

# Prospective teachers' creative thinking processes in solving contextual problems: cases of the higher and lower self-efficacy

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**Abstract:** This research aims to describe the creative thinking process of prospective elementary education teacher students based on self-efficacy in solving contextual problems. This qualitative-exploratory research involved two prospective elementary school teacher students with high and low self-efficacy. Data was collected using task-based interviews and analysis using interactive method that consist of condensation, data exposure, data interpretation, and verification methods. Prospective teacher students with high self-efficacy (HSE) in solving contextual problems can better apply creative thinking processes, especially at the stages of building ideas, planning ideas, and implementing ideas. HSE can find more than one solution correctly, while prospective teacher students with low self-efficacy (LSE) in solving contextual problems can only find one solution. Prospective teacher students with high self-efficacy can apply the four stages of creative thinking well and appear fluent, flexible, and novelty in solving contextual problems. In contrast to students with low self-efficacy at the stage of the creative thinking process, they seem only to meet the criteria for fluency but need to meet the indicators for flexibility and novelty.

**Keywords:** Creative Thinking Process, prospective teacher students, Self-Efficacy.

## INTRODUCTION

Creative individuals have ideas that can be used to solve problems and find solutions according to the desired goals. A creative person can see possible solutions to problems (Munandar, 2004). Creative individuals are greatly influenced by self-confidence or self-belief and motivation to achieve, where individual self-confidence in solving problems is very much needed. Self-efficacy is a person's self-confidence in their abilities and success in solving problems from a psychological perspective (AL Zaoubi, 2016). Self-efficacy influences behaviours that determine a person's goals and aspirations. Self-efficacy is a person's belief about their ability to produce a specified level of performance that influences events and one's life (Bandura, 2006). Individuals with high self-efficacy will have high creative thinking abilities and vice versa (Apriliya, 2019).

High self-efficacy greatly influences the creative thinking process, according to Redifer, Bae, and Zhao (2021), students with high self-efficacy have a positive impact on creative thinking. Conversely, low self-efficacy has a negative impact on low creative thinking abilities. Creative thinking is a person's ability to create new ideas or thoughts to achieve their goals in life (Maxwell, 2004). Creative thinking is a mental activity that a person uses to build new ideas or thoughts fluently and flexibly. In this sense, ideas are ideas for solving or posing mathematical problems correctly or according to his request (Siswono, 2008). According to Munandar (2012), creative thinking indicators are fluency, flexibility, originality, and elaboration. Through the creative thinking process, students can generate possible answers and ways to solve problems.

Creative thinking has a big influence on problem solving, according to research results by Treffinger (2005) which states that creative thinking skills are needed to solve problems, especially complex problems. This illustrates that creative thinking skills enable prospective teacher students to view a problem from various perspectives, thereby enabling them to find innovative solutions to the problem to be solved. Solving contextual mathematics problems occurs when student teachers interpret real problems. This situation requires the ability to think creatively to solve the given problem. Contextual problems are problems that are appropriate to the situation experienced by students in real life and close to students (Riski, 2018).

The results of researchers' observations and interviews with prospective teacher students in the Elementary School Teacher Education Study Program show that prospective teacher students need help understanding contextual problems. These difficulties include student-teacher candidates still needing help understanding the contextual problems given the difficulty in relating everyday problems to mathematical concepts; this results in not finding the right solution to these problems. One of the problems student face states that most students experience difficulties in solving mathematical problems, namely at the stage of understanding the problem and determining the formula or theory that will be used to

solve the problem (Sepang & Madzorera, 2014). Apart from that, students' weak ability to change the form of context into a mathematical model correctly means that students need to determine the right solution (Muir, et al, 2008). This problem must be overcome in the learning process, supported by teachers who can awaken students' creative thinking abilities.

Krulik and Runick (1995) state that creative thinking involves the stages of synthesizing ideas, generating/building ideas, and implementing ideas. Siswono (2007) summarizes the stages of the creative thinking process by seeing that the main characteristics of the creative thinking process lie in the idea generation/creation stage so that it produces stages of creative thinking, namely (1) synthesizing ideas, (2) building ideas, (3) planning implementation and (4) implement ideas. Synthesizing ideas means combining the ideas you have which can come from classroom learning and daily experiences. Generating ideas means generating ideas related to the problem given as a result of the previous synthesis process. Planning the implementation of an idea, namely choosing a particular idea to be used in solving a given problem or one you want to solve. Implementing an idea means implementing or using an idea that is planned to solve a problem.

Based on the problems above, the description of the creative thinking process of prospective teacher students based on self-efficacy in solving contextual issues needs to be researched because prospective teacher students who will later become teachers must be able to solve problems creatively so that they can prepare and implement learning that can improve students' creative thinking abilities.

## METHOD

Exploratory qualitative research methods were used in this research. Exploratory qualitative research is a research approach used to explore and understand the meaning of individuals or groups in dealing with social or human problems (Creswell, 2014). With this type of case study research, a case study is a research design that can be carried out in various fields where the researcher analyzes a case in depth, collects complete information using various data collection procedures based on a predetermined time. This qualitative research method using case studies was chosen because it is in accordance with the research objective of exploring or describing the thinking processes of prospective elementary school teachers based on high and low levels of self-efficacy.

Subject selection used a purposive sampling method, namely a data collection technique with certain considerations (Sugiyono, 2008). Subject selection was viewed from the criteria of high self-efficacy and low self-efficacy, each criterion was determined by one subject. Data collection uses task-based test and interview methods.

Data analysis uses the Milles and Huberman interactive model, which has three components: data reduction, data presentation, and conclusion drawing/verification (Miles, 2014). Persistent Observation carried out data credibility, and the researcher was in the classroom and observed the subject's activities for sufficient time. Apart from that, discussions were held with the course lecturers to carry out triangulation in validating the data, namely by triangulating sources and methods.

## RESULT

### Data on Self-Efficacy Levels of Primary School Teacher Prospective Students

Based on the results of research from 28 prospective elementary school teacher students who were given a self-efficacy questionnaire, data was obtained as in Table 1.1 below:

Table 1.1. Data on Self-Efficacy Levels of Primary School Teacher Prospective Students

| No | SE Level           | Total | Percentage |
|----|--------------------|-------|------------|
| 1  | High Self-Efficacy | 7     | 25%        |
| 2  | Low Self-Efficacy  | 21    | 75%        |
|    | Total              | 28    | 100%       |

Based on Table 1.1, the data on the Self-Efficacy Level of prospective elementary school teacher students can be presented as a percentage in Graph 1.1 below:

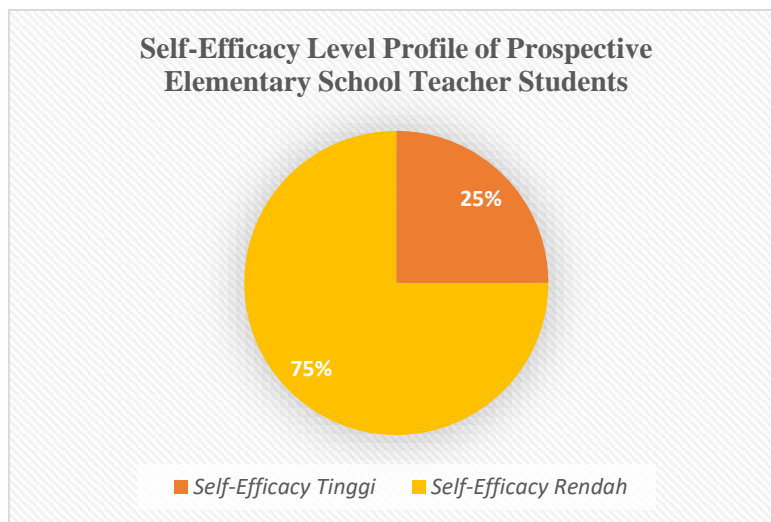


Figure 1.1 Graph of the percentage profile of the Self-Efficacy Level of prospective elementary school teacher students

Table 1.1 and graph 1.1 show that the data from 28 prospective elementary school teacher students shows that only 25% fall into the high self-efficacy category while the rest are in the low self-efficacy category. Furthermore, from this data, 1 (one) student subject with high self-efficacy and one with low self-efficacy were selected. Next, students were given a creative thinking test in solving contextual problems and carried out task-based interviews by researchers. To make it easier to describe data, subjects with high self-efficacy are given the HSE code, and subjects with low self-efficacy are given the LSE code. Meanwhile, as an interviewer or researcher, the code P is shown.

### Creative Thinking Process for Each Level of Self-Efficacy

Each individual can have different abilities in thought processes. The thinking process referred to in this research includes (1) synthesizing ideas, (2) creating ideas, and (3) planning the implementation of ideas and (4) implementing ideas. A good creative thinking process can fulfill the indicators of fluent creative thinking, flexibility and novelty. Through student teachers with high self-efficacy and student teachers with low self-efficacy, we can see their creative thinking processes when solving contextual problems. Meanwhile, solving contextual problems is carried out following the Ploya (1973) stages which consist of understanding the problem, planning a solution, implementing the solution and checking the solution again. An illustration of the relationship between the creative thinking process and Polya's problem solving stages can be seen in Figure 1.2 below:

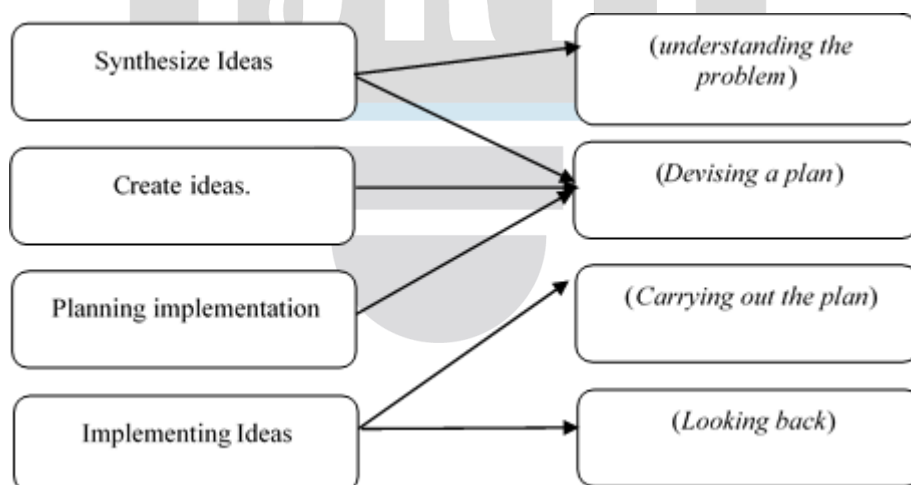


Figure 1.2 Relationship between creative thinking processes at the Polya stage

After carrying out creative thinking tests in contextual problem solving and task-based interviews on one prospective teacher student with high self-efficacy (HSE) and one prospective teacher student with low self-efficacy (LSE), the following results were obtained:

### Subjects with High Self-Efficacy (HSE):

Prospective teacher students with high self-efficacy (HSE) have a high level of confidence in answering questions from researchers when given a creative thinking test in contextual problem solving. After being given a test by HSE and reading the test, HSE is able to understand, explain fluently what is known and what is asked about the contextual problems in the test. Furthermore, HSE can explain the relationship between the contextual problems given and the mathematical concepts possessed by HSE. The following is a conversation between the researcher (P) and the HSE subject:

P: What do you know from this test question?

HSE: Hmm... Toko Bagus has a stock of cooking oil in 5 packs of  $\frac{1}{4}$  liter packaging, 5 packs of  $\frac{1}{2}$  liter packaging, 7 packs of  $\frac{3}{4}$  liter packaging, 3 packs of  $\frac{1}{3}$  liter packaging and 6 packs of  $\frac{1}{5}$  liter packaging

P: Apart from that, what else do you know?

HSE: Mrs. Budi wants to buy  $3\frac{2}{3}$  liter of cooking oil.

P: Have you ever encountered a problem like this?

HSE: Never usually, problems that are directly shaped in mathematics are not in story problems.

P: Then what is asked about this test question?

HSE: About how to combine, mmm... the cooking oil packaging that will be given to Mrs. Budi will provide 3 kinds of combinations.

P: What concept does this problem relate to?

HSE: Hmm... fractions

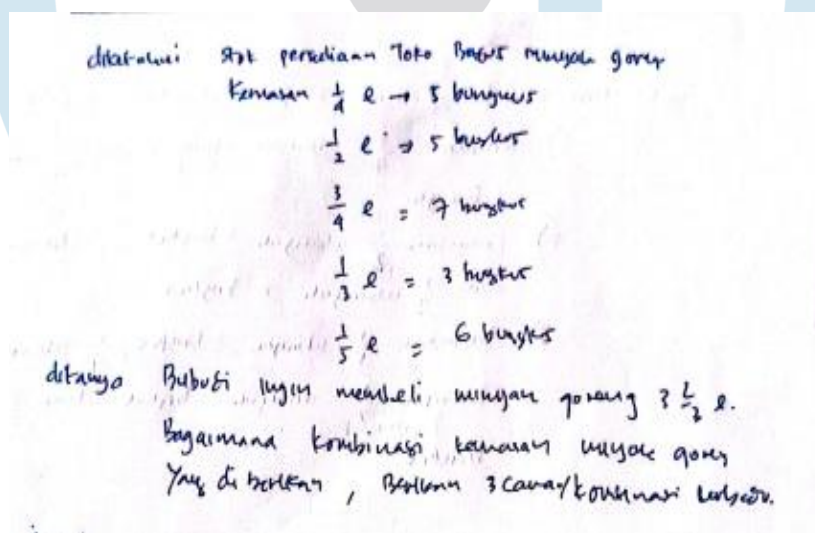


Figure 1.3 shows the HSE Subject work results for the stages of understanding the problem and the stages of the creative thinking process of synthesizing ideas.

HSE subjects in the stages of their creative thinking process can synthesize ideas well, meaning that HSE subjects can combine and link their ideas with mathematical concepts and everyday experiences. In synthesizing ideas, after reading the test questions given by HSE subjects, they can fluently write and state what is known and what is asked about the contextual problems given well and precisely.

HSE subjects in the next stage of the creative thinking process are able to build ideas in solving the problems asked in the test questions by providing more than one method that will be used. Next, HSE subjects can carry out the stages of the creative thinking process to plan the implementation of ideas. At this stage the HSE subject carries out the Polya stage of planning problem solving. HSE subjects were able to answer questions during task-based interviews conducted by the researcher (P) fluently as per the following conversation:

P: Can you solve it?

HSE: Yes...I can solve it.

P: What plan will you use to solve it?

HSE: I may use fraction multiplication.



P: Apart from multiplying fractions, are there any other ways?

HSE: Looks like there is... you can add it up, or you can also list a measurement so that it meets  $3\frac{2}{3}$  liter

HSE subjects can answer interviews smoothly, HSE is confident and able to find more than one solution in solving the contextual problems given. HSE subjects can relate the contextual problems given to the concepts they have. HSE subjects do not hesitate and have no difficulty in building ideas by combining ideas based on the knowledge they have with the contextual problems given.

Next, HSE subjects carry out stages of the creative thinking process of applying ideas, namely finding solutions to problems according to the instructions given in the problem in various ways. The HSE subject without hesitation and difficulty implemented various previous planning ideas on how to find the right combination for the cooking oil order that "Toko Bagus" would give to the Buyer. This stage of the creative thinking process is related to Polya's stage of implementing the solution. The following is the HSE conversation during the interview:

P: What ideas did you use to solve this test or problem?

HSE: First, I will try to solve it using the concept of multiplication and addition of fractions.

P: What is an example like?

HSE: Mmm... I used  $\frac{3}{4}$  liter x 4 fractions, so the result was 3 liters. I just added the  $\frac{1}{3}$  liter x 2 packaging so the total was  $\frac{2}{3}$  liter

P: Do you also produce other methods?

HSE: I tried adding them up, and I could also list the available packages.

P: Approximately how many packaging combinations can you produce?

HSE: I can work with 3 kinds of combinations.

Handwritten mathematical work showing two methods for solving a problem. The work is written in Indonesian and includes calculations for fractions.

**Metode I:** Menggunakan perkalian dan penjumlahan.

$$\frac{3}{4} \times 4 = 3$$

$$\frac{1}{3} \times 2 = \frac{2}{3}$$

$$3 + \frac{2}{3} = 3\frac{2}{3}$$

Jadi kemasan yang diberikan ukuran  $\frac{3}{4}$  liter 4 bungkus dan  $\frac{1}{3}$  liter 2 bungkus.

**Metode II:** dengan penjumlahan.

$$\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = 2\frac{1}{2}$$

$$\frac{1}{4} + \frac{1}{4} = \frac{1}{2}$$

$$\frac{1}{3} + \frac{1}{3} = \frac{2}{3}$$

$$2\frac{1}{2} + \frac{1}{2} + \frac{2}{3} = 3\frac{2}{3}$$

**Metode III:** dengan penjumlahan.

$$\frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5} = \frac{5}{5} = 1$$

$$\frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} = 1$$

$$\frac{1}{2} + \frac{1}{2} = 1$$

$$\frac{1}{3} + \frac{1}{3} = \frac{2}{3}$$

$$1 + 1 + 1 + \frac{2}{3} = 3\frac{2}{3}$$

Figure 1.4 HSE subjects, able to plan and implement plans and go through the stages of the creative thinking process (synthesizing ideas, building ideas, and implementing ideas)

In solving the test questions given by the HSE subject, ensuring that the solution to the problem is correct, HSE carries out a creative thinking process, the stage of implementing the idea which is related to the stage of checking the reliability in the polya stage. HSE checks the answers and tries to make conclusions by relating the answers obtained to the questions asked. The following are the results of interviews between researchers and HSE subjects:

P: After you found a solution to the problem, did you check your answer again?

HSE: Yes, ma'am... I will conclude and relate it to the question in the question.

P: Why did you do that?

HSE: I want to know whether what I have calculated is correct.

P: Do you feel that the solution you found is correct?

HSE: yes, I felt it.

P: Why is that?

HSE: Because the results are by what was asked.

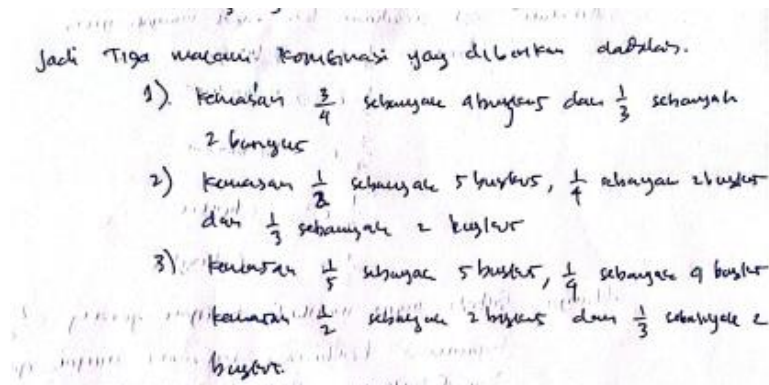


Figure 1.5 HSE subjects can carry out the Polya stages of re-checking the completion results and the stages of the creative thinking process in implementing ideas.

From the results of interviews and contextual problem solving tests with HSE subjects, it can be concluded that HSE subjects can carry out four stages of the creative thinking process of synthesizing ideas, building ideas, planning the implementation of ideas, and implementing ideas well, meeting the indicators of fluency, flexibility and novelty. HSE subjects can find more than one answer in various ways. The four stages of the creative thinking process carried out by HSE are related to Polya's four stages of problem solving.

#### Subjects with Low Self-Efficacy (LSE):

Subjects with low self-efficacy (LSE) after being interviewed and given creative thinking test questions in solving contextual problems, LSE subjects were able to synthesize ideas. As in the conversation in the interview with the LSE, the subject is as follows:

P: What do you know from this question?

LSE: It is known that good shops have a variety of cooking oil packages with available stock.

P: What kinds are there?

LSE: There are 5 packs of  $\frac{1}{4}$  liter,  $\frac{1}{2}$  liter 5 packs, 7 packs of  $\frac{3}{4}$  liter, 3 packs of  $\frac{1}{3}$  liter and 6 packs of  $\frac{1}{5}$  liter mam

P: Apart from that, what else do you know:

LSE: mm... Mrs. Budi wants to buy 3 cooking oils with a size  $3\frac{1}{3}$  liter

P: Have you ever encountered a problem like this before?

LSE: Not yet ma'am...

P: If so, what is asked of this question?

LSE: a combination of cooking oil packaging that will be given to Mrs. Budi.

P: Apart from that, what else?

LSE: That is all ma'am ...

After the LSE subject is at the stage of understanding the problem, he can explain what is known and what is asked, based on the results of the LSE subject's interview as follows:

P: Were you able to solve the problem on this test?

HSE: I will try

P: What kind of plan will you use to solve this problem?

LSE: ... I think I am trying to multiply and add.

P: Apart from that, is there any other way?

LSE: Not yet, ma'am... I still need clarification.

Kemasan  $\frac{1}{4}$  l  $\Rightarrow$  5 bungkus.  
 $\frac{1}{2}$  l  $\Rightarrow$  5 bungkus  
 $\frac{3}{4}$  l  $\Rightarrow$  7 bungkus  
 $\frac{1}{3}$  l  $\Rightarrow$  3 bungkus  
 $\frac{1}{5}$  l  $\Rightarrow$  6 bungkus.  
 Bu Budi ingin membeli  $3\frac{2}{3}$  l, bagaimana kombinasinya?  
 $\therefore \frac{1}{2}$  l  $\Rightarrow$  5 bungkus = 2,5 l  
 $\frac{1}{4}$  l  $\Rightarrow$  2 bungkus =  $\frac{0,5}{3}$  l  
 $\frac{1}{3}$  l (2 bungkus) =  $\frac{2}{3}$  l  
 $\therefore 3$  l +  $\frac{2}{3}$  l  
 $= 3\frac{2}{3}$  l

Figure 1.6 LSE Subject Completion Results on the Creative Thinking Test

After the LSE subject can plan a solution and carry it out in the creative thinking process, it can develop ideas but only meets the criteria for eloquence and needs to meet the requirements for flexibility and novelty. So, you can find and implement an idea when carrying out the LSE subject completion plan. However, because LSE students have low self-efficacy, LSE subjects need to carry out re-examination. Researchers tried to carry out validation by interviewing LSE subjects as follows.

P: What ideas or plans did you use to solve this problem?

LSE: Like this, ma'am, I... look for the right packaging according to what Mrs. Budi wants to buy.

P: Then what will you do?

LSE: I tried multiplying the packaging by the size of  $\frac{1}{2}$  liter x 5 liter, which produces a value of 2,5 and  $\frac{1}{4}$  liter x 2 packs gets a value of 0,5, then,  $\frac{1}{3}$  liter x 2 packaging so we get a value of  $\frac{2}{3}$  liter then I added them up.

P: is there another way?

LSE: meanwhile, ma'am...

P: Have you checked your answer again, and is it appropriate for the problem in the question?

LSE: that's enough, ma'am... I think that's enough; I'm confused, ma'am...

Interviews and contextual problem solving tests with LSE subjects showed that LSE felt less confident and thought what they had done was sufficient. LSE subjects experience difficulties when they have to work with different packaging combinations.

Table 1.2 summarizes the stages of the thinking process of prospective elementary school teacher students when solving contextual problems based on their level of self-efficacy.

Table 1.2 Summary of Stages of the Creative Thinking Process based on Level of Self-Efficacy

| Stage\level SE             | High Self-Efficacy  | Low Self-Efficacy  |
|----------------------------|---|--|
| <b>Brainstorming ideas</b> | Ideas are based on knowledge of fraction operations on ordinary and mixed fractions.<br>Can understand problems and relate contextual issues to the concept of fractions obtained from daily experience | Ideas based on the concept of fractions about multiplication and addition.<br>Can understand and relate contextual problems to the concept of fractions they have. |
| <b>Building ideas</b>      | Search for solutions by combining given contextual problems with fraction operations such as addition.  | Looking for solutions to contextual problems by linking fraction multiplication  |

|   |   |  |
|---|---|--|
| <b>Planning the implementation of ideas</b> | Fluently and confidently generating various ideas to produce solutions to given problems.<br>Able to generate various kinds of ideas to solve given problems.   | Still trying to come up with an idea and feel that it is enough because it is considered appropriate and needs help carrying out fractional operations.                |
| <b>Implement ideas</b>                      | Can combine packaging in the form of fractions and get appropriate results.<br>Try hard to check the correctness of the results of the problem-solving carried out.<br>Make conclusions and ensure the solution meets the questions of the given problem. | Lack of confidence in implementing ideas but can implement ideas according to the initial plan.<br>I am still trying to get another plan and do not want to try again. |

## DISCUSSION

Subjects with high self-efficacy (HSE), after being given a creative thinking test on contextual problems, can carry out four stages of the innovative thinking process and fulfill the creative thinking indicators of fluency, flexibility, and novelty. HSE subjects at the stage of understanding the problem (Polya stage): HSE subjects can state what is known and what is asked, relate the situation given to the mathematical concepts the HSE subject has, and write it well on the answer sheet. HSE subjects can synthesize ideas well, namely combining the ideas or ideas that have been obtained with the problems given. HSE subjects can link their concepts or knowledge with their contextual issues.

Furthermore, HSE subjects can carry out the stages of the creative thinking process of building ideas, planning the implementation of ideas well and smoothly. The HSE subject was able to state a solution plan in more than one way and found a solution of three combinations of cooking oil packaging that Mrs. Budi needed,  $3\frac{2}{3}$  liters. HSE subjects in planning the implementation of ideas and applications can choose an idea as an example of using the concept of multiplication and addition of fractions in solving the contextual problem that has been given. HSE subjects in solving contextual problems can apply creative thinking processes well and fulfill creative thinking indicators, namely fluency, flexibility and novelty. Apart from that, HSE subjects have good perseverance and self-confidence, so when they have found a solution, HSE subjects confirm the solution that has been found by checking again or checking again, paying attention to the solution to the problem given. At this stage, the HSE subject carries out the creative thinking process stages of implementing ideas; the HSE subject can implement or use the planned ideas in solving the given contextual problem.

In contrast to prospective teacher student subjects with low self-efficacy (LSE), LSE subjects are able to state what is known and what is asked about the problem given, namely applying the polya stages of understanding the problem, but there is still an understanding that is still not correct, at the stage of planning a solution. and the stages of implementing LSE subject solutions are only able to find one solution and still have difficulty implementing the plan. Apart from that, the LSE subject carried out the re-examination stage. At the stage of the creative thinking process, LSE subjects can carry out the process of synthesizing ideas but have difficulty understanding the problems given in the test questions. LSE subjects at the idea building stage have difficulty relating the contextual problems given to their mathematical concepts. Furthermore, in planning ideas and implementing ideas, the subject was only able to meet the fluency indicators.

After researching ideas, LSE subjects could build but only met the criteria for eloquence and needed to meet the requirements for flexibility and novelty. LSE subjects understand the problem of what is being asked so that they can find an idea and implement it when carrying out the LSE subject completion plan. However, because LSE students have low self-efficacy, LSE subjects do not carry out re-examination.

## CONCLUSION

Prospective teachers' creative thinking processes in solving contextual problems: cases of the higher and lower self-efficacy, it can be concluded that subjects with high self-efficacy (HSE) can solve creative thinking test questions. Carry out four stages, namely (1) synthesizing ideas, (2) building ideas, (3) planning the implementation of ideas, and (4) implementing ideas by meeting the indicators of creative thinking, namely eloquence, flexibility, and novelty. Meanwhile, LSE subjects can apply the stages of the creative thinking process. They can carry out the stages of (1) synthesizing ideas, (2) building ideas, (3) planning ideas, and (4) implementing ideas but only fulfill the indicators of fluent creative thinking.



High self-efficacy (HSE) prospective teacher student subjects have differences in their thinking processes from low self-efficacy (LSE) prospective teacher student subjects. These differences are in the stages of building ideas, planning the implementation of ideas and implementing ideas. HSE is able to find various ways or solutions to answer the problems given, while LSE is only able to find one solution or one way. Thus, it shows that student teachers with high self-efficacy (HSE) have better creative thinking processes than student teachers with low self-efficacy (LSE). Prospective teacher students with high self-efficacy can apply the four stages of creative thinking well and appear fluent, flexible, and novelty in solving contextual problems. In contrast to students with low self-efficacy at the stage of the creative thinking process, they seem only to meet the criteria for fluency but need to meet the indicators for flexibility and novelty.

Suggestions can be conveyed to familiarize and train student teachers in solving contextual creative thinking problems. Through contextual problem solving, student teachers can think scientifically systematically, using logic, to increase their creativity. Self-efficacy is also very important to pay attention to and improve so prospective teacher students are enthusiastic, active, and persistent when faced with their problems.

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