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Research article

Analysis of the Deaf Student's Critical Thinking Skill to Understanding Fractional Concepts Based on Visual and Kinesthetic Learning Styles

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Abstract.

Critical thinking skills can train construction students' knowledge, including deaf students whose learning mathematics content is different from hearing students. This study aims to analyze the critical thinking skills of deaf students to fractional concept understanding in the sub-skills of focus, reason, inference, situation, clarity, and overview. This study type is descriptive with a qualitative approach. Data was collected through critical thinking tests and unstructured interviews to explore students' test results. The data validity was obtained through time triangulation which was carried out by comparing several test results. This study involved 12 subjects comprising eight students with visual learning styles, three with kinesthetic learning styles, and one with other learning styles. Researchers will not review the other learning styles in this study. The critical thinking test used in this study consisted of questions representing the sixth critical thinking sub-skills. Researchers analyzed the collected data through data reduction, presentation, and conclusion. The results show that in understanding the concept of fractions, the critical thinking of deaf students is influenced by their learning style. Visual learning style students' activities related to images, while kinesthetic learning style students related to concrete objects around them manipulation.

Keywords: Critical Thinking; Deafness; Fractional Concept; Learning Styles

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1. Introduction

Science and technology are developing so fast that they require teachers and students to be more creative and critical in facing competition and changes in an ever-evolving world. Education plays an important role in producing a learning process and atmosphere that promotes potential student development. In the Regulation of the Minister of National Education Number 22 of 2006, it is emphasized that critical thinking skills are one of the skills needed by students to manage and utilize information to survive in constantly changing, uncertain, and competitive conditions. Therefore, students need to have and develop mathematical critical thinking skills to deal with math problems and daily problems (1,2). According to Haryani (3), in learning mathematics, students need

critical thinking skills to solve problems, both in activities of understanding problems, planning solutions, implementing solution plans, and reevaluating solutions that have been implemented.

Critical thinking uses thinking skills effectively to help a person make things, evaluate, and apply appropriate decisions. Therefore, this critical thinking skill is an intellectual potential that can be developed through the learning process (4), and these skills are very important for students at every level of education (5). Students can think rationally and reflectively when deciding what to believe and do with critical thinking. A rational attitude in critical thinking is usually developed to determine the best alternative problem-solving options. According to Setianingsih (6), the decisions produced by students' critical thinking will be the right and reasonable solutions in solving problems. So that students who have critical thinking skills will easily understand mathematical concepts because they are used to systems thinking and effectively reasoning through analyzing and evaluating activities.

The importance of critical thinking skills in math learning does not automatically make the development of this ability an essential concern for teachers and schools. According to Jacqueline and Brooks (in (7)), few schools still emphasize critical thinking skills as learning achievements. Schools encourage students to give the correct answers rather than encouraging them to come up with new ideas or rethink existing conclusions. But in fact, there are still teachers who ask students only to retell what the teacher has explained, defined, described, elaborate, or registered rather than doing analytical activities, drawing conclusions, connecting, synthesizing, criticizing, creating, and evaluating. Therefore, many schools with learning achievements still lack critical thinking skills achievement. Lack of opportunities to analyze and assess the concepts students learn, making learning less meaningful and rote only. This has an impact on the low understanding of student concepts. The results of research support this by Fatmawati et al. (8) who found student errors in understanding the concept of addition and subtraction of fractional numbers.

Based on interviews conducted at SLB Negeri Cilacap, it is known that deaf students have a variety of understanding of the concept of addition and subtraction operations. Interview results with the mathematics teacher at SLB Negeri Cilacap showed that students were taught to correct answers than understand the process of the results, so deaf students' critical thinking skills still did not reach the critical thinking skill indicators. Based on preliminary research done at SLB Negeri Cilacap showed (1) deaf students not able to understand the information when given the question, (2) deaf students have been not able to give the reason for the answer they wrote, (3) deaf students have been

not able to answer a conclusion and still incorrectly (4) some students can answer by knowing all the information on the problem, (5) deaf students have been not able to explain or give information further, and (6) some students at SLB Negeri Cilacap aren't able to double-check thoroughly.

The lack of critical thinking skills of deaf students is also influenced by the deafness factor, which has implications for their limited vocabulary and knowledge. The limitations of the deaf-related, their sensory function hearing, implicate difficulty abstract concepts understanding, including mathematical concepts. Concept understanding is vital in accepting basic mathematical concepts because solving mathematical problems requires applying to understand. The one of factors that need to be considered in the learning process is the learning styles of mathematics (9). The peculiarities of the way that the student's learning style affects the ability of students to understand and absorb lessons. Seeing the influence of learning styles on students' understanding, which involves thinking and solving problems, that learning styles also affect students' critical thinking skills. This effect follows the research result of Nurbaeti et al. (10) which shows a positive relationship between learning styles and students' critical thinking skills. This research result is supported by Ghofur et al.'s opinion (11) which mentions that learning styles are also a driving factor for achieving critical thinking skills.

According to DePorter & Hernacki (in (12)), learning styles can be classified into three types, namely visual, auditorial, and kinesthetic. Visual learning style is a learning style that utilizes more vision, while auditorial learning style is a learning style that uses the sense of hearing to facilitate the learning process. Differentially, kinesthetic learning is a learning style that more readily absorbs information by moving, doing, and touching something that provides information to remember it. Therefore, a teacher should be known the tendency learning style of their students so that they can choose and use learning methods that are suitable and favored by students.

Research related to critical thinking skills and learning styles has been done before. A few study that analyzes critical thinking skills, among others, was carried out by Basri et al (13) and Bire et al (14). Starting from previous studies whose research subjects were students with hearing, the researchers intended to combine elements of critical thinking skills and learning styles of deaf students in a study. This statement is based on Ghofur et al (11) which states that learning styles are also a driving factor for achieving critical thinking skills. The novelty of this study is the analysis of critical thinking skills focused on the sub-skills of critical thinking focus, reason, inference, situation, clarify and overview in terms of the type of learning style of deaf students (visual and kinesthetic). This novelty is expected to provide new knowledge for teachers in special schools

in preparing an ideal learning model according to the characteristics of students and the limitations of deaf students. Based on this description, this study aims to describe the critical thinking skills of deaf students in understanding the concept of division in terms of students' learning styles of mathematics. The research results are expected to provide information as an inspiring preliminary study for teachers in special schools in developing the critical thinking skills of deaf students through learning mathematics.

2. Methodology

This study type is descriptive with a qualitative approach. Qualitative descriptive is a study method based on the philosophy of postpositivism, used to examine the condition of natural objects (as opposed to experiments) where the researcher is as a critical instrument, data collection techniques are done triangulation (combined), data analysis is inductive/qualitative, and qualitative research results emphasize meaning more than generalizations. In this study, the researchers describe the critical thinking skills of 12 deaf students with visual, kinesthetic, and other learning styles in grade VII. But, the other learning styles will not be reviewed in this study. To determine deaf students' learning styles, researchers conducted a thorough examination of deaf students using learning style questionnaires, so that obtained eight students with visual learning style, three students with kinesthetic learning style, and one student with other learning style. The deaf students studied have received fractional material, especially fractional addition and reduction operations. This study was conducted at SLB Negeri Cilacap from September to October 2020.

The instrument used in data collection was a test and questionnaire. Three groups of participant study were selected using a learning style questionnaire instrument adapted from Education Planner. The learning style instrument consists of 20 questions, with option A showing a visual type answer, option B displaying a kinesthetic type answer, and option C offering both learning styles type answers. While, the critical thinking skills test consisted of 3 problems to measure focus, reason, inference, situation, clarity, and overview sub-skills. In addition to the test, the results of the interviews were used to validate the data. Instruments of the critical thinking test given to deaf students conduct critical thinking sub-skills: focus, reason, situation, clarity, and overview. Subjects of this study involved 12 deaf students who were given a critical thinking skills test, and they should finish the test in 45 minutes. Then, the researchers gave numbers 1-12 to make coding easier. In addition, interviews were conducted gradually with the deaf students to explore their answer sheets for 20 minutes.

The researchers conducted the data analysis through three stages (1) Data from the test and interview results were reduced by selecting important data and eliminating useless data; (2) data from the test results were analyzed by scoring, and several test and interview results were described descriptively and presented in six parts, i.e.: deaf students' critical thinking skills in the focus sub-skill, deaf students' critical thinking skills in the reason sub-skill, deaf students' critical thinking skills in the inference sub-skill, deaf students' critical thinking skills in the situation sub-skill, deaf students' critical thinking skills in the clarity sub-skill, and deaf students' critical thinking skills in the overview sub-skill; (3) the conclusion of the results of the deduced findings and data display. In this study, the validity of the data was viewed using triangulation. According to Wiersma, triangulation in credibility tests is interpreted as checking data from various sources in various ways and times (15). One of the data checks that affects the credibility of the data is time. The credibility testing of information or data is done by comparing several data at different times or situations. Through time triangulation, researchers compared several test results to obtain data validity.

3. Results and Discussion

In this study, the grouping of learning styles of deaf students was based on the results of a learning style questionnaire given to 12 subjects research. The result was that deaf students were grouped into three groups of learning styles: three students with a kinesthetic learning style, eight students with visual learning styles, and one student with an other learning style that not reviewed in this study Graphically, the proportion of student learning styles can be presented in Figure 1 below.

Then the group of students from the grouping results will be tested for their critical thinking skills by giving a critical thinking ability test. Whereas the learning style referred to in the study is related to the learning style of deaf students, which is typical, consistent, often unconscious, and is the tendency of students to absorb, organize, and process the information. The results of the analysis of the twelve subjects show different data, along with a complete description.

3.1. Critical Thinking of Deaf Students in The Visual to Understanding Fractional Concept

The critical thinking ability test results of the twelve subjects in each activity to understand the concept of fractions were taken twice. The first retrieval was carried out

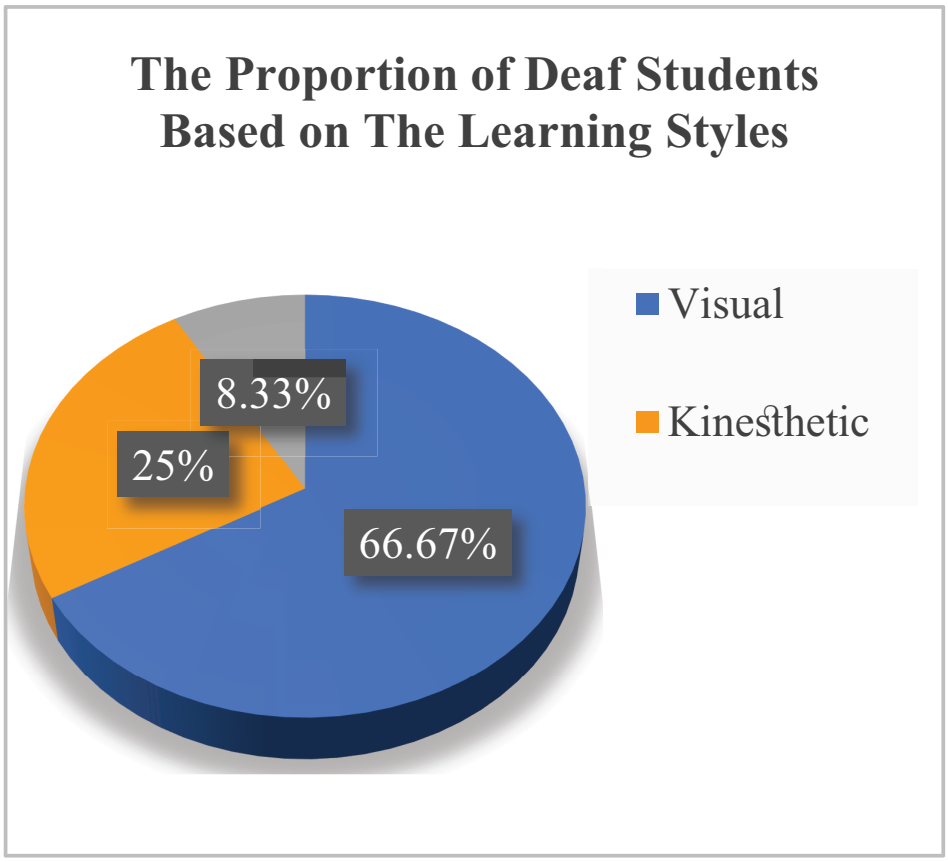

Figure 1: The Porportion of Deaf Students Based on The Learning Styles.

on September 24, 2020, while the second retrieval was carried out on October 2, 2020. Researchers carried out this retrieval because students didn't memorize the questions. Deaf students were asked to work on three test questions whose answers were presented in written form then, and the answers were photographed and sent to the researcher. The first problem is a question about the possibility of solving contextual problems related to fractions, as presented in Figure 2 below.

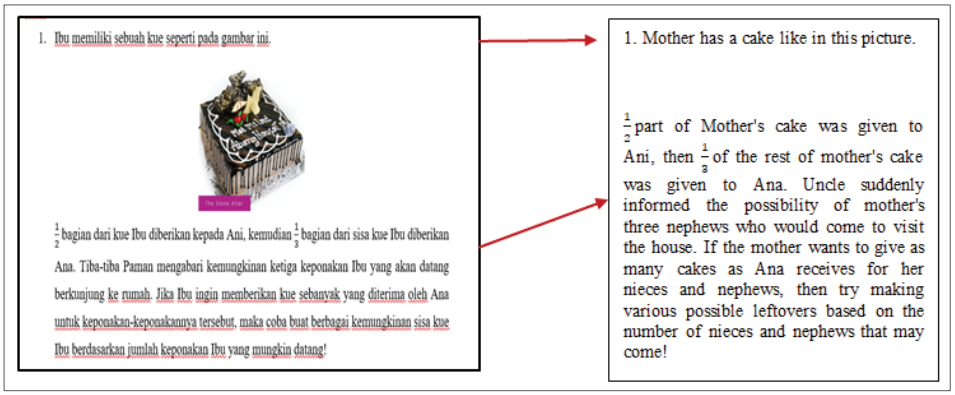

Figure 2: The Problem.

Deaf students with visual learning styles mostly remember things based on what they see (pictures). In detail, examples of the answers of deaf students in the visual learning style for the question are presented as shown in Figure 3 below.

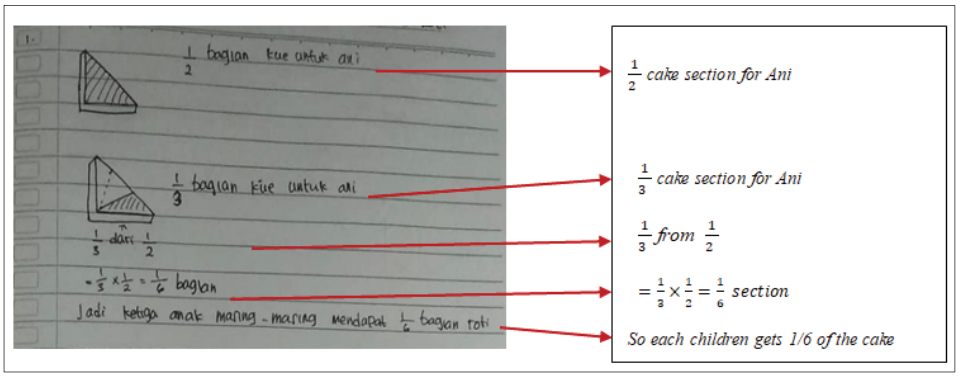

Figure 3: Deaf Student in Visual Learning Style' Answers with Redrawing.

First, the deaf student with a visual learning style illustrates the meaning of part of the cake by drawing a right triangle. Then, the right triangle is divided into three similar right triangles to illustrate $\frac{1}{3}$ part from $\frac{1}{2}$ part of the cake. This activity shows that students can pay attention to important things in the given problem and fulfill the sub-skill indicators: focus. They remember something in that problem based on what they see, like a cake picture. Then, using what they saw, they illustrate things they consider important in that problem by drawing, as shown in Figure 2 above. Figure 3 also shows that students can use further explanations about what is meant by the terms mentioned or achieve the sub-skill indicator, namely clarify. There, the students explain their interpretations of what they mean by the pictures by giving explanations next to the pictures. For example, the explanation writing of cake for Ani is placed next to the picture of his made's right triangle. Although they have achieved several indicators of critical thinking sub-skills, students who are deaf with visual learning style haven't been able to use all the information following the cake section's problem. That means an indicator of situation sub-skill of critical thinking ability is not achieved. This condition can be seen from the student's answer above, which shows that the student only uses part of the information, namely that $\frac{1}{3}$ part of $\frac{1}{2}$ part of mother's cake after mother give this cake to Ani.

The students should use other information in the question, namely information about 'various possibilities of rest cakes based on the number of nieces and nephews who come. First, only one of the mother's three nieces may come; only two of the mother's three nieces may come; all three of her nieces and nephews may come. The inability of students to use information appropriate with fractional problems makes a deaf student

with visual learning styles have difficulty making correct conclusions. This problem can be seen from the written answers of students who concluded that the possibility of rest cake based on the number of nieces and nephews that might come, only answered with the portion of the cake that each niece might receive like the portion received by Ana, which is $\frac{1}{6}$. This problem indicates incomplete information that the student hasn't used to conclude. It means a sub-skill indicator, namely, reason, is not achieved. As an implication of not using information following the problem, visual learning style students aren't fully able to provide logical reason based on relevant facts/evidence at each stage of making conclusions. That means the students still haven't achieved the indicator sub-skill, namely inference, and reasoning.

3.2. Critical Thinking of Deaf Students in The Kinesthetic to Understanding Fractional Concept

Deaf students with a kinesthetic learning style mostly associate the new information with their objects. In detail, an example of a kinesthetic learning style student's answer to the question is presented as shown in Figure 4 below.

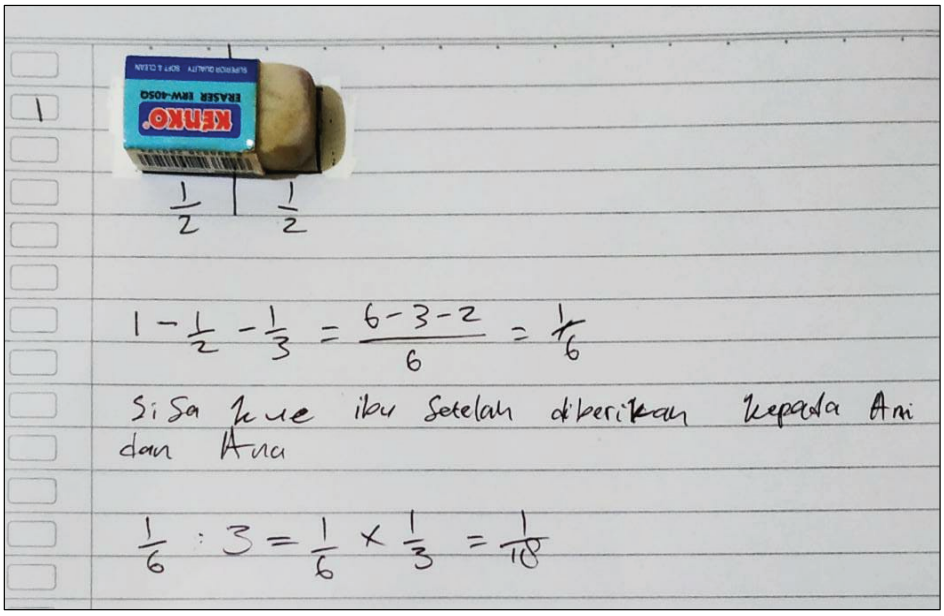

Figure 4: Deaf Student in Kinesthetic Learning Style' Answers with Associate The Objects Around.

First, students associate objects around them with the problem presented, namely the rubber eraser. They use a rubber eraser to illustrate his thing considered important in the problem as a form of representation of a cake. Then they divide the rubber eraser into two parts and give information that the object represents part of the cake for each piece of a rubber eraser, as shown in Figure 4 above. This activity suggests that students

with kinesthetic learning styles can pay attention to the importance of a given problem and achieve sub-skill indicators: focused. Figure 4 also shows that students can further explain what the mentioned terms mean or achieve sub-skill indicators, namely clarify. They present their interpretation of what they mean by the rubber eraser they attach to the paper. For example, $\frac{1}{2}$ part of the cake is placed under the rubber eraser that he attaches to the paper. Although it has achieved some indicators of critical thinking sub-skills, deaf students with kinesthetic learning styles haven't been able to use all the information following the cake section's problem. This condition is evident from their answer in Figure 3, which shows that they use only some information, i.e., only write $\frac{1}{2}$ part of the cake. The students should also use other information in the problem, namely information about the 'various possibilities of the rest of the cake based on the number of maternal nieces who came.

The student's inability to use information appropriate with fractional problems makes deaf students with kinesthetic learning styles have difficulty making correct conclusions. This problem is evident from students' written answers, who concluded that the possibility of the rest of the mother's cake after the mother gave this cake to Ani and Ana was $\frac{1}{18}$. It means an indicator sub-skill, namely, the reason isn't achieved. As an implication of not using information following the problem, students aren't fully able to provide logical reason based on relevant facts/evidence at each stage of making conclusions. That means the students still haven't achieved the indicator sub-skill, namely inference, and reasoning. Deaf students who are kinesthetic learning also have a level of critical thinking with categories in solving fractional problems because deaf students like to learn through manipulation and practice and like books oriented to flow and content as delivered by Wahyuni (12). It is known that all types of learning styles have their characteristics in learning activities, such as in solving problems. Because in principle, all students have positive potential in developing their ability to solve mathematical problems so that every student can think critically, as conveyed by Purwoko et al. (16).

The teacher should know the variety of student learning styles to choose and use learning methods that are suitable and liked by their students. The application of suitable and liked methods by students will have implications for the quality of learning and the teacher's effectiveness (17). The suitability of learning methods can also minimize the occurrence of student misconceptions. Because it, the teacher's model of delivering material affects the construction of student knowledge based on the suitability of the initial concept with the scientific concept (18). Therefore, in learning fractions, it is necessary to pay more attention to students' learning styles which will be very helpful in learning fractions as one of the arithmetic operations that require a concrete-experience

and language skills. Do not let students memorize so that their ability to represent arithmetic operations is limited (19).

4. Conclusions

This study concludes that the critical thinking skills of deaf students in each type of learning style have different critical thinking sub-skills. This condition is due to the characteristics of each different learning style. This study shows that the achievement of the critical thinking sub-skills of deaf students in understanding the concept of fractions is influenced by their learning style, with inference, situation, and clarity sub-skills being critical thinking sub-skills that are difficult for students to achieve. Visual learning style students tend to associate problems with pictures, while kinesthetic learning style students tend to associate problems through manipulation of concrete objects around them.

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