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The Habituation of Critical Thinking in Mathematics Learning in the Primary School

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Abstract. The research objective of this study is to describe the habituation and exemplary critical thinking of students in the following activities: 1) preliminary, 2) core, and 3) closing mathematics learning in the primary school. The type of this research was ethnographic qualitative research. The research was conducted at Sekolah Dasar Muhammadiyah 16 Karangasem Surakarta in the 2019/2020 school year. Data collection techniques of this study were participatory observation, in-depth interviews, and document analysis. Data validation was accomplished by having triangulation of sources and methods. Data analysis techniques were completed inductively. The results of the research showed that the process of habituation and exemplary of critical thinking in learning mathematics was done in the preliminary, core, and closing activities. The critical thinking ability profile shows that students were able to 1) determine known problems and information, 2) decide ideas to solve problems, 3) determine procedures for answering problems, and 4) thoroughly re-check the answer process. Habituation and exemplary of critical thinking on the first indicator showed that students were able to propose problems to be discussed and determine information related to fraction questions. Habituation and exemplary of critical thinking on the second indicator indicated that students were able to provide logical reasons in the form of ideas to solve problems. Habituation and exemplary of critical thinking on the third indicator demonstrated that students were able to complete math problems with the correct procedure. Habituation and exemplary of critical thinking on the fourth indicator indicated that students were able to take action in the form of re-checking problem-solving.

Keywords: critical thinking, mathematics, habituation, learning.

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INTRODUCTION

Education in the 21st-century is becoming increasingly crucial to ensure that students have the skills to use technology and media information. Problem-based and project-based learning is an alternative learning strategy that is ideal for integrating the character of 21st-century skills, i.e., critical thinking, communication, collaboration, and creativity.

Habituation of critical thinking for students is implemented to provide new changes in mathematics learning. One of the characteristics of new changes in mathematics learning is a good mastery of mathematical concepts. The results of the study (Furwati & Zubaidah, 2017) conclude that students who are able to master mathematical concepts well will be able to solve problems correctly.

Internationally, the low critical thinking skills in Indonesia are shown by the results of the 2015 PISA and TIMSS. According to 2015 PISA results (OEDC, 2018), Indonesia obtained an average math score of 386 from the highest average score of 490 and Singapore attained the highest score of 564. Meanwhile, the results of TIMSS (2015) showed that Indonesia acquired a math score of 397 from the highest score of 618, which was

achieved by Singapore. Based on the mathematical value of the PISA and TIMSS data, it is necessary to make efforts to habituate critical thinking since the early stage of learning mathematics.

Critical thinking is logical thinking that focuses on decision making. Critical thinking requires students to be able to understand the concepts in every act of learning. Habitual critical thinking skills are strongly crucial so that students are more skilled in composing arguments and making decisions. The results of the PISA and TIMSS studies show that critical thinking in Indonesia is at a relatively low level. It is because students have not reached the level of independence, i.e., understanding concepts, formulating problems, and communicating information (Eriana, Kartono, & Sugianto, 2018). It means that the problem of critical thinking becomes the teacher's strongly urgent concern.

The results of a preliminary study conducted by researchers at Sekolah Dasar Muhammadiyah 16 Karangasem Surakarta demonstrated that students were able to think rationally in responding to a problem, had not seemed able to make the right decisions in solving problems and had not been able to formulate arguments correctly and systematically. Furthermore, the results of observations on teacher mathematics learning indicated that the teacher tended to use the lecturing method with the use of PowerPoint to convey the concept of mathematics material. It can be interpreted that the habituation of critical thinking had not been optimally performed in learning mathematics in primary schools where the research was completed. According to (Narmaditya et al., 2017), learning activities that can encourage students to have critical thinking skills need to habituate to various activities such as asking questions, discussing, and solving problems through innovative strategies.

As stated earlier, problem-based and project-based learning strategies are alternatives to habituate students with critical thinking. According to (Novitasari, M., Sutama, Narimo, S., Fathoni, 2019), mathematics learning is one of the implementations of integrated activities to develop student potential and abilities. Furthermore, it is said that mathematics material is comprehended through critical thinking while critical thinking is exercised through a series of mathematics learning processes. It can be interpreted that teacher creativity to learners is the dominant factor in practicing students' critical thinking.

The results of interviews with primary school teacher where the study was conducted showed that to minimize the limitations of skills in learning, teachers attempted to take part in learning workshops both inside and outside the school. It is in line with (Bonghanoy, Sagpang, Alejan & Rellon, 2019) who stated that teachers continuously need to take part in teaching professionalism development training to create transformative learning, increase literacy and student interest, and make teacher performance better. Teacher skills training in mastery of digital literacy triggers students to analyze information, evaluate, and create information in asking and answering mathematical problems (Novitasari et al., 2020).

The habituation of critical thinking will be optimal if the teacher is able to apply learning strategies for understanding the concepts with a variety of methods and habituate himself with exercises based on High Order Thinking Skills (HOTS). To make students easily understand mathematical concepts, one alternative is that the subject matter is associated with what students are familiar with. It is supported by the opinion of (Afifah, Khoiri, & Qomaria, 2018), which states that mathematics teachers must connect mathematics concepts with everyday life.

Higher-order thinking (HOT) minimizes the ability to recall information while the assessment measures more ability. HOT is the ability to think of individuals at a higher level, including critical, logical, metacognitive, and creative thinking. HOT occurs when individuals are able to connect new information with information that has been previously owned, then make solutions to problems in previously unknown contexts. It is based on the Regulation of the Minister of Education and Culture Number 23 of 2015, which states that students need to be habituated to work on HOTS questions with group exercise and independent exercise to habituate thinking critically, logically, metacognition, and creatively. Through this continuous practice, the teacher analyzes the students' critical thinking processes for the next learning action (As'ari, Kurniati, & Subanji, 2019). Thus, teachers must have superior pedagogic and professional competence in solving problems, be skilled in facilitating students to have high self-confidence, and create something creative and innovative in a pleasant learning atmosphere.

Becoming a teacher requires solemnity, seriousness, and sincerity in its main duties and functions. A teacher who is creative and innovative shows a "flexible" attitude, is not boring, and has many new ideas in the learning process, thus, presents a comfortable, warm, interesting, and pleasant classroom atmosphere. The creative and innovative teacher can be the answer to the difficulty of delivering material that is fun and easy to understand. Critical thinking demands creative and innovative teacher performance. It is in line with the

argument of (Supriadi, 2017) who states that creative and innovative learning can work well because every teacher has the proper effort in facilitating students to master science, technology, values, and skills.

A creative and innovative teacher needs to analyze critical thinking indicators that have been mastered by his students. Indicators of critical thinking are IDEALS (Peter, 2012), i.e., 1) Identify: mentioning the subject matter, 2) Define: stating the facts the limitation of the problem (stating the information needed, including what is known and asked in the questions, and mentions information that is not used), 3) Enumerate: mentioning the choice of means and logic answers, 4) Analyze: analyzing the options to choose the best method and answer, 5) List: stating the correct reasons for the method and the best answer that is chosen, and 6) Self -Correct: thoroughly re-checking the answer process. Indicators of critical thinking according to (Ainiyah, Suyitno, & Winarti, 2018) are 1) clarification related to proposing problems to be discussed, and determining information; 2) assessment related to providing logical reasons in the form of ideas to solve problems; 3) inference related to specific procedures to solve problems; 4) strategy related to taking action in the form of solving mathematical problems.

Based on this description, the indicators of critical thinking in this study are 1) determining known problems and information, 2) deciding the ideas to solve problems, 3) determining procedures for answering problems, and 4) re-checking the answer process thoroughly. The research objective in this article described the habituation of four indicators of critical thinking in 1) opening activities, 2) core activities, and 3) closing activities for learning mathematics in primary schools.

RESEARCH METHODS

This research was a qualitative ethnographic study. This study guided researchers to explore and depict social situations (Sutama, 2019) regarding the habituation of critical thinking in mathematics in primary school. The research was conducted at SD Muhammadiyah 16 Karangasem Surakarta in the 2019/2020 academic year.

Data collection techniques of this study were participatory observation, in-depth interviews, and document analysis. The participatory observation was conducted during the mathematics learning process at the primary school where the research was conducted. The participatory observation was applied to observe student and teacher activities in the learning process related to student activities and abilities and the skills of teachers to habituate critical thinking.

In-depth interviews were conducted with students and teachers. Interview with students was related to critical thinking skills on the indicators of 1) determining known problems and information, 2) deciding ideas for solving problems, 3) determining procedures for answering problems, and 4) thoroughly re-checking the answer process. Interview with teachers was concerning with the strategies for habituation of critical thinking on indicators of 1) determining known problems and information, 2) determining ideas to solve problems, 3) determining procedures for answering problems, and 4) re-checking the answer process thoroughly.

Document analysis was performed to analyze the archive of learning media and the results of student mathematics work. Archives of learning media associated with lesson plans, student activity sheets, and learning media.

The research data validation was completed by triangulation of sources and methods. Analysis of research data was done inductively with the process of data collection, data reduction, data presentation, and drawing conclusions, which were completed reciprocally (Sutama, 2019). Data collection activities to data analysis in this research article are illustrated in Figure 1.

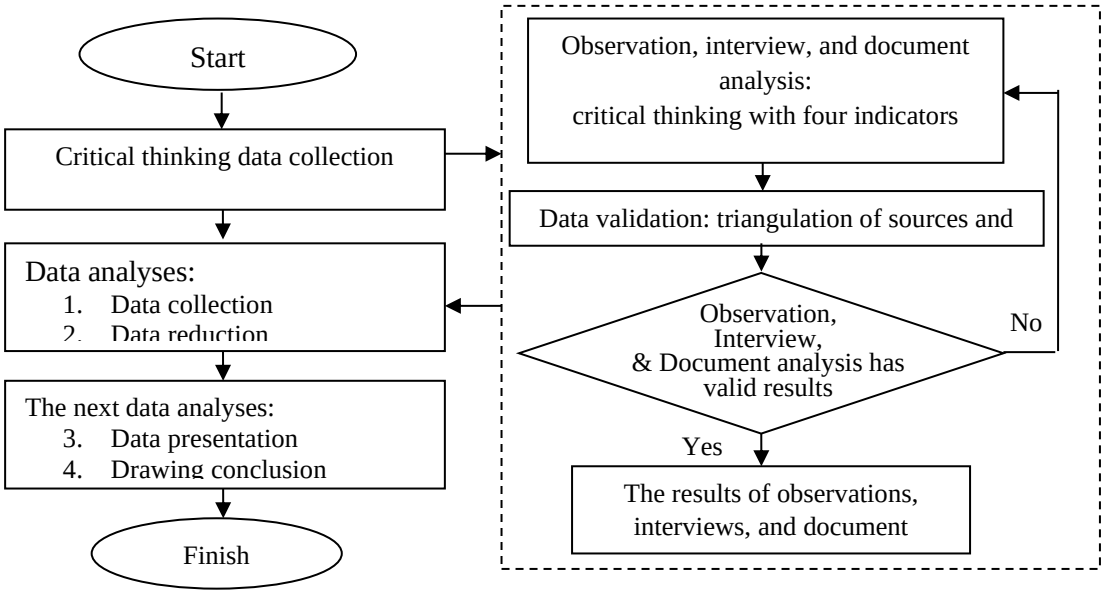


Figure 1: *Data collection activities to data analysis*

RESULTS AND DISCUSSION

The habituation of critical thinking in the preliminary mathematics learning activities indicated that the primary school teacher where the research habituated and set an example by Smiling, Addressing, Greeting, Polite, and Courtesy (*Senyum, Salam,* Sapa*, Sopan, Santun* or 5S). With the formation of the ability to think critically with the 5S, the primary school teacher taught to respect others wherever they are (in the classroom, the teacher respects students, students respect teachers, and students respect each other). Furthermore, the teacher stated that habituation and exemplary with the 5S will have an impact on 1) understanding of polite thinking for any problems faced in learning, 2) curiosity, and 3) other abilities to apply thinking skills. It is supported by the results of research from (Sutama, Narimo, et al., 2020), which state that to habituate and set an example in learning mathematics literacy, students need to show benefits both in the process, output, and outcome of the material studied politely and with mutual respect. It means that at the beginning of each meeting and repeated (as needed) in learning, students need to be comfortable, happy, have high curiosity, and respect each other.

In the preliminary activity, the teacher implemented the question and answer method and interactive lectures in the Problem Based Learning (PBL) strategy with PowerPoint media, folding paper, and fraction stick media. The question and answer method was implemented in classroom conditioning for readiness to learn, perception, and motivation. During the conditioning, besides greeting and praying with one of the students leading, the teacher asked about the health and readiness of students to learn.

In the teacher's perception, the teacher applied a PowerPoint that contains mathematical material that has been mastered, new material to be studied, and the teacher asked its relevance. Examples of questions given by the teacher for material that students have mastered is "try to explain the steps for the addition/subtraction operation of the two denominated fractions, who wants to answer please raise your hand". With enthusiasm, most of the students raised their hands, and one of the students was invited to answer, "the number above is added/subtracted by the other number above and then divided by one of the numbers below". The teacher provided feedback, "It is very good. The number above is called the "numerator" and the number below is called the "denominator". The addition/subtraction of the two denominators is the same, i.e., the sum/difference of the two numerators is divided by one of the denominators of the two fractions. It means that through this example, the teacher habituated and set an example of critical thinking in the aspects of determining known problems and information and determining ideas for solving problems.

An example of a question given by the teacher for the new material to be studied was "now, try to explain the steps of the addition/subtraction operation for two fractions that are not the same, who wants to answer please raise your hand". By asking their friends, most of the students did not dare to raise their hands,

then the teacher with guiding the questions (remember two fractions can be added/subtracted if the denominator is ....) finally one of the students raised his hand and was invited to answer. With the teacher's guidance, students answered "the first step of two fractions is equalized by the denominator (with the denominator of least common multiple or KPK), the second is the sum/difference of the two numerators is divided by one of the denominators of the two fractions that have been equalized. It means that through this example, the teacher habituated and set an example of critical thinking in aspects of the procedure for answering the problem.

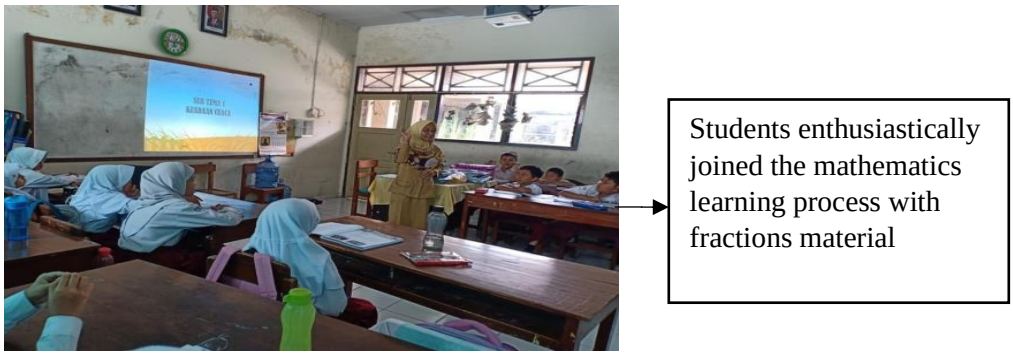


Figure 2. *Preliminary activities*

In motivational activities, the teacher asked about the benefits of learning fractions. If students know the benefits of the material being studied, students will have a high commitment to learning. In this case, students must understand the concept of fractions and use them in their daily life calculations. Through power points and questions and answers, the teacher showed examples of fraction questions in everyday life as follows.

> "A brother bought 1 large bread to eat with three younger siblings. Each younger sibling eats 1/8 portion, and the brother eats 1/4 part more than younger siblings". How many pieces of bread did they not eat?

By showing these examples, the teacher emphasized that learning fractions will be strongly useful both for learning and in everyday life. It is in line with (Sutama, Prayitno, Ishartono, & Sari, 2020) who state that to motivate learning, teachers must always show the benefits, facilitate, and guide students in problem-solving, namely what is known, how to solve it, and how to calculate it. This description can be interpreted that the teacher had guided critical mathematical thinking in the aspects of determining known problems and information, deciding ideas for solving problems, and determining procedures for answering problems.

The teacher implemented an interactive lecture method with the help of power points to show the objectives while the learning process applied with the PBL strategy. Learning objectives that were presented in PowerPoint are as follows.

Cognitive Products

1. By being given a problem of adding up two unequal denominators, students can add up two unequal denominators correctly.
2. By being provided a problem of subtracting two unequal denominators, students can subtract two unequal denominators correctly.

Cognitive Process

1. By being given an operation problem for the addition of two unequal denominators, students can explain the steps for the operation to add two unequal denominators correctly
2. By being provided a problem of the subtraction operation for two unequal denominators, students can explain the steps of the operation to subtract two unequal denominators correctly.

Psychomotor

1. By using the folding paper and the props provided, students can add up the two unequal fractions correctly.
2. By utilizing the folded paper and the props provided, students can write down the two unequal denominated fractions correctly.

Affective

1. Developing character behavior, including:

a. students are able to be fun friends while having questions and answers
b. students are able to understand and respect each other's opinions
c. students are able to perform tasks properly and full of responsibility
2. Developing social skills
a. students are able to communicate verbally
b. students are able to communicate in writing form".

The learning objectives describe clearly that the teacher habituates and sets an example of critical mathematical thinking in four aspects, i.e., 1) determining known problems and information, 2) deciding ideas for solving problems, 3) determining problems procedures, and 4) re-checking the answer process thoroughly.

PBL learning was conducted in stages of 1) giving student orientation to the problem; 2) organizing students; 3) guiding individual and group investigations; 4) Developing and presenting the work; and 5) analyzing and evaluating the problem-solving process. During the pause of learning, the primary school teacher in the study stated that with PBL, it is hoped that both I (the teacher) and the students will be active. It is supported by the results of research (Sutama, Prayitno, et al., 2020), which conclude that many potential teachers and students need to be developed to be active and productive. It means that through PBL, students are facilitated to actively develop their potential in all aspects of critical thinking.

The results of the interview with the primary school teacher where the study was conducted indicated that the use of appropriate methods, media, and learning strategies become a supporting component of the critical thinking process. Furthermore, through the PBL strategy, students are encouraged to think critically, analyze information, and solve problems by asking or answering questions. It is reinforced by the results of research (Nugraha, 2018), which conclude that the implementation of the Problem Based Learning strategy can improve critical thinking skills and learning outcomes of primary school students. The results of the study (Maulidiya & Nurlaelah, 2019) reveal that Problem Based Learning is a learning strategy that can improve critical thinking skills and involve the active role of students and teachers in managing learning.

The habituation of critical thinking in the core activities of learning mathematics began by repeating the questions in the initial activities as presented below.

The excerpt of questions and answers from teachers and students in the early stages of core mathematics learning activities is presented below:

(G = teacher; S = students).

M: Can you understand the addition of two fractions with different denominators?

S: Yes, by equating the denominator first.

M: What do you do to equalize the denominator?

S: By finding the KPK (least common multiple).

Based on the question and answer excerpt above, with the teacher's guidance students were able to solve the (simple) problem of fractions with a different denominator, namely $\frac{2}{3}+\frac{4}{5}=\frac{2\times5}{3\times5}+\frac{4\times3}{5\times3}=\frac{10}{15}+\frac{12}{15}=\frac{22}{15}$. Finally, through the question and answer session, the teacher wrote the summary formula to always be understood in the addition or subtraction of two fractions with a different denominator as following.

$$\frac{a}{b}+\frac{c}{d}=\frac{ad+cb}{bd} \qquad \frac{a}{b}-\frac{c}{d}=\frac{ad-cb}{bd}$$

It indicates that the teacher's habituation of repeating important concepts can make students think critically well. This activity aims to habituate students with both learning in groups and independent learning to understand concepts before analyzing problems in learning. It is in line with the results of research (Ronald A. Styron, Jr., 2014), which reveal that team-based learning is effective learning for students to think critically.

The core activity was continued by implementing the PBL strategy. The teacher has conducted the first stage (giving the student orientation to the problem) and the second stage (organizing students in a fun). In the first stage, the teacher explained the learning objectives and activities to be conducted. The teacher used to motivate students to be actively involved in solving the selected problem. In the second stage, the teacher assisted students to define and organize learning tasks related to problems that have been oriented.

The results of observations showed that the teacher guided to generate hypotheses on the problems found. Students were able to propose problems for discussion and were able to determine known information.

Examples of work results $\frac{3}{7}-\frac{2}{8}=\frac{3-2}{7-8}=-1$ indicated the wrong concept but one of the students could do it right: $\frac{3}{7}-\frac{2}{8}=\frac{3\times 8}{7\times 8}-\frac{2\times 7}{7\times 8}=\frac{24}{56}-\frac{14}{56}=\frac{10}{56}$. Based on this work, students could state what they understand from the subtraction formula of two fractions with different denominators and could state the information that was recognized so that it became a keyword in solving the problem. Students with the habituation of critical thinking will improve conceptual understanding and in turn better mathematics learning outcomes. It is reinforced by the results of research (Setyaningrum, 2018), which state that conceptual understanding and basic concept understanding make student learning outcomes better.

The third, fourth, and fifth stages of PBL were performed by the teacher in conducive and pleasant conditions. In the third stage, the teacher encouraged students to collect as much information as possible, conduct experiments, create and share their own ideas to obtain explanations and problem-solving. In the fourth stage, the teacher facilitated students in analyzing the data that has been collected in the previous stage. Have the data been in line with the problems that have been formulated and grouped based on their categories? Students provided arguments about answers to problem-solving. In the fifth stage, the teacher asked students to reconstruct the thoughts and activities that have been conducted during the learning process. Teachers and students analyzed and evaluated the problem solving presented by each group. Figure 3 shows one of the groups represented by a student presenting the results of her group work. Students were able to provide logical reasons in the form of ideas to solve problems.

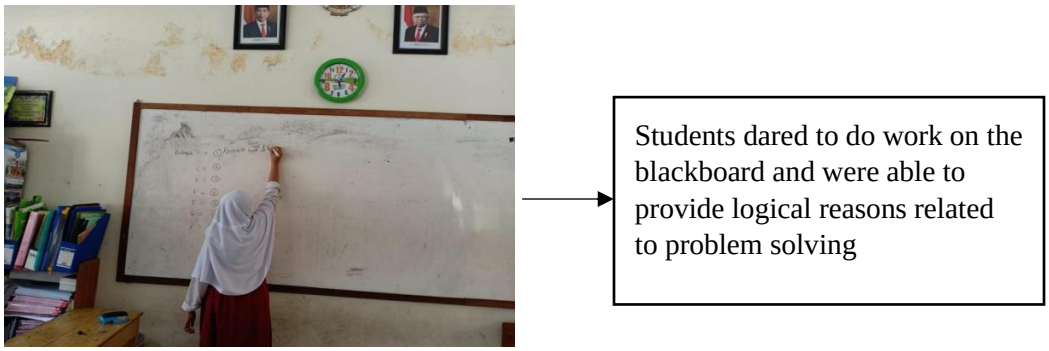


Figure 3. *The student presented the result of her group work*

Figure 3 shows that students with high curiosity had the courage to do and gave reasons in front of the class regarding fractions. The impact of critical thinking on indicators of conveying ideas to solve problems is skillful communication and independence in learning mathematics. (Hidayah, Salimi, & Susiani, 2017) state that students improve their critical thinking process by utilizing ideas or information and making the best decisions in the mathematics learning process.

Furthermore, the results of observations and interviews with the teacher where the study was conducted show that students were able to use specific procedures in solving problems and thoroughly re-checking the answer process. For example in Figure 4, students with teacher guidance were enthusiastic about solving fraction problems using the correct specific procedure.

Through teacher guidance, students were able to solve questions with correct procedures in accordance with the provisions

Figure 4. *Students used a specific procedure to solve the problem*

Figure 4 demonstrates that with or without teacher guidance, students were able to solve problems with correct procedures and rechecked either independently or collaboratively. The impacts of the habituation of critical thinking on indicators using problem-solving procedures and rechecking answers thoroughly are students were more reflective and had high self-confidence in learning mathematics. It is confirmed by the results of research (Purwati, Ratna & Fatahillah, 2016), which discovered that the creative problem-solving learning model is able to create problem-solving skills with various ideas to solve problems optimally.

The habituation of critical thinking on indicators of determining ideas for solving mathematical problem strategy is done by playing problem-based in groups. Figure 5 shows the students were playing with fraction cards.

Students played to habituate to critical thinking on indicators of developing problem-solving strategies

Figure 5. *Students were playing fraction cards*

In the core activity, students were divided into several groups. Each group was given the task to solve the problem of adding different fractions to the denominator, namely ½ + 1/3 = ..., by using a shaded block or shape demonstration. As long as students completed the assignment, the teacher guided while assessing the process. Student work was expected to lead to a fraction of ½ to be 3/6 and the fraction of 1/3 to be 2/6, which is a fraction of its value. Since the denominator became the same, the sum could be solved. The teacher reiterated that if the sum of the fractions is different from the denominator, then the fraction with the denominator must be equalized first by finding the fraction of its value. This learning activity is supported by research results (Fatimah, Sutama, & Aly, 2020), which state that creativity can be encouraged through the effectiveness of learning in the classroom. It means that habituating critical thinking to indicators of developing problem-solving strategies can be done by giving students space for creativity.

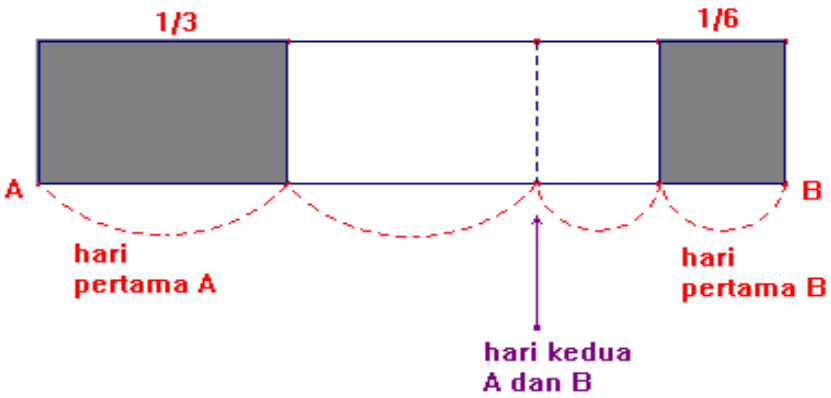
After playing with fraction cards, learning activities were continued with solving fraction problems in the content of daily life questions as follows.

> "If a job is done by A, then in one day the work is completed by a third. Meanwhile, if it is done by B, then one job will be completed in six days. If the two of them do it together, how many days can it be done? "

With the teacher's assistance, students were able to think critically related to 1) Determining known problems and information, if A does, then the work will be completed in 3 days. If B does, then the work is finished in 6 days. Or, the statement can be changed to: If A does, then $\frac{1}{3}$ of his part will be done in a day. If B does, $\frac{1}{6}$ of his part will be done in a day. 2) Deciding the ideas to solve the problem. For example, person A and person B negotiate to work together so that a conversation occurs.

A: "Let's finish this job together. So, we can finish it more quickly."
B: "Okay, but how?"
A: "I will start from the left side and you start from the right. At the end of the work, we will meet in the middle. "
B: "That is a great idea. Let's begin!"

Based on this conversation, a problem-solving model was created which can be illustrated in Figure 6.



Hari pertama A: The first day of A
Hari pertama B: The first day of B
Hari kedua A dan B: The second day of A and B

Figure 6. *Problem Solving Model*

3) determining the procedure for answering the problem, and 4) re-checking thoroughly the answer process that is conducted in the process. Based on the illustration in Figure 6, students found the answer, that was, if A and B work together, then the work is completed within 2 days. It indicates the student could take action in the form of problem-solving and re-checking. Thus, the habituation of critical thinking on indicators of taking action in the form of problem-solving is shown by students by following directions and guidance from the teacher to solve math problems about fractions. The teacher implemented a problem-based learning strategy with students collaborating and being enthusiastic about the process from the beginning to the end of learning.

Based on the explanation of the content of Figure 6, it shows the importance of students learning to collaborate considering the weaknesses and strengths of their thinking skills. It is in line with the research results (Julia & Isrokatun, 2019); (Fatimah et al., 2020), which confirm that through collaborative work, students can evaluate skills and encourage project-based learning. Furthermore, students who have metacognitive knowledge will be able to control themselves to do or not do something. It is also reinforced by the opinion (Sutama, Anif, Prayitno, & Sari, 2019), which agree that students who have metacognitive knowledge will have more optimal achievement than students who do not have metacognition knowledge. According to (Thayeb & Putri, 2017), students who being practiced to use metacognitive abilities can improve math problem-solving skills from the beginning to the end of learning. It means that the teacher's policy is to

form metacognitive abilities. Thus, students have more complete basic abilities in line with their knowledge and experience.

The habitation of critical thinking in the closing activities of mathematics learning is that the teacher provided a reflection on making conclusions, post-test, and follow-up. Through question and answer, students reflected on the material that had been studied, both material that had been or had not been mastered, and alternative actions for subsequent learning. Also, through questions and answers, students were guided to write conclusions about the teaching material they had learned. Students worked on the post-test independently without opening teaching materials. In the follow-up learning, at home, students and their parents were asked to watch mixed fraction and decimal learning videos and note the basic concepts and search problems to be solved together at school. This closing activity can habituate and set examples of critical mathematical thinking in four aspects, namely 1) determine known problems and information, 2) decide ideas to solve problems, 3) determine procedures for answering problems, and 4) thoroughly re-check the answer process. The lesson ended with prayers and greetings.

CONCLUSION

The process of habituation and exemplary critical thinking in mathematics learning at Sekolah Dasar Muhammadiyah 16 Karangasem Surakarta was performed starting from the stages of preliminary activities, core activities, and closing activities. The profiles of the critical thinking ability of the fourth-grade students of Sekolah Dasar Muhammadiyah 16 Karangasem Surakarta in the 2019/2020 school year were able to 1) determine known problems and information, 2) decide ideas to solve problems, 3) determine procedures for answering problems, and 4) thoroughly re-check the answer process.

Habituation and exemplary of critical thinking on indicators of determining known problems and information indicated that students were able to propose problems to be discussed and determined information related to math fraction problems. Habituation and exemplary critical thinking on indicators of determining ideas for solving problems showed that students were able to provide logical reasons in the form of ideas to solve math problems. Habituation and exemplary critical thinking on indicators of deciding the procedures to answer problems confirmed that students were able to work on math problems with the correct procedure. Habituation and exemplary critical thinking on the indicators of thoroughly rechecking the answer process demonstrated that students were able to take action in the form of re-checking problem-solving.

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REFERENCES

Afifah, A., Khoiri, M., & Qomaria, N. (2018). Mathematics Preservice Teachers ' Views on Mathematical Literacy. *International Journal of Trends in Mathematics Education Research*, *1*(3), 92–94.

Ainiyah, Q., Suyitno, H., & Winarti, E. R. (2018). Analisis Kemampuan Berpikir Kritis Matematis Pada Pembelajaran PSPBL Berbantuan Smart Point Ditinjau dari Kemandirian Belajar. *Prisma Https://Journal.Unnes.Ac.Id/Sju/Index.Php/Prisma/*, *1*, 279–288.

As'ari, A. R., Kurniati, D., & Subanji. (2019). TEACHERS EXPECTATION OF STUDENTS ' THINKING PROCESSES IN WRITTEN WORKS : A SURVEY OF TEACHERS ' READINESS IN. *Journal on Mathematics Education*, *10*(3), 409–424.

Bonghanoy, G. B., Sagpang, A. P., Alejan, R. A., & Rellon, L. R. (2019). Transformative professional development for mathematics teachers. *Journal on Mathematics Education*, *10*(2), 289–302. https://doi.org/10.22342/jme.10.2.6882.289-302

Eriana, Kartono, & Sugianto, &. (2018). Understanding Ability of Mathematical Concepts and Students' Self-reliance towards Learning by Implementing Manipulative Props (APM) on Jigsaw Technique. *Journal of Primary Education*, *0*, 176–183.

Fatimah, M., Sutama, & Aly, A. (2020). Religious culture development in community school: A case study of boyolali middle school, Central Java, Indonesia. *Humanities and Social Sciences Reviews*, *8*(2), 381–388. https://doi.org/10.18510/hssr.2020.8243

Furwati, S., & Zubaidah, S. (2017). Conceptual Understanding and Representation Quality on Newton's Laws through Multi-Representation Learning. *Jurnal Pendidikan Sains*, *5*(3), 80–88.

Hidayah, R., Salimi, M., & Susiani, T. S. (2017). CRITICAL THINKING SKILL: KONSEP DAN INIDIKATOR PENILAIAN. *Jurnal Taman Cendikia*, *1*(02), 127–133.

Julia, J., & Isrokatun, I. (2019). Technology literacy and student practice: Lecturing critical evaluation skills. *International Journal of Learning, Teaching and Educational Research*, *18*(9), 114–130. https://doi.org/10.26803/ijlter.18.9.6

Maulidiya, M., & Nurlaelah, E. (2019). The effect of problem based learning on critical thinking ability in mathematics education. *Journal of Physics: Conference Series*, *1157*(4). https://doi.org/10.1088/1742-6596/1157/4/042063

Narmaditya, B. S., 2, 1, Wulandari, D., 1, & and Siti Rosnita Binti Sakarji. (2017). DOES PROBLEM-BASED LEARNING IMPROVE CRITICAL THINKING SKILLS? *Cakrawala Pendidikan*, (3), 378–388.

Novitasari, M., Sutama, Narimo, S., Fathoni, A. (2019). Promoting Literacy Culture and Character Education to form High-Level Thinking Students in Elementary School. *International Journal of Innovative Science and Research Technology*, *4*(9).

Novitasari, M., Sutama, Narimo, S., Fathoni, A., Rahmawati, L., & Widyasari, C. (2020). Habituation of digital literacy and critical thinking in mathematics in elementary school. *International Journal of Scientific and Technology Research*, *9*(3), 3395–3399.

Nugraha, W. S. (2018). PENINGKATAN KEMAMPUAN BERPIKIR KRITIS DAN PENGUASAAN KONSEP IPA SISWA SD DENGAN MENGGUNAKAN MODEL PROBLEM BASED LEARNING. *EduHumaniora: Jurnal Pendidikan Dasar*, *10*(2), 115–127.

OEDC. (2018). Pisa 2015. In *PISA Results in Focus* (pp. 2–32).

Peter, E. (2012). Critical thinking: Essence for teaching mathematics and mathematics problem solving skills. *African Journal of Mathematics and Computer Science Research*, *5*(3), 39–43. https://doi.org/10.5897/ajmcsr11.161

Purwati, Ratna, H., & Fatahillah, A. (2016). ANALISIS KEMAMPUAN BERPIKIR KRITIS SISWA DALAM MENYELESAIKAN MASALAH PERSAMAAN KUADRAT PADA PEMBELAJARANMODEL CREATIVE PROBLEM SOLVING. *Kadikma*, *7*(1), 842.

Ronald A. Styron, Jr., E. D. (2014). Critical Thinking and Collaboration: A Strategy to Enhance Student Learning. *SYSTEMICS, CYBERNETICS AND INFORMATICS*, *12*(7), 1–2. https://doi.org/10.1038/132817a0

Setyaningrum, W. (2018). Blended Learning: Does it help students in understanding mathematical concepts? *Jurnal Riset Pendidikan Matematika*, *5*(2), 244–253. https://doi.org/10.21831/jrpm.v5i2.21428

Supriadi, D. (2017). Implementasi Manajemen Inovasi dan Kreatifitas Guru dalam Meningkatkan Mutu Pembelajaran. *Indonesian Journal of Education Management and Administration Review*, *1*(2), 125–132.

Sutama. (2019). Metode Penelitian Pendidikan; Kuantitatif, Kualitatif, PTK, Mix Methods, R&D. In *Journal of Chemical Information and Modeling* (Vol. 53). https://doi.org/10.1017/CBO9781107415324.004

Sutama, Anif, S., Prayitno, H. J., & Sari, D. P. (2019). Metacognitive knowledge of mathematics education students in analytical geometry of space. *Journal of Physics: Conference Series*, *1211*(1). https://doi.org/10.1088/1742-6596/1211/1/012056

Sutama, Narimo, S., Anif, S., Prayitno, H. J., Sari, D. P., & Adnan, M. (2020). The development of student worksheets: Questions of PISA model to analyze the ability of mathematical literacy in junior high school. *Journal of Physics: Conference Series*, *1538*(1). https://doi.org/10.1088/1742-6596/1538/1/012065

Sutama, Prayitno, H. J., Ishartono, N., & Sari, D. P. (2020). Development of Mathematics Learning Process by Using Flipped Classroom Integrated by STEAM Education in Senior High School. *Universal Journal of Educational Research*, *8*(8), 3690–3697. https://doi.org/10.13189/ujer.2020.080848

Thayeb, T., & Putri, A. P. (2017). Kemampuan Metakognisi Untuk Meningkatkan Keterampilan Pemecahan Masalah Matematika Siswa Kelas Viii B Mts Madani Alauddin Paopao Kabupaten Gowa. *MaPan*, *5*(1), 1–17. https://doi.org/10.24252/mapan.2017v5n1a1

TIMSS, P. &. (2015). International Mathematics Achievement. In *SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015.* (p. http://timss2015.org/download-center/).