Analysis misconception of integers in microteaching activities

R D Setyawati and I Indiati*
Department of Mathematics Education, Faculty of Mathematics, Science and Information Technology Education, Universitas PGRI Semarang, Semarang, Indonesia

*Corresponding author’s e-mail: intan.indiati@upgris.ac.id

Abstract. This study view to analyse student misconceptions on integers in microteaching activities. This research used qualitative research design. An integers test contained questions from eight main areas of integers. The Integers material test includes (a) converting the image into fractions, (b) examples of positive numbers including rational numbers, (c) operations in fractions, (d) sorting fractions from the largest to the smallest, and vice versa; e) equate denominator, (f) concept of ratio mark, (g) definition of fraction, and (h) difference between fractions and parts. The results indicated an integers concepts: (1) the students have not been able to define concepts well based on the classification of facts in organized part; (2) The correlational concept: students have not been able to combine interrelated events in the form of general principles; and (3) theoretical concepts: students have not been able to use concepts that facilitate in learning the facts or events in an organized system.

1. Introduction
Mathematics grows and develops because of thinking processes, therefore logic is the basis for mathematical formation [1]. The material presented by the teacher should be in accordance with the concept. If the teacher submits the material not in accordance with the concept (misconceptions), then the teacher does not have good professional competence. This certainly shows the absence of a balance to the Law no. 14 Year 2005 with the actual situation, and it is also very important to be known for prospective teachers, especially for prospective mathematics teacher. Prospective teachers should attempt to study mathematics while studying (before becoming a teacher).

Prospective teachers should avoid misconceptions so that learning competencies can be achieved. Misconceptions point to a concept that is inconsistent with the scientific understanding or understanding received by experts in that field [1]. The opinion suggests that the intended scientific understanding will appear in the use of the language used in conveying the concept itself. So it will be known whether in accordance between the scientific understandings with the understanding of experts. "Misconception associated with numbers found through the mathematics curriculum. Here, we identify and review certain misconceptions that are most common among primary and secondary school students "[2]. It can be argued that misconception is associated with numbers discovered through mathematics. Identification of misconception is most prevalent in elementary school. Another opinion of the figures that support the idea [3], "... an individual's misconception can be found useful by students to help them recognize their knowledge, difficulties, and misconception to support their self-assessments and facilitate identification of an appropriate focus of their efforts, to meet their learning needs ".

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The above indicates that the discovery of a misconception that occurs in the individual is useful for students to acknowledge knowledge that refers to a conceptual response, difficulties and misconception that may also occur to himself so as to attempt to identify personally as a self-assessment in order for the learning needs to be achieved. "Misconception, as well as the fact things as preconceived notions, non-scientific beliefs, naïve theories, mixed conceptions or conceptual misunderstanding ", [4] Nesher also suggests that the ideas of misconception refer to the line of thought that causes a series of errors resulting from the premise that underlie a particular concept or process, not a systematic, sporadic error.

Misconception can be described as an idea of misconceptions such as constructive ideas, objects or events based on people's experiences including such things as a presumption, a non-scientific belief, a theory, a mixed concept or a conceptual misconception. [5] Nasser & Carifio argue that for many years errors in mathematics, especially in algebra are regarded as a form of procedural or computational error. [6] Names, (a) the concept of classification; (b) Correlational Concepts and (c) Theoretical Concepts. It points to a problem-solving strategy that requires ideas and experiences in presenting, theories and concepts. From that matter it needs the existence of misconception analysis of prospective teacher in order to give solution for next at process of learning in class to become good.

2. Methods
The research method used in this research is qualitative research method with triangulation data analysis technique. Research subjects in this study were students who experienced misconception. The process of collecting data obtained in several ways, namely: giving questions, interviews, field notes, and documentation. The process of data analysis as follows: raw data collection, data analysis. The purpose of this study is to determine the location of misconceptions about the understanding of the concept of PGMIPATI students in the matter of integers before microteaching.

3. Results and Discussion
The results of the identification can be seen in the tables below.

**Table 1. Identification Results of Misconceptions of the number lines concept (Correlational Concepts)**

| Misconceptions | Correct |
|----------------|---------|
| There are students with codes A2, A3 and A4 that drew a number line like the following, | Drawing the number line should be, |
| ![Number Line](number_line.png) | ![Number Line](number_line.png) |

**Table 2. Misconceptions Identification Results on problem solving strategies (Theoretical Concepts)**

| Misconceptions | Correct |
|----------------|---------|
| There is a student with code A4 that did the following questions, | Given that : |
| Given that : | The number of questions is 25 |
| The exam consists of 25 questions | The correct answer is 20 questions |
| The correct answer got score 4 | The incorrect answer is 3 questions |
| The wrong answer gets -1 | The correct answer score is 4 |
| If the problem is unanswered, gets score 1 | The wrong answer score is -1 |
| Asked: | The score of unanswered questions is 1 |
| If Iwan answers 20 questions correctly and 3 questions incorrectly, what is Iwan’s score? | Asked: |
| Answered: | What is the score that Iwan got? |
| Answered: | Answered: |
| From 25 problems, Iwan only does 20 questions with correct answers and 3 questions with wrong answers, then we can count how many problems that Iwan does, namely: | NB = 20 x 4 = 80 |
| | NS = 3 x (-1) = (-3) |
| | NK = (25-(20+3)) x 1 |
| | = (25-23) x 1 |
| | = 2 |
Misconceptions

25- 20 – 3 = 2
The meaning of the 2 above is questions that is not answered by Iwan. With the information available then obtained:
20 questions with correct answers
3 questions with wrong answers
2 unanswered questions
In conclusion that the score obtained by Iwan if the correct answer got 4, wrong answer got -1 and did not answer got 1 is as follows,
20 x 4 + 3 x (-1) + 2 x 1
= (20 x 4)+3(3x(-1))+2x1)
= 80-3+2
= 78

Information:
NB = score of the correct answer
NS = The score of the incorrect answer
NK = The unanswered question
Thus, the answer that Iwan obtained is as follows 80 + (-3) + 2 = 79

The table 1 and 2 above shows that the student has not been able to understand the problem by solving the problem. This is in line with the results of research conducted [7], he said that the word problem is a form of problem that is considered as difficult.

Table 3. Misconceptions Identification Results on the concept and strategy of solving the problem of operating properties on integers (Classification Concepts)

| Misconceptions | Correct |
|----------------|---------|
| Students with code A3 answered that the associative nature applies to the reduction of integers because they produce the numbers themselves, Example: 3 - 2 = 1 (Description: 3 is an integer and 2 is also an integer, the result is also an integer that is 1) | The associative nature does not apply to integer reduction operations. If want to prove whether the associative nature applies to a reduction operation it must satisfy, x – (y –z) = (x-y) – z Example: 2 – (5-4) = (2-5) -4 2 – 1 = -3 – 4 1 ≠ -7 Since the left side is not the same as the right-hand side, the associative nature does not apply to integer reduction operations The element of identity is the element that is operated (sum and multiplication) with a number whose result is the number itself. Form: \( a * e = e * a = a \) where, for * has the meaning of an operation (sum or multiplication) and a is a number, whereas e is the element of identity (addition or multiplication) Another definition of the identity element is the result of the addition / multiplication operation with its inverse For example: \( 5 \times \frac{1}{5} = 1 \), so for multiplication, the element of identity is 1. In subtraction operations and division operations, the identity element does not apply. |
| - Student code A1 answered that the identity element is an operation on the number, where the number when operated will produce the number itself | |
| - Students of the codes A6 and A7 answered that the identity element is a number operated with another number that produces the number itself. Students code A3 gave his opinion in answering the question that we remember the nature of the identity element, where all numbers operated by operation (+, -, x, :) would generate the number itself. In multiplication the identity element is 1 because all numbers multiplied by 1 will produce the number itself | |
Table 4. Results of Misconceptions Identification of concepts and strategies for solving problems on multiplication operation on integers (Classification Concepts)

| Misconceptions                                                                 | Correct                                                                 |
|--------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| Students with codes A2, A6, A7 and A8 answered that 2 x 4 = 8, because at the multiplication we can look at the properties that exist, 2 x 4 = 2 + 2 + 2 + 2 (2 besides amounting to 4 as multiplied by 4 the number multiplied by then yields 8 | Since 2 x 4 is included in multiplication operations, where multiplication operations are repeated sums, so 2 x 4 has the meaning that there is a recurring sum for 4 + 4 which when summed yields 8 or if it is associated with commutative properties, then 2 x 4 = 4 x 2 which means that there are sums of 2 of 4 tribes so as to produce 8 |
| Students with codes A2, A6, A7 and A8 answered that (-2) x 4 = (-2) + (-2) + (-2) + (-2) = -8 | Since 2 x 0 is included in the multiplication operation, where multiplication operation is repeated addition, so 2 x 0 has the meaning that there is a recurring sum for 0 + 0 which when summed yields 0. The empty set is not zero, since the empty set is a set that does not have the same object or member of the two existing set members. Whereas zero is part of the integer and the counting number. The empty set and zero are two different things. |
| Students with codes A2, A6, A7 and A8 answered the question that 2 x 0 = 0, Since 2 x 0 is a number which if multiplied by positive or negative integers will produce 0. Some say with repeated summing of number 2 by 0 times, so the result is zero (empty set) | (-2) x (-1) = 2, since the multiplication operation (-2) x (-1) is the repeated sum of the numbers (-2) 1 times. Because number 1 is negative, then the result is positive. Negative numbers multiplied by negative numbers will have positive results |

Table 5. Results of Misconceptions Identification of the concept of prime numbers (The concept of Classification)

| Misconceptions                                                                 | Correct                                                                 |
|--------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| - Student with code A1 defined prime number is number which is divisible by number itself | Prime number is number that exactly has 2 factors, namely 1 and the number itself. |
| - Students with codes A3, A4, A5 and A6 defined prime numbers as numbers that can only be divided by numbers themselves |                                                                                       |

Table 6. Results of Misconceptions Identification of the concept of operation on integers (Theoretical Concept)

| Misconceptions                                                                 | Correct                                                                 |
|--------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| Students with code A3 solved the following problem, 5 + 48 - (-12): 4 = ... | 5 + 48 - (-12) : 4 = [(5 + 48) - ((-12) : 4)] = {53 - (-3)} = 53 + 3 = 56 |
| Operations to be done first is the sum, adjusted to the level, namely: 5+48 = ... | Noteworthy are: a. Put the operation in parenthesis first |
|                                                                              | b. Put forward the power / root operation                              |
|                                                                              | c. Putting the multiplication / division operation first                |
|                                                                              | d. Complete the sum / subtraction operation                             |
|                                                                              | e. For operations of the same level start from the front.              |
Table 7. Misconceptions Identification Results on the concept of integer sum operation (Correlational Concept)

| Misconceptions                                                                 | Correct                                                                 |
|-------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| A student with code A6 gave a statement that "the number of positive integers and negative integers is a negative integer" is true. | The statement that "the number of positive integers and negative integers is a negative integer" is false Example:  
  a.  \(2 + (-3) = -1\) 
  b.  \(3 + (-2) = 1\)  
  Consider for example (a), 2 is a positive integer and (-3) is a negative integer, if both are summed then it denotes (-1) which is a negative integer. Similarly for example (b), 3 is a positive integer and (-2) is a negative integer, and when both are summed it produces 1 as a positive integer. |
| Example:  
  \(5 + (-2) = 7\)                                                                 |                                                                           |

Table 3, 4, 5, 6, and 7 show that the student still could not operate the integer in accordance with the results of research conducted by Norton and Irvin which shows the difficulty of learning algebra associated with the operation of negative integers [8].

After the implementation of concept comprehension test, then conducted interview. Here is the result of the interview.

Table 8. Misconceptions Identification Results on the definition of integers (The concept of Classification)

| Misconceptions                                                                 | Correct                                                                 |
|-------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| Students with code A3 said that integers are numbers that can be rounded just in a positive integer | Integer is a set number consisting of a negative integer, zero and a positive integer. |

Table 9. Results of Misconceptions Identification of Differences in Integers and Rational Numbers (Correlational Concepts)

| Misconceptions                                                                 | Correct                                                                 |
|-------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| student code A3 said that integers cannot be expressed in fractions and rational numbers can be expressed in fractions  
  so \(-\frac{2}{3}\) is a fraction.                                                                 | Integer is a set number consisting of negative integers, zeros and positive integers and can be expressed in fractions \(\frac{a}{b}\), e.g. negative integers, i.e. 
  \(-\frac{4}{3}\) which can be expressed in fractions such as \(\frac{-4}{3}\),  
  while the rational number is the number which can be expressed in the form \(\frac{a}{b}\) where a, b is an integer and b ≠ 0. |

Table 10. Results of Misconceptions Identification of the Application of Integers in Everyday Life (The Concept of Classification)

| Misconceptions                                                                 | Correct                                                                 |
|-------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| Students with code A3 gave examples of the application of integers in everyday life such as the distance from City A to City B | In medical science that is the use of thermometer |
Table 11. Results of Misconceptions Identification of the definition of Reduction, addition, multiplication and division Operations (Classification concept)

| Misconceptions                                           | Correct                                                                 |
|----------------------------------------------------------|--------------------------------------------------------------------------|
| Students with codes A4 provided information that the reduction is subtracting a larger value with a smaller one, adding is to add two numbers in order to obtain a result, multiplication is repeated summation and the division is a divided number. | Reduction is the reduction of two or more numbers into a number that is the result of the reduction. Addition is the addition of a group of numbers or more into a number which is the sum, Multiplication is a recurring sum and the division is repeated reduction. |

Table 12. Results of Misconceptions' identification of the application of multiplication operations (Theoretical Concepts)

| Misconceptions                                           | Correct                                                                 |
|----------------------------------------------------------|--------------------------------------------------------------------------|
| Student with code A7 stated that because a negative integer if operated multiplication by a positive integer, produces a negative integer, and that is valid at -2 x 4 = -8 | Since there is a negative integer if multiplication is operated by a positive integer, it produces a negative integer, and it applies at -2 x 4 = -8, but it needs an explanation again that -2 x 4 = - (2 x 4) = - (4 + 4) = -8 |

Table 13. Misconceptions Identification Results of the element of the addition identity (Classification concept)

| Misconceptions                                           | Correct                                                                 |
|----------------------------------------------------------|--------------------------------------------------------------------------|
| Student code A6 stated that the identity element on the reduction is 0 | Nothing, because the identity element exists only in addition and multiplication. For reduction is not applicable. |

Table 14. Results of Misconceptions Identification of Problem Solving Strategies (Theoretical Concepts)

| Misconceptions                                           | Correct                                                                 |
|----------------------------------------------------------|--------------------------------------------------------------------------|
| Student with code A9 resolved the question in interview as follow, \( \frac{2}{5} \) of \( \frac{1}{2} \) = \( \frac{2}{5} \times \frac{1}{2} \) = \( \frac{4}{10} \) = \( -\frac{1}{10} \) | \( \frac{2}{5} \) of \( \frac{1}{2} \) = \( \frac{2}{10} \) = \( \frac{1}{5} \), there are students who still interpret the meaning of “of” in the reduction operation. In fact, for of in the matter has meaning from, that is solved using multiplication operations |

4. Conclusion

The results indicated (1) an integers concepts: the students had not been able to define concepts well based on the classification of facts in organized part; (2) The correlational concept: students had not been able to combine interrelated events in the form of general principles; and (3) theoretical concepts: students had not been able to use concepts that facilitate in learning the facts or events in an organized system.

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