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Submission date: 17-Apr-2023 10:13PM (UTC+0700)

Submission ID: 2067288406

File name: Mathematical Reflective Thinking Process of Prospective Elementary Teachers Review from the Disposition in Numerical Literacy Problems.pdf (857.73K)

Word count: 9350

Character count: 50555

Research Article https://doi.org/10.12973/ijem.8.3.405

International Journal of Educational Methodology
Volume 8, Issue 3, 405 – 420.

ISSN: 2469-9632
https://www.ijem.com/

Mathematical Reflective Thinking Process of Prospective Elementary Teachers Review from the Disposition in Numerical Literacy Problems

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Received: February 20, 2022 ▪ Revised: April 4, 2022 ▪ Accepted: June 9, 2022

Abstract: The purpose of this qualitative research is to analyze the reflective thinking process of prospective elementary teacher in numeracy problems in terms of their mathematical disposition. The subjects in this study were 26 prospective elementary school teachers who had attended elementary mathematics lectures. The focus in this research is the process of mathematical reflective thinking in solving story problems of a two-variable linear equation system in terms of the level of mathematical disposition. The research instrument consisted of a disposition questionnaire, a reflective thinking ability test and the researcher himself as the main instrument. Good mathematical reflective thinking skills are supported by disposition, by constantly monitoring one's own performance, reflecting on one's own performance, reasoning on one's own performance, considering the overall situation, the habit of analyzing the relationship between variables, being flexible in various alternative solutions to mathematical problems and trying to solve mathematical problems. From the results of this study, lecturers can develop learning media, scaffolding, or teaching materials that accommodate different dispositional abilities of prospective teachers that can be used to improve the reflective thinking process.

Keywords: *Disposition, numeracy problems, reflective thinking process.*

To cite this article: Setiyani, Waluya, S. B., Sukestiyarno, Y. L., & Cahyono, A. N. (2022). Mathematical reflective thinking process of prospective elementary teachers review from the disposition in numerical literacy problems. *International Journal of Educational Methodology*, *8*(3), 405-420. https://doi.org/10.12973/ijem.8.3.405

Introduction

One of the main domains of 21st century competence is the ability to think that must be possessed by graduates at every level of education (Muntazhimah et al., 2021). Thinking is a cognitive process that is always carried out by each individual and continues (Mentari et al., 2018). Learning mathematics is synonymous with thinking activities to develop competencies, skills, and attitudes (Mentari et al., 2018; Sani, 2016). Competence in solving mathematical problems is an important competency that must be possessed by prospective teachers in learning mathematics. Through learning mathematics in the 2013 curriculum, students are required to have higher-order thinking skills (Syamsuddin, 2019). One of the important competencies that students have as prospective mathematics teachers in facing the demands of the 21st century is the ability to think Reflectively (Badri et al., 2019; Widiyasari et al., 2020). The main goal of Dewey and Constructivist pragmatists is to produce reflective thinkers. That is, a person is able to re-organize and re-construct his performance, evaluate, and minimize mistakes made in the future (Basol & Evin Gencel, 2013).

Literacy skills are closely related to reflective thinking processes, where reflective thinking is a critical thinking process to make judgments (Rakhmawati & Mustadi, 2021). Furthermore, some literature provides information that a dialogical approach through reflective activities can develop numeracy skills (Jones & Tanner, 2008). The process of reflective thinking is a high-level skill that can trigger students to think critically so that it makes it easier for someone to develop their literacy skills and solve complex problems (Rakhmawati & Mustadi, 2021).

Through Regulation of the Minister of Education and Culture Number 23 of 2015 concerning character development, the Government made a policy on the National Literacy Movement to improve literacy culture in schools, communities and families. Numerical literacy is one of the basic literacy that can be implemented starting from basic to higher education. Numerical literacy (Kementerian Pendidikan dan Kebudayaan [Ministry of Education and Culture], 2017) is knowledge and skills in using numbers and symbols related to basic mathematics to solve practical problems in everyday life,

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analyzing information displayed in the form of tables, graphs, and diagrams to be able to predict or give interpretations. and make decisions based on the results of the analysis. In simple terms, numeracy literacy is the ability of a person or individuals to use number concepts and mathematical arithmetic operations skills to solve math problems in everyday life. For example, a student learns to divide an integer by another integer. When the first number is not divisible, there will be a remainder, but in everyday life it is not done mathematically such as rounding up or rounding down. For example, if there are 40 people traveling and transported by minibus with 12 people, mathematically the minibus needed is 3.3333 so that it is rounded down to 3 minibuses. What if the seat is only occupied by one person? This means that there are 4 people who do not get a seat so that the required minibus is 4 pieces. Numerical literacy is a part of mathematics but learning mathematics is not necessarily able to grow numeracy skills. In numeracy literacy skills, reflective thinking skills are needed so that someone can make the right decisions. The ability to think reflectively also contributes to the achievement of learning outcomes (Ghanizadeh, 2017).

Meyer divides the notion of thinking into three basic ideas, namely cognitive thinking that results from habits, thinking is a process that involves some manipulation and a series of knowledge in the cognitive system, and thinking is the result of habits in solving problems or finding solutions (Demirel et al., 2015). Generating reflective thinkers is the main goal of Dewey's constructivist and pragmatic approach (Basol & Evin Gencel, 2013). Sezer, 2008) stated that someone who is accustomed to reflective thinking can consciously control active learning, access what is known, what needs to be known, and how to bridge the gap (Jado, 2015). Reflective thinking can train a person's habits to learn more deeply, diligently, increase motivation, analyze and evaluate their own learning (Gürol, 2011).

But in fact, the majority of teachers prioritize giving assessments rather than feedback (Choy & Oo, 2012). Indonesia is a country that has very low numeracy literacy skills, compared to countries in Southeast Asia (Ambarwati & Kurniasih, 2021). The Programme for International Student Assessment (PISA) 2018 results released by the Organisation for Economic Co-Operation and Development (OECD) also show that the average math score of Indonesian students is ranked 7th from the bottom (73) reaching 379 with an OECD average score of 487 (Tohir, 2019). In particular, the United Nations Sustainable Development Goals (SDGs) Target 4.6 calls on all countries of the world to "ensure that all youth and a proportion of adults, both men and women, achieve literacy and numeracy" by 2030 (see: https:// sustainabledevelopment.un.org/sdg4). This explicitly implies that there are serious gaps in literacy and numeracy around the world. The school's role in supporting this, particularly related to numeracy literacy and character education was reviewed by observations and interviews at state junior high school namely SMP Negeri 3 Sukawati. The review states that the implementation of the development of numeracy literacy and character education has not been carried out optimally (Widiantari et al., 2022).

Definition of reflective thinking process according to (Akpur, 2020) namely efforts to rationalize problems, build relationships between ideas, experiences, knowledge, perceptions, past understandings, reasoning and choose the right strategy to solve problems. This is in line with (Hidayat et al., 2021) which states that reflective thinking is an effort to connect old knowledge in order to determine the right strategy for solving problems. Reflective is an active or continuous thought process about what has been learned so that the impact, if someone is accustomed to thinking reflectively, the memory of a knowledge will last a long time and increase learning potential (Farahian et al., 2021). (Kember et al., 2000) describes the reflective thinking process into four stages, namely: habitual action, understanding, reflection, and critical reflection. (Ryan & Ryan, 2013) constructing a reflective thinking process which consists of 4 levels, namely reporting and responding, relating, reasoning and reconstructing. Pappas developed a taxonomy of reflective thinking from the lowest to the highest level to see how far a person's reflective thinking ability is (Syamsuddin, 2019). The taxonomy of reflective thinking can be seen in Figure 1.

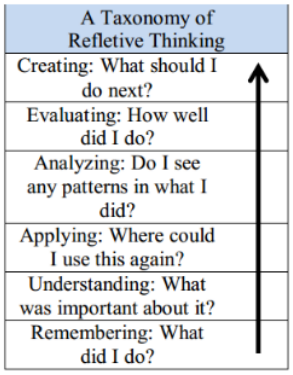


Figure 1. Taxonomy of Reflective Thinking

In Figure 1 the lowest level of reflective thinking ability is remembering which can be represented by the question "what do I do?", understanding which can be represented by the question: "Is something important", Applications that can be represented by the question "Can I use this again?", analysis that can be represented by the question "Are there other patterns?", Evaluation which can be represented by the question "How should I do?". The highest level of this taxonomy is the creation which is represented by the question "What should I do next?". The mathematical reflective thinking process in this study consisted of four stages, namely reflecting on mathematical problem situations, sensitivity, experience in solving problems and self-reflection.

Students' reflective thinking skills are as important as teachers' reflective thinking skills (Tuncer & Ozeren, 2012). Elementary School Teacher Education (PGSD) students as prospective elementary school teachers must get used to thinking reflectively, reflecting on what has been done and how to reflect it (Mirzaei et al., 2014). However, what happened in the field was very different from expectations. Students of the PGSD FKIP UGJ Study Program are not used to analyzing the answers to the problems given, evaluating, concluding, and reflecting so that they get the best solution from what they have done. Lecturers only pay attention to the final result, without seeing how the problem-solving process is. This is in line with (Gürol, 2011) which states that reflective thinking is often a process that is ignored by lecturers, because lecturers only focus on the final answer obtained, without paying attention to how the students respond. Whereas talking about the purpose of teacher education programs is to equip them with technically competent, reflective and self-critical (Mentari et al., 2018). When referring to the problem-solving steps according to Polya, the last stage is "checking again", if they have found a solution, students tend to feel satisfied and end the learning process (Hajar et al., 2018). There have been many studies which state that one way that can help teachers improve reflective thinking skills is to develop reflective thinking processes (Widiyasari et al., 2020). Therefore, both students and teachers (prospective teachers) need to review and reflect on their routines regularly, looking for ways to come up with strategies to help them become reflective thinkers (Naghdipour & Emeagwali, 2013).

In learning mathematics, there are three aspects of ability that play an important role in the success of learning so that students must have the affective, cognitive and psychomotor abilities (Waluya & Asikin, 2021). There is a strong and positive relationship between the ability to think reflectively, problem solving and attitude (Demirel et al., 2015). Someone who has the ability to think mathematically reflectively will develop a disposition (attitude) and support each other (Haryati et al., 2017). Mathematical disposition is an attitude that describes perception, self-confidence, diligent, flexible thinking in solving problems and exploring various alternative solutions (Kartono et al., 2014) According to Sumarmo et al. (as cited in Hendriana et al., 2017) indicators of mathematical disposition include monitoring one's own performance, reflecting on one's own performance, reasoning on one's own performance, considering the overall situation, the habit of analyzing relationships between variables, being flexible in various alternative solutions to mathematical problems and trying to solve problems. in solving math problems.

Several studies related to reflective thinking skills have been carried out. However, there is no research that examines the mathematical reflective thinking process of elementary school teacher candidates in terms of their mathematical disposition. Therefore, the purpose of this study is to describe how the mathematical reflective thinking process of elementary school teachers in terms of their mathematical disposition.

Methodology

This type of research is a descriptive qualitative, that aims to obtain the results of the analysis of the mathematical reflective thinking process of elementary school teachers in terms of their disposition. This research was conducted at Swadaya Gunung Jati University (UGJU) Cirebon in the even semester of the 2020/2021 academic year from May to June 2021. The research subjects were 26 PGSD students, then grouped into three categories based on the results of filling out mathematical disposition questionnaire by students. The three categories are students with high (H), medium (M), and low (L) disposition abilities. The grouping of the three categories refers to the rating scale according to (Azwar, 2013) that is:

Table 1. Criteria for Students' Mathematical Disposition Category

Score	Criteria
Score $< \bar{X} - \frac{1}{2}s$	Low
$\bar{X} - \frac{1}{2}s \leq$ Score $\leq \bar{X} + \frac{1}{2}s$	Medium
Score $> \bar{X} + \frac{1}{2}s$	High

The instruments in this study were the researcher, interview guide, mathematical disposition questionnaire and mathematical reflective thinking ability test. Before being given to research subjects, these two instruments have been validated constructively and content by experts through the Forum Group Discussion. The data analysis technique goes through 3 stages according to Miles and Huberman (Miles & Huberman, 1994) namely: (1) Data reduction, (2) Data display, (3) Conclusion. The test results were analyzed using qualitative data analysis based on the process of mathematical reflective thinking skills.

The mathematical disposition questionnaire consists of six aspects studied, namely monitoring one's own performance, reflecting on one's own performance, reasoning on one's own performance, considering the overall situation, the habit of analyzing relationships between variables, being flexible in various alternative solutions to mathematical problems, and trying to solve problems. mathematics. The answer choices on this scale are never, sometimes, often and always. In the questionnaire with positive statements, a score of 4 for the answer is always, 3 for the answer often, 2 for the answer sometimes and 1 for the answer never. In the questionnaire with negative statements, a score of 4 for the answer was never, 3 for the answer sometimes, 2 for the answer often and 1 for the answer always.

Students' reflective thinking processes can be described through in-depth interviews. The structured interview guide instruments can be seen in table 2.

Table 2. Interview Guide Instruments

Reflective Thinking Process	Reflective Ability Descriptors	Structured Questions
Reflection of the problem situation	1. Explain the problem in the problem in your own words. 2. Analyze any information contained in the questions. 3. Identify the adequacy of data to solve the problem.	1. What do you understand from the problem situation in the problem? 2. Give an explanation, what information is contained in the question? 3. What is known and asked in this question? 4. Is the information contained in the problem sufficient to solve it?
Reflection of sense based on the problem situation	1. Connecting problems with daily life 2. Explain the strategy/method used to solve the problem. 3. Identify concepts/materials related to the question 4. Analyzing prerequisite material in problem-solving.	1. Have you ever encountered a problem like this in your daily life? can be explained? 2. What strategy will you use to solve this problem? 3. What mathematical concepts do you need? 4. Is there any prerequisite material needed to solve the problem?
Reflection of experience based on solution	1. Describes the steps to solving the problem based on the strategy that has been designed. 2. Elaborating questions 3. Evaluating the answers that have been obtained	1. Self-reflection
Self-reflection	1. Comparing questions with previous experiences 2. Reviewing the obstacles encountered in solving the problem 3. Creating or creating new original ideas	1. Have you ever done something like this before? 2. Is this question easy, normal or difficult? Why? 3. After doing this problem, what ideas do you get?

Numerical literacy is the knowledge and skill to (a) use a variety of numbers and symbols related to basic mathematics to solve practical problems in various contexts of everyday life and (b) analyze information presented in various forms (graphs, tables), charts, etc.) and then use the interpretation of the results of the analysis to predict and make decisions (Kementerian Pendidikan dan Kebudayaan [Ministry of Education and Culture], 2017).

Before the mathematical reflective thinking ability test is given to prospective elementary school teachers, the quality of each item is seen through a Forum Group Discussion (FGD) with experts, then using validity and reliability tests. The results of the validity test for each question using Pearson product-moment correlation with the SPSS 24 software can be seen in the Table 3.

Table 3. Validation Criteria

Number Test	Validity Index	Level of Validity
1	0,56	Medium
2	0,82	High

Based on the results of the validity test, three questions were considered valid criteria. Furthermore, the results of the reliability test using Cronbach's alpha with SPSS 24 software can be seen in table 4.

Table 4. Reliability Statistics

Cronbach's Alpha	N of Items
.653	2

Based on table 4, the Cronbach's alpha value is 0.653 including the test criteria that are reliable or consistent. From the validity and reliability test and FGD, then the questions can be used to measure students' mathematical reflective thinking process. The data analysis technique goes through 3 stages according to Miles and Huberman (Sukestiyarno, 2020), namely: (1) data reduction, (2) data display, (3) conclusion.

Findings / Results

Data on the mathematical disposition of prospective elementary school teachers was obtained through a questionnaire distributed via google form (https://forms.gle/i5G5XdnUv7XnX66e8). The results of the analysis of students' mathematical dispositions can be seen in Table 5 below:

Table 5. Mathematical Disposition of Level III Students

Criteria	Amount
Low	8
Medium	10
High	8

Then from the group of students' dispositions, two research subjects were selected which were considered the most representative of other students in one group. In addition, this selection is based on students who can communicate well and have time to meet face-to-face with researchers. Each subject will be interviewed by researchers about the reflective thinking process of each question they have worked on. The problem of reflective thinking ability consists of 2 description questions.

Mathematical Reflective Thinking Process Low Disposition Research Subjects (SPDR)

The mathematical reflective thinking process of prospective teachers can be traced to question number 1 below.

During recess, Siti went to the cooperative to buy 5 chocolates and 3 glasses of mineral water for Rp. 7000.00. At the same time, Dian bought 3 chocolates and 3 glasses of mineral water at the same cooperative for Rp. 6,000.00. If the Princess pays with money, Rp. 10,000.00 while she bought 2 chocolates and 1 glass of mineral water, how much money did Putri receive back?

An in-depth interview on SPDR-1 was held on June 6, 2021 through face-to-face. The explanation of the interview transcript related to question no. 1 as follows:

Researcher (R): What information do you know from the problem situation in the problem?

SPDR-1 : So that's what she asked for her daughter's change when she bought 2 chocolates and mineral water for Rp. 10.000. the first known 5 chocolates and 3 mineral water for Rp. 7000. The second, 3 chocolates and 3 glass mineral water for Rp. 6.000

R : What is the first thing that comes to mind to solve the problem?

SPDR-1 : First you have to know the price of 1 chocolate and then how much is the price of 1 glass of mineral water first, ma'am... If you have found the money that was Rp. 10.000, how much did you use for 2 chocolates and 1 mineral water.. Then you know the change.

R : Is the data sufficient to solve the problem? Try you reflect, how do you solve the problem?

SPDR-1 : Enough ma'am... first, let's see the price of chocolate is Rp. 1.100 and water mineral Rp 500.

R : Where did you get that price from?

SPDR-1 : guessing ma'am... if I sell chocolate and mineral water at the shop, the price is roughly like that

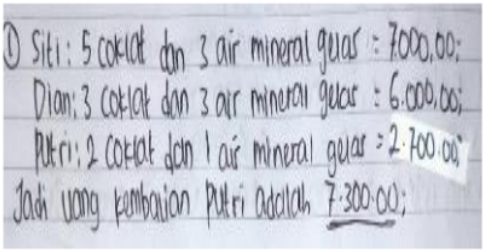
R : if you put it into equation 1 what is the result?

SPDR-1 : Rp. 7.000 maam....

R : What about equation 2?

SPDR-1 : Rp. 4,800 ma'am... that's why I am confused, ma'am....

The results of SPDR-1 and SPDR-2 answers can be seen in Figure 2 below.



Translation
Siti : 5 chocolates and 3 mineral water IDR 7,000
Dian : 3 chocolates and 3 mineral water IDR 6.000
Putri : 2 chocolates and 1 mineral water IDR 2.700
So Putri's remaining money is IDR 7,300

Translation
Siti : 5 chocolates + 3 mineral water = 7,000
Dian : 3 chocolates + 3 mineral water = 6.000
Putri : 2 chocolates + 1 mineral water = 10.000

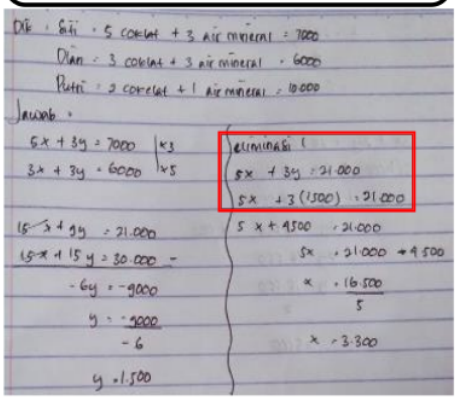
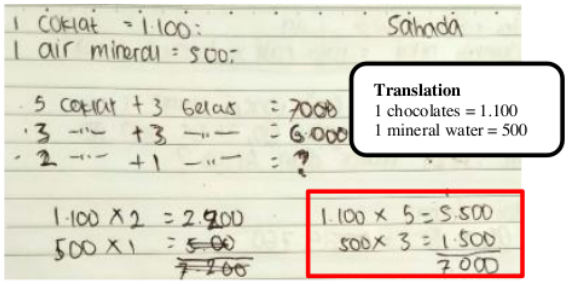


Figure 2. SPDR-1 and SPDR-2 Answers

Based on Figure 2 and the results of in-depth interviews with SPDR-1, information was obtained that SPDR-1 could reflect the information contained in the questions, understand what was asked, and be known. At stage Reflection of sense based on the problem situation, SPDR-1 is sensitive to the question, namely with the statement "must find the price of 1 chocolate and mineral water first, ma'am, how much do you use, then the change will be from Putri's money minus the total expenditure". In the Reflection of experience based on the solution stage, SPDR-1 solves the problem by estimating the price of chocolate and mineral water based on the actual price in real life and the results are in accordance with equation 1. So directly the price of 1.100 chocolate and 500 mineral water is obtained as shown in the Figure 3.



Translation
1 chocolates = 1.100
1 mineral water = 500

Figure 3. Reflective Thinking Process

The researcher asked to do the process of substituting the price into equation 2, namely 3 chocolates and 3 mineral water. The results of this process can be seen in Figure 4 below.

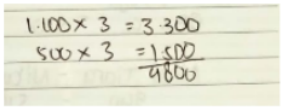


Figure 4. Reflective Thinking Process

Based on Figure 4, the total of 3 chocolates and 3 glasses of mineral water is 4.800. in this case it is different from the context of the question, namely 6.000. SPDR-1 realizes that the algorithm process used in solving the problem is wrong, but has not been able to justify it.

Unlike SPDR-1, SPDR-2 is capable of performing mathematical modeling to solve problems. SPDR-2 is able to provide important information in problems, relate problems to everyday life, elaborate questions, and perform eliminations and substitutions. However, SPDR-2 is wrong when substituting y = 1.500 into equation 1, so the result x = 3000 obtained by calculation is wrong. In the self-reflection stage, SPDR-2 realized the mistake. The next researcher confirmed that if the

result was x = 3.000, what was the next step taken by SPDR-2 to solve the problem. The next answer for SPDR-2 is to reduce the price of chocolate with the price of glass mineral water as shown in Figure 5 below.

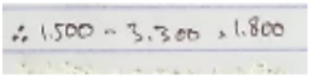


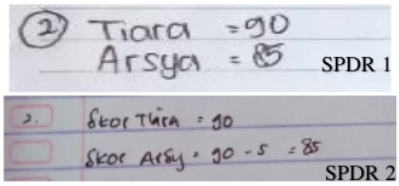
Figure 5. Reflective Thinking Process

Based on Figure 5, SPDR-2 is in a hurry to draw conclusions and is not careful in completing arithmetic operations. This is evidenced by the result of subtracting 1.500 – 3.300 is 1.800.

Furthermore, the process of mathematical reflective thinking ability of elementary school teacher candidates will be explored in the following question number 2.

Anggi, Galih, Wasni, Sheren, Tiara and Arsy have taken the Mid-Semester Examination (UTS) for mathematics subjects with scores of 80, 74, 85, and 90 respectively. The average score of the math test became 84 by including test scores of Tiara and Arsy. What is the score obtained by Tiara and Arsy if the difference in their scores is 5 provided that the score obtained by Tiara is greater than Arsy's score?

The results of SPDR-1 and SPDR-2 answers can be seen in Figure 6 below



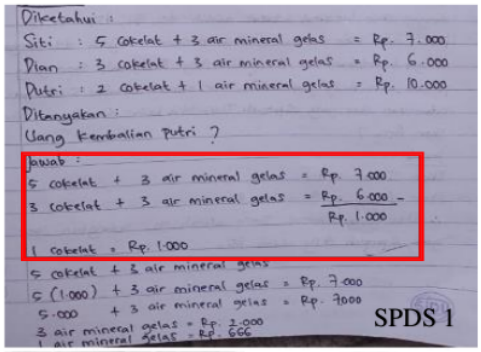
Translation
Tiara's Score = 90
Arsy's Score = 85

Figure 6. SPDR-1 and SPDR-2 Answers Test No. 2

Based on the results of the answers to Figure 6 and in-depth interviews with both subjects, SPDR-1 and SPDR-2 have not been able to understand the problem situation and have not mastered the concept of average. Both SPDR-1 and SPDR-2 only guessed the answer based on the last digit of the question, namely 90 and 85 which happened to match the sentence the difference between the tiara and Arsy scores was 5. Both stated that the information in the question was lacking, this question was confusing, and difficult.

Mathematical Reflective Thinking Process Medium Disposition Research Subject (SPDS)

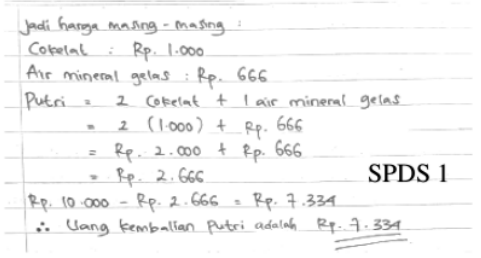
The results of the answers to question number 1 for SPDS-1 and SPDS-2 can be seen in Figure 7 below.



Translation
Siti : 5 chocolates + 3 mineral water = 7000
Dian : 3 chocolates + 3 mineral water = 6000
Putri : 2 chocolates + 1 mineral water = 10000

Asked : Putri remaining money?

Answer :
5 chocolates + 3 mineral water = 7000
3 chocolates + 3 mineral water = 6000 -
1000
1 chocolate = 1000
5 chocolates + 3 mineral water
5 (1000) + 3 mineral water = 7000
5000 + 3 mineral water = 7000
3 mineral water = 2000
1 mineral water = 666
SPDS 1



so the price of each :
chocolate = 1000
mineral water = 666
Putri = 2 chocolate + 1 mineral water
= 2 (1000) + 666
= 2000 + 666
= 2666
10000 – 2666 = 7334
So, Putri remaining money is 7334

SPDS 1

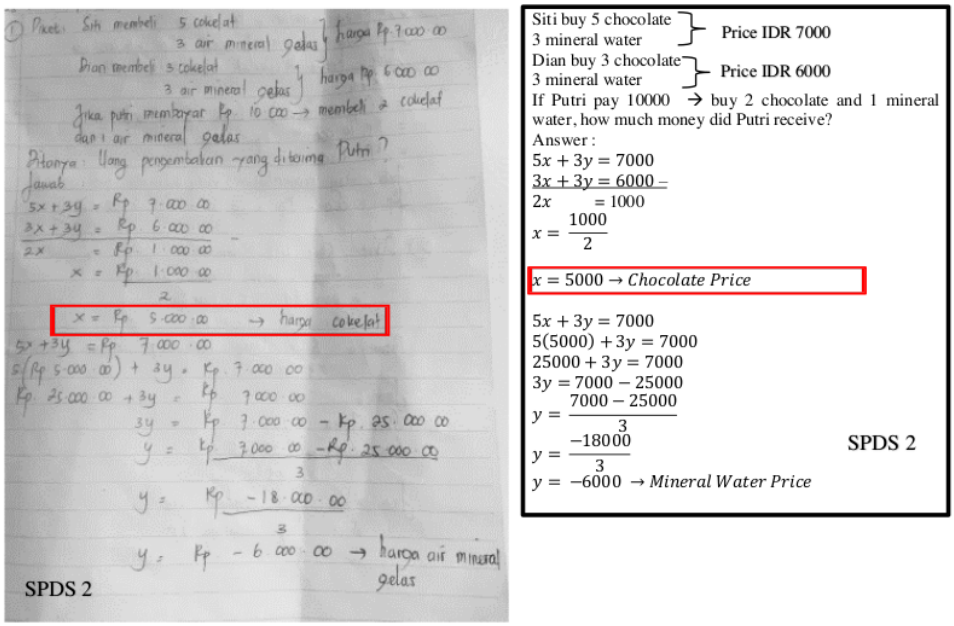


Figure 7. Reflective Process

Based on Figure 7 and in-depth interviews with SPDS-1 and SPDS-2, information is obtained that both subjects understand the problem situation, have sensitivity to questions, solve problems systematically and are able to elaborate on questions. However, SPDS-1 and SPDS-2 are less thorough in solving the problem calculations. The Reflection of sense based on problem situation SPDS-1 states that the first thing to look for is the price of one chocolate and a glass of mineral water. SPDS-1 performs the elimination process on these two equations without doing any mathematical modeling first. The Reflection of experience based on solution stage, SPDS-1 and SPDS 2 do not re-evaluate the price of a chocolate and mineral water that has been obtained. SPDS-1 and SPDS-2 realized their mistake when the researcher guided the completion process in the interview session.

An in-depth interview on SPDS-2 was held on June 6, 2021 through face-to-face. The explanation of the interview transcript related to question no. 2 as follows:

P : What information do you know from the problem situation in the problem?

SPDS-2 : Anggi scores 80, Galih 74, Wasni 85, and Sheren 90. Then I think about the score Tiara 90. The difference is 5. So Arsy's score is 85, mom...

P : where did you get the Tiara 90 score from?

SPDS-2 : from guessing ma'am..find the largest value continues to be divided by 5, ma'am……

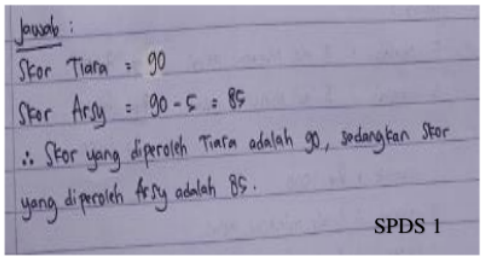
P : Is the information in the question sufficient to answer what? asked?

SPDS-2 : Not yet, ma'am, because Tiara and Arsy's scores are not yet known

P : That's the two scores asked?

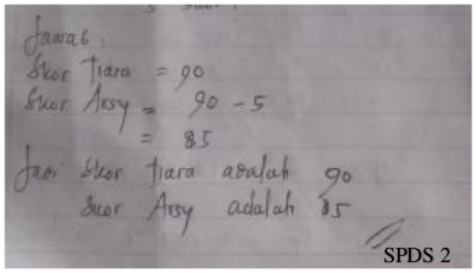
SPDS-2 : hehehe... yes, I'm confused, Maam...

Furthermore, the results of the answers to question number 2 for SPDS-1 and SPDS-2 can be seen in Figure 8 below.



Answer :
Tiara's Score = 90
Arsy's Score = 90 – 5 = 85
So the score obtained by Tiara is 90,
while the score obtained by Arsy is 85.

SPDS 1



Answer :
Tiara's Score = 90
Arsy's Score = 90 – 5 = 85
So the score obtained by Tiara is 90,
while the score obtained by Arsy is 85.

SPDS 2

Figure 8. Reflective Thinking Process

Based on the results of the answers to Figure 2 and in-depth interviews with both subjects, SPDS-1 and SPDS-2 have not been able to understand the problem situation and have not mastered the concept of average. Both SPDS-1 and SPDS-1 only guessed the answer based on the last digit of the question, namely 90 and 85 which happened to match the sentence the difference between the value of tiara and Arsy was 5. SPDS-2 determined the Tiara score of 90 based on the largest score and then divided by 5 to get the Arsy score. Both stated that the information in the questions was lacking, the questions were confusing, and difficult. Both research subjects can solve the average problem if the overall value is known. From this it can be concluded that SPDS-1 and SPDS-2 have not done much on higher order thinking skills (HOTS) questions.

Mathematical Reflective Thinking Process Subjects of High Disposition Research

The presentation of the interview results at the SPDT was held on June 6th, 2021 through a zoom meeting. The transcript of the interview is as follows:

Researcher(R): From question number 1 that was done earlier, do you understand the problem situation in the question?

SPDT-1 : Understood, ma'am, from the problem we are looking for how much the total price that the daughter bought is 2. 1 water chocolate with 10,000 mother's money

R : Okay, then what information did you get from that question?

SPDT-1 : The purchase price of 5 chocolates plus 3 water is 7000, and there are also those who buy 3 chocolates plus 3 water for a total of 6000 money. What is being asked here is how much money was spent when buying 2 chocolates and 1 water with 10,000 mothers money.

R : Okay... Is the information contained in the problem sufficient to solve what asked?

SPDT-1 : Yes, Mother, because here it is clearly described the total money spent every child, from there we can find the price per food first ma'am, first ma'am...It's easy for me to find the price per food, just this time, ma'am... it's clear, ma'am...

R : If you reflect back, have you ever encountered a problem like this in everyday life?

SPDT-1 : Ever mom...

R : Can you explain what the problem is, Um?

SPDT-1 : Like when we go to a restaurant, we don't know the price of the food... After that We charter ourselves how many total foods we buy and how many types, then we divide Ma'am by the total price because we ask for a bill to distinguish which one is food and which one is a drink with the same product.

R : Okay, then if there is a problem like in question number 1, what strategy is there? general thought to solve it?

R : What mathematical concepts are used?

SPDT-1 : about arithmetic, substitution and elimination…

R : Is there any prerequisite material, Um?

SPDT-1 : mmm… we have to master multiplication first, ma'am…

R : OK.. Well now try to remember what uum did for solve question number 1 earlier?

SPDT : First, we eliminate the same number first, ma'am ... here it is known 5 chocolate plus three water for seven thousand, with three chocolates plus three water for six thousand. Here we are times one all… five times one five, three times one three, three times one three, three times one three by seven thousand times one seven thousand and six thousand times one six thousand. Then subtract. Here there are five chocolates minus 3 chocolates, that produces 2 chocolates, so then 3 water minus three water is gone, ma'am… seven thousand minus six thousand remaining a thousand mothers… then we divide… one thousand divided by two chocolates. Therefore, the result of one chocolate is five hundred mothers.

R : Have you finished the work?

SPDT-1 : Already , this is the price of one chocolate, then we will substitute it into the first equation

R : yeah, okay… next?

SPDT-1 : Well here the price of 5 chocolates + 3 water = 7.000. means 5 times five hundred plus three water.. we look for the price of the water first ma'am… well here we move the segment 2.500 to the right, so 7.000 – 2.500 then produces 4.500. So 3 water costs 4.500… the price of one mineral water will be divided by Maam… 4.500 : 3… so each water price is 1500.

R : Are you sure the answer is?

SPDT-1 : Just a moment ma'am…. (looks counting again) Are you sure mom...

R : Does that mean it's done?

SPDT-1 : Not yet ma'am…. Because they asked for a refund…

R : What next…?

SPDT-1 : Because here it is known that the child bought 2 chocolates and 1 water, then we will substitution ma'am…Two times 500 plus one times 1.500. So it produces 1.000 + 1.500 equals 2500. So the child's snack is 2.500 ma'am…

R : Already completed?

SPDT-1 : Not yet ma'am. So the rest of the child's pocket money is 10.000-2.500 =

7.500 ma'am

R : After you got the answer, you rechecked or no?

SPDT-1 : Yes Ma'am, mmm… from the end result of each step ma'am.. how ma'am Oh… At a price of 2 the chocolate is 1000, how much is it divided by two. Is it 500. So I checked it per unit ma'am..

P : Is there another way to solve this problem?

SPDT-1 : Don't know maam..

P : Have you ever worked on this problem Um?

SPDT-1 : Ever Maam…

P : This question is easy, difficult or normal um…?

SPDT-1 : Hehehehe, if the general level is easy, ma'am...

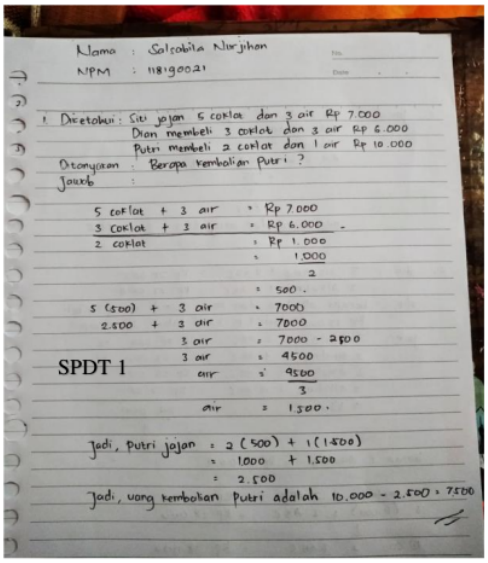
P : Can questions like this be given to elementary school children?

SPDT-1 : Most likely high-class children can ma'am… by making things easier ma'am…

P : Like what?

SPDT-1 : Yes, ma'am, for example, Andi bought two cakes at a price of Rp. 1.000, how much for each? the price of each cake? So, the child can share ma'am. It can also use real money for example ma'am….

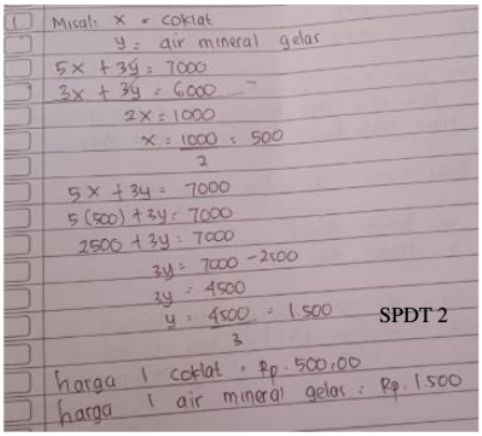
In addition to SPDT-1, researchers also conducted in-depth interviews on SPDT-2. The answers to the SPDT-1 and SPDT-2 questions can be seen in Figure 9 below.



Known :
Siti buy 5 chocolate and 3 water 7000
Dian buy 3 chocolate and 3 water 6000
Putri buy 2 chocolate and 1 water 10000

Asked:
How much Putri remaining money?

Answer :
$5\ chocolate + 3\ water = 7000$
$3\ chocolate + 3\ water = 6000\ -$
$2\ chocolate = 1000$
$= \frac{1000}{2}$
$= 500$
$5\ (500) + 3\ water = 7000$
$2500 + 3\ water = 7000$
$3\ water = 7000 - 2500$
$3\ water = 4500$ SPDT 1
$water = \frac{4500}{3}$
$water = 1500$
So, Putri Spent money = 2 (500) + 1 (1500)
= 1000 + 1500
= 2500
So, Putri's remaining money is 10000 – 2500 = 7500

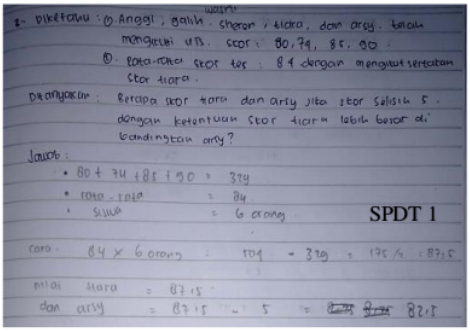


For example :
x = chocolate
y = mineral water
5x + 3y = 7000
3x + 3y = 6000
2x = 1000
$x = \frac{1000}{2} = 500$
5x + 3y = 7000
5 (500) + 3y = 7000
2500 + 3y = 7000
3y = 7000 – 2500
3y = 4500
$Y = \frac{4500}{3} = 1500$
Price one chocolate 500
SPDT 2

Figure 9. SPDT-1 and SPDT 2 in Solving Problem No. 1

Based on the analysis of interview transcripts and answers to questions in Figure 2, SPDT-1, understands the problem well, can elaborate on questions, works with systematic and detailed algorithms. In the reflection of sense based on problem situation stage, SPDT-1 did not complete the method with mathematical modeling. The concept of elimination and substitution in a two-variable linear equation system is well mastered by SPDT-1. Furthermore, based on the results of in-depth interviews SPDT-2 is able to understand problems, perform mathematical modeling, elaborate questions, provide examples of questions similar to problems in everyday life and work with systematic and detailed algorithms. However, at the reflection of experience based on solution stage, SPDT-2 forgot what was asked in the question. SPDT-2 does not review the answers obtained with the questions.

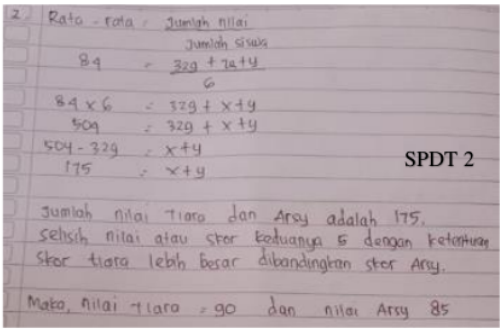
Furthermore, the results of SPDT-1 and SPDT-2 answers in solving question number 2 can be seen in Figure 3 below.



SPDT 1

Known :
Anggi, Galih. Sheren, Tiara and Arsy have followed the mid test with score : 80, 74, 85, 90. The average test score of 84 with include of tiara scores.
Question :
What is Tiara's score and Arsy If the difference in score = 5 with provided that the Tiara score is greater than Score Arsy?
Answer :
80 + 74 + 85 + 90 = 329
Average = 84
Student = 6
Solution : 84 x 6 = 504 – 329 = $\frac{175}{2}$ = 87.5
Score Tiara = 87.5

SPDT 1



SPDT 2

Average = $\frac{total\ value}{total\ student}$
$84 = \frac{329 + x + y}{6}$
$84 \times 6 = 329 + x + y$
$504 = 329 + x + y$
$504 - 329 = x + y$
$175 = x + y$
the total value of Tiara and Arsy is 175. the difference in value or the score of both is 5 provided that Tiara's score is greater than Arsy score.
Then Tiara's score = 90 and the Arsy's score = 85

SPDT 2

Figure 10. SPDT-1 and SPDT 2 in Solving Problem No. 2

Based on Figure 10 and interview transcripts for tracing the reflective thinking processes of prospective elementary school teachers, information is obtained that SPDT-1 and 2 are able to master statistical concepts associated with linear equations of two variables. SPDT-1 and 2 understand the problem well, can solve the problem according to the strategy used. In the Reflection of experience based on solution stage, SPDT-1 does not evaluate the answers that have been obtained. When confirmed, SPDT-1 thought back if the six values were added up, namely: 80+74+85+90+87.5+82.5 = and not 504. From the reflective thinking process, SPDT-1 was confused about connecting the concept of the average answer. At the time of self reflection, SPDT-1 was confused with the word that the difference in the value of Arsy and Tiara was equal to 5. While SPDT-2 used predictions to determine the scores of Tiara and Arsy.

R : After knowing the value of Tiara and Arsy is 175, then how do you do it? get the value of Tiara 90 and Arsy 85?

SPDT-2 : 170: 2 Ma'am…

R : Where did the 170 come from?

SPDT-2 : Out of 175 ma'am, 5 of them are stored first so that it is easy to calculate.

R : If 175:2 is it difficult to count?

SPDT-2 : It's easy, ma'am. It means that the tiara score is greater than 5, so the 5 are immediately separated, ma'am

R : What method do you use? is that you?

SPDT-2 : Prediction ma'am, hehehe...

Whereas from this a mathematical model can be formed. Furthermore, this equation is eliminated by. From this it can be concluded that SPDT-1 and SPDT-2 do not understand the concept of mathematical modeling. This is in line with the statement $x - y = 5$; where x is Tiara's score and y is Arsy's score. $x + y = 175$ (Tanisli & Kose, 2013) that some pre-service teachers have misconceptions and difficulties regarding the concepts of variables, algebraic expressions, equivalence and equality. Based on the SPDT-1 mathematical disposition questionnaire, it was found that SPDT-1 worked continuously without matching it with the original plan. While SPDT-2 tends to solve math problems part by part separately.

Discussion

From the two research subjects of prospective teachers with low dispositions, information was obtained that SPDR-1 and SPDR-2 had not mastered the system of linear equations of two variables and the concept of the average. In solving the problem of a system of linear equations with two variables, the two research subjects are more into guessing (illogical and systematic). The results of this study are also in line with (Irfan & Rahardi, 2018) who found that students used non-standard methods such as divided, multiplied, subtracted, and added to solve the proportion problem. In the aspect of disposition, it was revealed that the two subjects did not re-check the answers to the math problems that had been done, did not look for the relationship between the information provided before solving mathematical problems, did not think that compiling mathematical models helped solve problems, and did not feel challenged by different math problems with examples.

Based on the results of the two subjects with moderate dispositions, information was obtained that both of them were able to master the material but were not careful in working on the questions. SPDS-1 and SPDS-2 only answer from the question by doing the imitation procedure (Depaepe et al., 2015; Lemonidis, 2008). They don't reflect on what they've done (Irfan et al., 2019). This can be seen from the answer to the value of money in the form of a decimal and the value of money with a negative sign. If the prospective teacher does not master the theory/concept, it will be a problem in relating it to real-life situations (Dede & Soybaş, 2011). Furthermore, based on the results of the disposition questionnaire, SPDS-1 and SPDS-2 also rarely re-check the mathematical answers obtained and SPDS-1 assumes that checking the adequacy of all existing components before solving mathematical problems is just a waste of time and does not think that compiling mathematical models helps solve problems. problem. Furthermore, SPDT-1 and SPDT-2 did not understand the concept of mathematical modeling. This is in line with the statement (Tanisli & Kose, 2013) that some pre-service teachers have misconceptions and difficulties regarding the concepts of variables, algebraic expressions, equivalence and equality. Based on the SPDT-1 mathematical disposition questionnaire, it was found that SPDT-1 worked continuously without matching it with the original plan. While SPDT-2 tends to solve mathematics problem part by part separately.

Reflective thinking is doing analysis, making judgments about what has happened and giving meaning with a deeper understanding and connecting experiences or ideas with others (Hino, 2016; Rodgers, 2002). Betne state that reflective thinking occurs after problem solving is carried out with the aim of checking for errors in the concepts used and trying to justify them, so that they can develop students' skills in using mathematical concepts (Agustan et al., 2017). Mathematical reflective thinking is built based on understanding concepts and making mature decisions when facing mathematical problems (Gürol, 2011). When students have good reflective thinking skills, students will be better able to develop their numeracy literacy skills (Rakhmawati & Mustadi, 2021). This statement is in line with (Sellings et al., 2018), which states that to improve numeracy literacy skills can be built through reflective thinking activities consisting of critical discourse, analysis of misconceptions, and making questions.

If numerical literacy leads to the desired result, which involves various skills to be able to acquire, interpret, use, and communicate various kinds of numbers and mathematical symbols to solve practical problems in various contexts of everyday life and be able to analyze information that is displayed in various forms. graphs, tables, charts, etc.) to make decisions, so reflective thinking focuses on the process of making judgments about what has happened. From the results of this study, lecturers can develop learning tools or scaffolding forms that accommodate different dispositional abilities of prospective elementary school teachers, always providing mathematical problems measuring problem solving skills with an emphasis on numeracy literacy skills.

Conclusion

Based on questionnaires, tests, and interview transcripts, prospective elementary school teachers who have a high disposition already understand the concept of linear equations of two variables, perform substitution and elimination, understand the concept of variables, and can provide explanations. Prospective elementary school teachers who have a moderate disposition, understand the concept of linear equations of two variables, but are in a hurry to work on problems without re-checking and using estimates in solving problems. Prospective elementary school teachers who have low dispositions, do not understand the concept of a two-variable linear equation system, looking for average, solving problems with estimates and using non-standard methods.

From the mathematical disposition questionnaire, prospective elementary school teachers with high dispositions have good mathematical reflective abilities because they are able to solve all questions. Elementary school teacher candidates with moderate disposition levels have good mathematical reflective abilities because they can solve problems systematically even though the results are not precise. This is due to carelessness (less thorough). Meanwhile, prospective elementary school teachers with low dispositions do not have mathematical reflective abilities because all the questions that are done using sign estimates are based on clear concepts. Therefore, it is necessary to practice story questions with the type of higher order thinking skills and appropriate learning methods to accommodate these three levels of disposition.

Recommendations

Numerical literacy is identical to contextual problem solving, so to solve them, reflective thinking skills are needed which can be constructed through reflective activities. That way the student error factor in solving problems can be reduced and can encourage students to obtain the best strategy in achieving learning objectives. To improve numeracy literacy and reflective thinking skills, several learning tools will be developed. Sophistication in the field of technology offers several learning resources that are interesting, varied, easy to use and can be accessed at any time. Therefore, in the future, lecturers or researchers can develop learning tools or scaffolding forms that accommodate the different dispositional abilities of prospective elementary school teachers. A good disposition attitude can be built through planned learning. The variable studied in this study is the reflective thinking process of a prospective elementary teacher in solving numeracy problems based on attitudes, namely dispositions. However, further research needs to be done on how to reveal the reflective thinking process in students at the elementary, junior high school and senior high school levels, in terms of cognitive aspects such as intellectual intelligence, cognitive style and others. This is done, in order to find problems in more detail and prepare forms of scaffolding, teaching materials, or learning media that can be used to improve the reflective thinking process.

Limitations

The research presented here is limited to finding errors in numeracy literacy questions based on the reflective thinking process of prospective teachers. In the next stage, mathematics learning tools and scaffolding will be developed based on the theory that has been built and the findings in this study.

Authorship Contribution Statement

Setiyani: Conceptualization, design, analysis, writing. Waluya: Conceptualization, critical revision of manuscript. Sukestiyarno: Conceptualization, editing, proofreader. Cahyono: Conceptualization, material support, drafting manuscript.

References

Agustan, S., Juniati, D., & Siswono, T. Y. E. (2017). Reflective thinking in solving an algebra problem: A case study of field independent-prospective teacher. *Journal of Physics: Conference Series*, *893*, 12002. https://doi.org/10.1088/1742-6596/893/1/012002

Akpur, U. (2020). Critical, reflective, creative thinking and their reflections on academic achievement. *Thinking Skills and Creativity*, *37*, 100683. https://doi.org/10.1016/j.tsc.2020.100683

Ambarwati, D., & Kurniasih, M. D. (2021). Pengaruh Problem based learning berbantuan media youtube terhadap kemampuan literasi numerasi siswa [Effect of problem based learning assisted by youtube media on students' numerical literacy ability]. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, *5*(3), 2857–2868. https://doi.org/10.31004/cendekia.v5i3.829

Azwar, S. (2013). *Penyusunan skala psikologi* [Psychological scale preparation]. Pustaka Belajar

Badri, Y., Nindiasari, H., & Fatah, A. (2019). Pengembangan bahan ajar interaktif dengan scaffolding metakognitif untuk kemampuan dan disposisi berpikir reflektif matematis siswa [Development of interactive teaching materials with metacognitive scaffolding for students' mathematical reflective thinking ability and disposition]. *Jurnal Penelitian Dan Pembelajaran Matematika*, *12*(1), 156–172. https://doi.org/10.30870/jppm.v12i1.4863

Basol, G., & Evin Gencel, I. (2013). Reflective thinking scale: A validity and reliability study. *Educational Sciences: Theory and Practice*, *13*(2), 941–946. https://bit.ly/3xBDFQm

Choy, S. C., & Oo, P. S. (2012). Reflective thinking and teaching practices: A precursor for incorporating critical thinking into the classroom? *International Journal of Instruction*, *5*(1), 167–182. https://bit.ly/3Qf8iT6

Dede, Y., & Soybaş, D. (2011). Preservice mathematics teachers' experiences about function and equation concepts. *EURASIA Journal of Mathematics, Science and Technology Education*, *7*(2), 89–102. https://doi.org/10.12973/ejmste/75183

Demirel, M., Derman, I., & Karagedik, E. (2015). A study on the relationship between reflective thinking skills towards problem solving and attitudes towards mathematics. *Procedia-Social and Behavioral Sciences*, *197*, 2086–2096. https://doi.org/10.1016/j.sbspro.2015.07.326

Depaepe, F., Torbeyns, J., Vermeersch, N., Janssens, D., Janssen, R., Kelchtermans, G., Verschaffel, L., & Van Dooren, W. (2015). Teachers' content and pedagogical content knowledge on rational numbers: A comparison of prospective elementary and lower secondary school teachers. *Teaching and Teacher Education*, *47*, 82–92. https://doi.org/10.1016/j.tate.2014.12.009

Farahian, M., Avarzamani, F., & Rajabi, Y. (2021). Reflective thinking in an EFL Writing course: To what level do portfolios improve reflection in writing? *Thinking Skills and Creativity*, *39*, 100759. https://doi.org/10.1016/j.tsc.2020.100759

Ghanizadeh, A. (2017). The interplay between reflective thinking, critical thinking, self-monitoring, and academic achievement in higher education. *Higher Education*, *74*(1), 101–114. https://doi.org/10.1007/s10734-016-0031-y

Gürol, A. (2011). Determining the reflective thinking skills of pre-service teachers in learning and teaching process. *Energy Education Science and Technology Part B-Social and Educational Studies, 3*(3), 387-402.

Hajar, Y., Yanwar, R., & Fitrianna, A. Y. (2018). Analisis kemampuan berpikir reflektif siswa smp ditinjau dari disposisi matematis siswa [Analysis of the reflective thinking ability of junior high school students in terms of students' mathematical dispositions]. *Jurnal Pembelajaran Matematika Inovatif*, *1*(1), 79-92. https://doi.org/10.22460/jpmi.v1i1.p79-92

Haryati, T., Nindiasari, H., & Sudiana, R. (2017). Analisis kemampuan dan disposisi berpikir reflektif matematis siswa ditinjau dari gaya belajar [Analysis of students' mathematical reflective thinking abilities and dispositions in terms of learning styles]. *Jurnal Penelitian Dan Pembelajaran Matematika*, *10*(2), 146-158. https://doi.org/10.30870/jppm.v10i2.2039

Hendriana, H., Rohaeti, E. E., & Sumarmo, U. (2017). *Hard skills dan soft skills matematik siswa* [*Students' math hard skills and soft skills*]. Refika Aditama

Hidayat, N., Usodo, B., & Saputro, D. R. S. (2021). Reflective thinking ability of junior high school students in relations and function problems. *Journal of Physics: Conference Series*, *1776*, 12024. https://doi.org/10.1088/1742-6596/1776/1/012024

Hino, K. (2016). *Listening and responding to children's reflective thinking: Two case studies on the use of the national assessment in Japan*. World Scientific. https://doi.org/10.1142/9789813143623_0007

Irfan, M., Nusantara, T., Wijayanto, Z., & Widodo, S. A. (2019). Why do pre-service teachers use the two-variable linear equation system concept to solve the proportion problem? *Journal of Physics: Conference Series*, *1188*, 12013. https://doi.org/10.1088/1742-6596/1188/1/012013

Irfan, M., & Rahardi, R. (2018). Characteristics of students in comparative problem solving. *Journal of Physics: Conference Series*, *948*(1), 12007. https://doi.org/10.1088/1742-6596/948/1/012007

Jado, S. M. A. (2015). The effect of using learning journals on developing self-regulated learning and reflective thinking among pre-service teachers in Jordan. *Journal of Education and Practice*, *6*(5), 89–103.

Jones, S., & Tanner, H. (2008). Reflective discourse and the effective teaching of numeracy. In O. Figueras, J. L. Cortina, S. Alatorre, T. Rojano, & A. Sepúlveda (Eds.), *Proceedings of the Joint Meeting of PME 32 and PME-NA XXX* (Vol. 3, pp. 225-232). Cinvestav-UMSNH .

Kartono, Sulhadi, & Rahayu R. (2014). The effect of mathematical disposition toward problem solving ability based on ideal problem solver. In Sutikno, A. Widiyatmoko, Masturi, & Harjito (Eds.), *Proceedings International Conference on Mathematics, Science, and Education 2014* (pp.102–107). ICEMST.

Kember, D., Leung, D. Y. P., Jones, A., Loke, A. Y., McKay, J., Sinclair, K., Tse, H., Webb, C., Yuet Wong, F. K., & Wong, M. (2000). Development of a questionnaire to measure the level of reflective thinking. *Assessment & Evaluation in Higher Education*, *25*(4), 381–395. https://doi.org/10.1080/713611442

Kementerian Pendidikan dan Kebudayaan [Ministry of Education and Culture]. (2017). *Panduan gerakan literasi nasional* [Guide to National literacy movement]. https://bit.ly/3mKjCcq

Lemonidis, C. (2008). Prospective teachers' application of the mathematical concept of proportion in real life situations. In A. Gagatsis (Ed.), *Research in mathematics education* (pp.163-172). School of Sciences and Sciences of Education, University of Cyprus.

Mentari, N., Nindiasari, H., & Pamungkas, A. S. (2018). Analisis kemampuan berpikir reflektif siswa SMP berdasarkan gaya belajar [Analyze the reflective thinking ability of junior high school students based on learning styles]. *NUMERICAL: Jurnal Matematika Dan Pendidikan Matematika*, *2*(1), 31–42. https://doi.org/10.25217/numerical.v2i1.209

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook*. Sage.

Mirzaei, F., Phang, F. A., & Kashefi, H. (2014). Assessing and improving reflective thinking of experienced and inexperienced teachers. *Procedia-Social and Behavioral Sciences*, *141*, 633–639. https://doi.org/10.1016/j.sbspro.2014.05.111

Muntazhimah, M., Turmudi, T., & Prabawanto, S. (2021). The relation between prior knowledge and students' mathematics reflective thinking ability. *Journal of Physics: Conference Series*, *1731*, 12043. https://doi.org/10.1088/1742-6596/1731/1/012043

Naghdipour, B., & Emeagwali, O. L. (2013). Assessing the level of reflective thinking in ELT students. *Procedia-Social and Behavioral Sciences*, *83*, 266–271. https://doi.org/10.1016/j.sbspro.2013.06.052

Rakhmawati, Y., & Mustadi, A. (2021). Examining the necessity of reflective module: Literacy numeracy skill of students elementary school. *AL-ISHLAH: Jurnal Pendidikan*, *13*(1), 597–609. https://doi.org/10.35445/alishlah.v13i1.534

Rodgers, C. (2002). Defining reflection: Another look at John Dewey and reflective thinking. *Teachers College Record*, *104*(4), 842–866. https://doi.org/10.1111/1467-9620.00181

Ryan, M., & Ryan, M. (2013). Theorising a model for teaching and assessing reflective learning in higher education. *Higher Education Research & Development*, *32*(2), 244–257. https://doi.org/10.1080/07294360.2012.661704

Sani, B. (2016). Perbandingan kemampuan siswa berpikir reflektif dengan siswa berpikir intuitif di Sekolah Menengah Atas [Comparison of students' ability to think reflectively with students' intuitive thinking in high school]. *Jurnal Pendidikan Matematika Dan Sains*, *4*(2), 63–76. https://doi.org/10.21831/jpms.v4i2.12947

Sellings, P., Felstead, K., & Goriss-Hunter, A. (2018). Developing pre-service teachers: The impact of an embedded framework in literacy and numeracy. *Australian Journal of Teacher Education*, *43*(4), 1–16. https://doi.org/10.14221/ajte.2018v43n4.1

Sezer, R. (2008). Integration of critical thinking skills into elementary school teacher education courses in mathematics. *Education*, *128*(3), 349-363. https://bit.ly/3Q8TaXg

Sukestiyarno, Y. L. (2020). *Metode penelitian pendidikan* [Educational research methods]. UNNES Press

Syamsuddin, A. (2019). Analysis of prospective teacher's mathematical problem solving based on taxonomy of reflective thinking. *Journal of Physics: Conference Series*, *1157*, 32078. https://doi.org/10.1088/1742-6596/1157/3/032078

Tanisli, D., & Kose, N. Y. (2013). Preservice mathematics teachers' knowledge of students about the algebraic concepts. *Australian Journal of Teacher Education*, *38*(2), 1-18. https://doi.org/10.14221/ajte.2013v38n2.1

Tohir, M. (2019). Hasil PISA Indonesia tahun 2018 turun dibanding tahun 2015 [Indonesia's PISA results in 2018 are down compared to 2015]. OSF Preprints. https://doi.org/10.31219/osf.io/pcjvx

Tuncer, M., & Ozeren, E. (2012). Prospective teacher's evaluations in terms of using reflective thinking skills to solve problems. *Procedia-Social and Behavioral Sciences*, *51*, 666–671. https://doi.org/10.1016/j.sbspro.2012.08.221

Waluya, S. B., & Asikin, M. (2021). Analysis mathematical representation ability by self-efficacy of prospective mathematics teachers. *Journal of Physics: Conference Series*, *1918*, 42118. https://doi.org/10.1088/1742-6596/1918/4/042118

Widiantari, N. K. K., Suparta, I. N., & Sariyasa, S. (2022). Meningkatkan literasi numerasi dan pendidikan karakter dengan e-modul bermuatan etnomatematika di era pandemi COVID-19. *Jurnal Ilmiah Pendidikan Matematika*, *10*(2), 331–343. http://doi.org/10.25273/jipm.v10i2.10218

Widiyasari, R., Kusumah, Y. S., & Nurlaelah, E. (2020). Analisis kemampuan berpikir reflektif mahasiswa calon guru matematika pada mata kuliah program linier [Analysis of the reflective thinking ability of prospective mathematics teacher students in linear programming courses]. *Fibonacci: Jurnal Pendidikan Matematika Dan Matematika*, *6*(1), 67–76. https://bit.ly/3MFNcKx

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