses abstract conceptualization and reflective observation. In line with this theory, assimilating subject in this study used their mental representation (abstract conceptualization) first to lead himself come up with the useful connection into external interpretation (reflective observation). It was the strategy that he used to find the equivalent fraction from pictorial representation (determining the number of shaded part).

Meanwhile, the procedure that he used is that by explaining his mental representation into external representation. It is shown on his procedure in finding the equivalent fraction by making the same of the denominator. The procedure that subject used in line with the theory related to Kolb's learning styles that interpreted in mathematics context by Knisley (n.d). It said that an assimilating students corresponding with analyser, where analyser students have logical explanations and algorithms. As what the assimilating subject did, he answered the questions with a logical, step-by-step progression to represent the symbolic representation into pictorial representation that begins with the initial assumptions that he thought about equivalent fractions concepts, then elaborate the procedure until concludes with the answer that is obtained as a number to be shaded.

Regarding to the second indicator related to the ability to state the proper fractions of the shaded regions in the given diagrams with or without converting to its simplest form *(representing pictorial representation into symbolic representation)* there are several data that describe the profile of assimilating subject. In general, assimilating subject understood the information on the questions entirely after read the test given. Since, he was able to re-explain the question with his own language. The strategy that used by assimilating subject to state the fractions from the given figure is that just by counting the number of shaded part directly. He made connection among the given question, between pictorial representation and symbolic representation and vice versa. Besides, he also realized that the fractions have the same value. Moreover, he proposed a reason related to his conceptual understanding of equivalent fractions and explained it into the external representation and also he showed his understanding of equivalent fractions. Indeed, he used the logical thinking in assuming what exist in his mind as a mental representation to understand the concept of equivalent fractions in representing the pictorial representation into symbolic representation.

B. The Description Profile of Conceptual Understanding of Equivalent Fractions for Converging Subject

Regarding to the first indicator related to the ability to shade a given proper fractions on a given diagram with or without converting the fraction to a suitable equivalent fraction *(representing symbolic representation into pictorial representation)* there are several data that describe the profile of converging subject. In general, converging subject understood the information on the questions entirely after read the test given. Since, he was able to re-explain the question with his own language. The procedure that converging subject used to represent the pictorial representation from the symbolic representation is that shading by labelling on it to differentiate each of part. In the case shading$\frac{1}{2}$, converging subject was able to explain how much $\frac{1}{2}$ in a cake which divided into 4 parts. Yet, he difficult to come up with a reason why it could be $\frac{1}{2}$. Regarding to the kind of understanding (Skemp, 1976), converging subject has

instrumental understanding. He knew the rules without reasons. Converging subject tended to shade the part in a group, even though he knew the reason it is not should be like that. But, he argued that by shading the part in a group make him easier when labelling.

While understanding the question converging subject was able to create a correct connection between the different representations. He made a connection between fractions models by understanding the sameness and the distinctness of pictorial representation. It also showed his understanding the concept of finding the equivalent fractions. His understanding promotes remembering the information that has already had. The strategy that used by converging subject to find the equivalent fraction from pictorial representation (determining the number of shaded part) he used the concrete model and practical applications, by seeing the number part of cake then make a connection that it consider as denominator. He also checked his answer by simplifying the fraction from the obtained answer. This fact in line with the theory that revealed from Kolb & Kolb (2005), that converging students find practical uses for ideas and prefer to learn by experimenting stimulating. It showed his ability to determine the equivalent fractions from symbolic into pictorial by converting into its simplest form.

Meanwhile, the procedure that he used is that by determining the number part of whole then considering it as a denominator to find the equivalent fractions where its numerator become the number to be shaded. He used the connections available related to fractions for solving the problem. Converging subject used the same strategy and procedure to answer a whole question. He knew other but did not use it. Since, it is not familiar for him. The past knowledge of him let converging subject automatically use the concept that already attributed to their mind.

Regarding to the second indicator related to the ability to state the proper fractions of the shaded regions in the given diagrams with or without converting to its simplest form *(representing pictorial representation into symbolic representation)* there are several data that describe the profile of converging subject. In general, converging subject understood the information on the questions entirely after read the test given. Since, he was able to re-explain the question with his own language. The strategy that used by converging subject to state the fractions from the given figure is just by counting the number of shaded part directly, even he already got the answer while answered the question *b*. He seemed that has already set goals that what he did will answer the following question. This characteristic in line with the Turesky & Gallagher (2011), it revealed that converging student has an ability to set goal and make decision.

Converging subject was able to make connection that each part of fractions representation among questions has the same value. But, he did not notice the information that the questions connect the symbolic representation into pictorial representations and vice versa. Firstly he hesitated to make connection among question a, b and c directly. He tried to remember the procedure to determine the value of each fractions whether it has the same or not. But then, after he saw again his answer, he realized that he did it beforehand, to check whether it has the sameness of its value. It showed that he has the potential to apply the knowledge in a meaningful way by remembering what he was already learned to be transferred in the present situation. Finally, he can made connection among the questions. Converging subject understood the questions by stating the correct connection that the questions asked him to find equivalent fractions.

C. Comparison among Subjects in term of their Profile Conceptual Understanding of Equivalent Fractions

There are several point which were had by four subject in term of their profile, which shows their similarity and their difference. The details of them will be provided as follows.

1. The subjects have the similarity in understanding the questions. They caught the information on the questions entirely. It shown on the way they re-explain the question with their own language.
2. The procedure that subjects used to represent the pictorial representation from the symbolic representation is the same. They shading and labelling on it to differentiate each part.
3. The subjects tend to shade the part in a group, even though they knew it should not be like that, yet each of them has the certain reason for arguing.
4. The subjects were able to create a correct connection between the different representations. They made connection between fractions models by understanding the sameness and the distinctness of pictorial representation. It also showed their understanding the concept of finding the equivalent fractions.
5. *Converging* subject used his concrete experience by using pictorial representations to contruct the useful information which lead them to create internal representation. Meanwhile, for *assimilating* subject he used his internal (mental) representation (by imagines it firstly) then constructed the useful connection which lead them to create external representation.
6. The subjects have the similarity in procedure to find equivalent fractions from pictorial representations. They make the same of the denominator. The difference of them is that *converging* subject also checked his answer by simplifying the fractions from the obtained answer. It means that he also showed his ability to determine the equivalent fractions from symbolic into pictorial by converting into its simplest form.
7. The subjects used strategy to state the fractions from the given figure is that just by counting the number of shaded part directly. Even, the converging subject already got the answer while answered the question *b.*
8. *Assimilating* subject was able to create a connection among the given question, between pictorial representation and symbolic representation and vice versa. Besides, he also realized that the fractions have the same value. Meanwhile, for *converging* subject made connection that each part of fractions representation among questions has the same value. But, he did not notice the information that the questions connect the symbolic representation into pictorial representations and vice versa. Firstly he hesitated to make connection among question *a, b* and *c* directly. He tried to remember the procedure to determine the value of each fractions whether it has the same or not. But then, after he saw again his answer, he realized that he did it beforehand, to check whether it has the sameness of its value. Finally, he can made connection among the questions.

CONCLUSIONS

Based on the result and analysis, this section will provide conclusions related to the profile of primary school students' conceptual understanding of equivalent fractions based on their different Kolb's learning style and elaborate the similarities and also the differences among them. It also answers the research questions in the beginning. Each of them will be elaborated as follows.

1. **The profile of conceptual understanding of equivalent fractions from assimilating subject is described as follows.**

a. In representing symbolic representation into pictorial representation he made connection between fractions models by understanding the sameness and the distinctness of pictorial representation. He had learning mode abstract conceptualization and reflective observation. He had systematic procedure and logical thinking.

b. In representing pictorial representation into symbolic representation he used the logical thinking in assuming what exist in his mind as a mental representation to understand the concept of equivalent fractions in representing the pictorial representation into symbolic representation.

2. **The profile of conceptual understanding of equivalent fractions from converging subject is described as follows.**

a. In representing symbolic representation into pictorial representation he made connection between fractions models by understanding the sameness and the distinctness of pictorial representation. He had instrumental understanding. He found practical uses for ideas and prefers to learn by experimenting stimulating.

b. In representing pictorial representation into symbolic representation he has a characteristic that he has an ability to set goals and make decision. Has the potential to apply the knowledge in a meaningful way by remembering what he was already learned to be transferred in the present situation.

3. **The similarities and the differences among subject in term of their profile conceptual understanding of equivalent fractions will be described as follows.**

Each subjects had the similarity and differences that interesting captured as follows. *Assimilating* and *converging* subjects made connection spontaneously between fractions models by understanding the sameness and the distinctness of pictorial representation. *Converging* subject used their concrete experience by using pictorial representations to contruct the useful information which lead them to create internal representation. While *assimilating* subject used his internal (mental) representation (by imagines it firstly) then constructed the useful connection which lead them to create external representation. *Assimilating* and *converging* subjects made the same of the denominator to find equivalent fractions from pictorial representations. The difference of them is that *converging* subject showed his ability to determine the equivalent fractions from symbolic into pictorial by converting into its simplest form by checked his answer by simplifying the fractions from the obtained answer. *Assimilating* was able to create a connection among the given question, between pictorial representation and symbolic representation and vice versa. Besides, he also realized that the fractions have the same value. *Converging* subject made connection that each part of fractions representation among questions has the same value. But, he did not notice the information that the questions connect the symbolic representation into pictorial representations and vice versa in the beginning.

Nonetheless, each of them had the similarity in understanding the questions. They caught

the information on the questions entirely. The procedure that subjects used to represent the pictorial representation from the symbolic representation is the same. They shading and labelling on it to differentiate each part. The subjects tend to shade the part in a group, even though they knew it should not be like that, yet each of them has the certain reason for arguing. The subjects used strategy to state the fractions from the given figure is that just by counting the number of shaded part directly.

SUGGESTION

Regarding to the conclusions; the suggestion and the implication of this study is detailed as follows.

1. The teachers should consider the several of the profile primary school students' conceptual understanding of equivalent fractions based on Kolb's learning styles to accommodate students' needs in teaching and learning process.
2. To accommodate the *assimilating* and *converging*'s need, the students should be aware of their learning style characteristics. Besides, they should understand their preferred learning style which related to their way to perceive, interact with, and respond to the learning environment.

BIBLIOGRAPHY

Anderson, J., & Wong, M. 2007. Teaching Common Fractions In Primary School: Teachers" Reaction to a New Curriculum. *Proceedings of the Australian Association for Research in Education's 36th Annual International Education Research Conference, Volume 1*. (pp. 1-13).

DiMuro, P., & Terry, M. 2007. A matter of style: Applying of Kolb's Learning style model to college mathematics teaching practices. *Journal of College Reading and Learning, 38*, 53-60.

Kamii, C., & Clark. F., B. 1995. Equivalent Fractions: Their Difficulty and Educational Implications. *Journal of Mathematical Behaviour*, 14, 365-378. Retrieved September 13, 2013 from http://www.sciencedirect.com.ezp02.library.qut.edu.au/science?

Kaur, K., & Pumadevi. 2009. Example and Conceptual Understanding of Equivalent Fractions Among Primary School Students. Retrieved on September 3, 2013 from *www.recsam.edu.my/cosmed/cosmed09/.../Abstract/.../04.pdf*

Keefe, J.W. 1985. Assessment of learning style variables: The NASSP Task Force Model. *Theory into Practice*, 24(2), 138-144.

Knisley, J. n.d. *A four-stage model of mathematical learning.* Retrieved September, 3 2013, from http://faculty.etsu.edu/knisleyj/MathematicsEducatorArticle.pdf

Kolb, A. Y., & Kolb, D. A. 2005. Learning styles and learning spaces: Exhancing experiential learning in higher education. *The Academy of Management Learning and Education, 4*, 193-212.

Manolis, C., Burns, D. J., Assudani, R., & Chinta, R. 2013. Assessing experiential learning styles: A methodological reconstruction and validation of the Kolb Learning Style Inventory. *Learning and Invidividual Differences, 23*, 44-52.

Miles, B.M., & Huberman, A.M. 1994. *Qualitative data analysis: An expanded sourcebook* (2nd edition). Thousand Oaks, California: Sage.

Skemp, R.R. 1976. Relational understanding and instrumental understanding, *Mathematics Teaching*, 77, 20-26.

Turesky, E. F., & Gallagher, D. 2011. Know thyself: Coaching for leadership using Kolb's experiential learning theory. *Coaching Psychologist, 7*, 5-14.