This study aimed to describe the types of misconceptions conducted by preservice elementary teachers (PGSD) students in integer operations. Misconceptions are classified into 3 types: 1) Careless Errors (Ca); 2) Concept errors (Co); 3) Careless errors and Concept errors (Ca and Co). The researcher presented 6 problems about integer operation to 45 students of PGSD (preservice teachers for elementary school) students that were taking elementary mathematics subject. The results showed that 10% of students made Careless errors (Ca) misconceptions in integer addition and subtraction. The highest portion of the students, 53% performed Concept error (Co) in subtracting negative numbers. Another 9% showed Careless and Concept error (Ca and Co) misconception in subtraction of integers of the same sign (negative with negative or positive with positive).

Keywords: Misconceptions, Integer Operations, Preservice Elementary School Teachers

1. Introduction
Many daily activities cannot be separated from the mathematics. Pertiwi & Marsigit [1] explained that there were several competencies are important in mathematics learning, such as: 1) tracking patterns and relationships; 2) the development of creativity, intuition, and discovery; 3) communication and social interaction activities; and 4) problem solving. Therefore, the focus of mathematics learning must be shifted towards the understanding of the mathematical concept.

PGSD students as prospective elementary school teachers are required to understand the subjects they are going to teach. One way to accomplish this is by teaching the mathematics step-by-step in increasing levels of difficulty with different associated cognitive abilities. In this case it must be ensured that PGSD students understand all teaching competencies. Only by understanding the facts, concepts, and principles learned will students have procedural skills in solving mathematical problems.

Elementary School Mathematics is a subject intended to equip PGSD students with the ability to think logically, analytically, systematically, critically, and creatively through developing the content of each competency. School mathematics competencies consist of numbers operations, algebra, geometry, measurement, and data processing. The number concept must be learned and understood by every learner. An essential part of the number concept is the integers. NCTM [2] stated that "young children
focus on whole numbers with which they count, compare quantities, and develop an understanding of the structure of the base-ten number system". The focus of integer concept is on calculating skills such as understanding the location or position of integers, as well as understanding the properties of integer operations such as addition and subtraction, and being able to solve them appropriately. Integer becomes the basis needed to succeed in learning algebra and other high-level mathematical mastery [3]. Many students in the Mathematics for Elementary School subject find it difficult to solve problems related to integers, even basic arithmetic operations such as addition and subtraction of simple numbers. This shows that the mastery and understanding of the concept of integers is still low. When assisted using number coins, many students still make mistakes. For example, the operation of calculating the subtraction of negative numbers such as \(-4 - 5 = \ldots\), some students answered \(-1\). It can be concluded that students are still mistaken in understanding a concept. This is called misconception. According to Purwaningrum & Bintoro [4], misconception is a type of error in understanding each mathematical concept and solving mathematical problems.

Misconception in any subject is not a trivial problem. Even more so when it comes to basic arithmetic skills. "Understanding the wrong prerequisite concept can lead to misconceptions" [5]. A small mistake in understanding or interpreting the concept will result in propagating errors. Moreover, if the material becomes a prerequisite ability that students must master to be able to understand advanced material. This will certainly result in fatal mistakes.

The purpose of this research is to find out and describe the types of misconceptions experienced by students of the University of Mataram's PGSD related to the concept of integers, especially integer operations, as well as the factors that cause these misconceptions. The types of misconceptions are further grouped based on the types of misconceptions described and adapted to the revisions in Badriyah et al. [6]. The 3 types of misconceptions are: 1) Careless errors that are caused by carelessness when solving problems. For example, careless in calculation, careless in writing the results or answers to the questions; 2) Concept errors, which are mistakes made when not understanding the nature, concepts, definitions or mathematical principles that can be used to solve problems; 3) Careless errors and Concept errors (Ca and Co), are errors relating to accuracy and errors in using integer concepts in solving problems.

2. Methods

This research was a qualitative study that conducted in November 2019 with the research subjects being 45 PGSD students of the Universitas Mataram Year 2019/2020. Research subjects are given a test to detect misconceptions about integer calculation, as well as knowing the types of errors or misconceptions. The misconception categories are: Careless errors (Ca), Concept errors (Co), and Careless errors and Concept errors (Ca an Co).

Data reduction was carried out to avoid the same information from student answers. Data reduction was obtained by counting the number of students who answered right and answered wrong on each question. Further analyzed data was the wrong student answers. The answers then analyzed to obtain how the students answered. The students worked on six problems about arithmetic operations. The indicators are: 1) subtracting positive and negative numbers; 2) adding positive and negative numbers; 3) subtracting negative numbers with positive numbers; 4) subtracting negative numbers with negative; 5) adding negative numbers with positive; 6) subtracting positive numbers with positive. Students were asked to solve question 3) and 4) using number coins. The use of number coins can help learners to translate between pictorial and written representational forms for addition and subtraction of integers [7].

3. Results and Discussion

The main focus of this research is analyzing misconceptions and types of misconceptions or mistakes made by students in solving mathematics problems on integer calculation. The percentage of students that made mistakes on each question is shown in Table 1.
Table 1. Percentage of Students Answer on Each Question

| No. | Question | Answer N = 45 | Wrong Answer N = 45 | Not Answered N = 45 | Student Percentage |
|-----|----------|---------------|---------------------|---------------------|--------------------|
|     |          | Correct Answer | Wrong Answer        | Not Answered        |                    |
| 1.  | 125 - (-64) | 38            | 7                   | 0                   | 84% 16% 0%        |
| 2.  | 49 + (-75)  | 31            | 13                  | 1                   | 69% 29% 2%        |
| 3.  | -8 - 4     | 14            | 31                  | 0                   | 31% 69% 0%        |
| 4.  | -12 - (-5)  | 10            | 35                  | 0                   | 22% 78% 0%        |
| 5.  | -24 + 95   | 21            | 20                  | 4                   | 47% 44% 9%        |
| 6.  | 24 - 67    | 21            | 22                  | 2                   | 47% 49% 4%        |

Table 1 shows variations in misconceptions or errors by students in the questions. Most errors were in questions number 3 and 4, where 69% students answered incorrectly. Problems 3 and 4 are about subtractions of negative numbers. This explains that students did not understand well about the use of negative numbers. Moreover, students were asked to solve the problems using the number coin media. In short, the students find it difficult to answer the questions because they do not understand very well about the concept of negative numbers. The use of number coins is also suspected to cause the confusion in answering question 3 and 4.

In contrast, the item number 1 has the highest percentage of correct answers at 84%. In other word there are 38 students who answered the correctly. Based on the students’ answer sheets, the solution for question 1 is 125 - (-64) = 189 was solved by adding up the numbers. Students concluded that "negative met negative" then the result is positive, or minus met minus the result is plus. With that assumption, they only need to add the two numbers (125 + 64) to get 189.

There are 3 types of answering errors: Careless errors (Ca), Concept errors (Co), and Careless and Concept errors (Ca and Co). The percentage students in each type of misconception is presented in Table 2 below.

Table 2. Students Misconceptions

| No. | Problem | Careless errors (Ca) | Concept errors (Co) | Careless and Concept error (Ca and Co) | Careless errors (Ca) | Concept errors (Co) | Careless and Concept error (Ca and Co) |
|-----|---------|----------------------|---------------------|----------------------------------------|----------------------|---------------------|----------------------------------------|
| 1.  | 125 - (-64) | 0                    | 9                   | 0                                      | 0%                   | 20%                 | 0%                                      |
| 2.  | 49 + (-75)  | 2                    | 11                  | 0                                      | 4%                   | 24%                 | 0%                                      |
| 3.  | -8 - 4     | 1                    | 24                  | 0                                      | 2%                   | 53%                 | 0%                                      |
| 4.  | -12 - (-5)  | 1                    | 24                  | 1                                      | 2%                   | 53%                 | 2%                                      |
| 5.  | -24 + 95   | 0                    | 14                  | 0                                      | 0%                   | 31%                 | 0%                                      |
| 6.  | 24 - 67    | 1                    | 8                   | 3                                      | 2%                   | 18%                 | 7%                                      |

Students were not careful when writing the symbol of numbers and writing the sign for a number operation. For example, in problem number 2, the question is 49 + (-75). However, some students wrote different questions on the answer sheet, such as student A wrote 49 + (-74) and student B wrote 49 + (-7).
Another misconception lies in writing the number sign. In addition, there are also students who incorrectly calculate the number operations. As in the example questions 3 and 6.

*Figure 1.* (a) Answer of question 2 by student A; (b) Answer of question 2 by student B

Question 3 is \(-8 - 4\), but a student wrote it as \(-8 + 4\). Furthermore, for question 6 that should have been \(24 - 67\), but there was one student who wrote it into a summation operation \(24 + 67\). The types of student misconceptions for the Careless errors (Ca) category were only caused by two errors as described above, and the frequency of the number of students answering incorrectly, between 1 to 2 people only or lies between the range of 2% to 4%.

Concept errors (Co) occurs 18% to 53% or each problem. There are 8 students for question 6 and 24 students for questions 3 and 4 fell into the error. The indicators for questions 3 and 4 are related to the operation of subtracting negative numbers. For questions 3 and 4, the students were asked to answer them using the media number aids. The aim is to help students become aware of the negativity in operating results, especially negative integer arithmetic operations [8]. In addition, the use of number coins is intended to help represent and concretize negative count operations intended. The students have previously been introduced to the use of number coin instead of number line in studying integers in elementary mathematics learning lectures. However, some students made misconceptions. The numbers are as follows:

*Figure 2.* (a) Answer to question 3 by student C; (b) Answer to question 6 by student D

For problem 3, the student answered \(-4\) for question was about the subtraction of negative numbers \((-8 - 4)\). When using the number coin media, the students draw eight negative coins to represent \(-8\), and four positive coins to represent \(+4\). One positive coin and one negative coin if paired worth zero. Because there are four pairs of coins worth zero (0) and the remaining four coins are negative, the result of the counting operation is \(-4\). In other word, the students solve the question 8-4 instead of \(-8-4\). This
misconception was carried out by student E. For the indicator operation of subtraction of negative numbers (in question 4), there are 24 students or around 53% who experienced misconceptions. Misconceptions on completing integer operations can occur because students only memorize concepts without regard to relationships that exist between concepts [9].

Finally, for Careless and Concept error (Ca and Co) types, there were 4 students who experience misconceptions for questions 4 and 6. Question 4 is related to the indicator of subtraction of negative number with negative number (−12−(−5)). Careless error (Ca) was done by students because it is wrong in rewriting number from -15 to 15 which affect the results of the calculation.

Students were asked to solve problem 4 using the number coin media. The concept error (Co) misconception arises from this, where students did not understand correctly the concept of negative integer subtraction. Students answered -27 as a result of -12-(-15). Moreover, the method of solving using the number coin media is not fully usable to solve the problem, because there were only 12 negative coins and 15 positive coins. The misconception is due to students' conceptual understanding of negative signs that are not appropriate to use [10].

The careless and concept error (Ca and Co) misconceptions were also found in problem 6 for subtraction of positive numbers with another larger positive number (24−67). A student incorrectly rewrote the given problem to 24-64. Furthermore, another student also answered –88 which is incorrect. This means that for this type of misconception, students were not careful in reading questions, writing answers, and do not understand the concept of subtracting integers, including subtraction of integers of the same type (negative with negative and positive with positive).

4. Conclusion

The mathematics misconceptions of PGSD students as prospective elementary school teachers in answering integer operations are divided into 3 types, Careless error (Ca), Concept error (Co), and Careless and Concept error (Ca and Co). The percentage of students who made Careless errors (Ca) was 10% (5 students) out of a total of 6 questions given. Mistakes made in the form of inaccuracy in rewriting the components of the problem given. Students also incorrectly wrote the symbol of the number in question or giving a positive or negative symbol of integers, or writing the sign of a numeric operation. The most frequent mistakes are Concept errors (Co) by 53% of the total students. The students do not understand correctly the rules and principles in the completion of the positive and negative integer count operations. Sometimes students ignore the positive or negative symbols of integers, so assume that there is no difference between the two. Furthermore, as many as 4 students with a percentage of 9% of a total of 6 questions were given a misconception of the type of Careless and Concept error (Ca and Co). Careless and Concept errors (Ca and Co) are mistakes or carelessness when reading and rewriting questions and concept errors when completing integer operations that include the reduction of similar integers, namely negative with negative and positive with positive.

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