DISCOVERING THE ERRORS AND MISCONCEPTION IN OPERATION ON INTEGERS

Mark Gil C. Dela Rosa[1], Princes Joy O. Rosete[2], Katelyn Joy N. Maggay[3], Joanna Rose M. Mego[4], Mel Jan D. Rivas[5], Reina Mae E. Elegido[6]

College Instructor[1] and Student Researchers, President Ramon Magsaysay State University – Iba Campus

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Abstract: This study aimed to identify the errors and misconceptions in solving the operation of integers among the grade 7 studenst of Amungan National High School. This study aimed to identify the sources and causes of students' errors and misconceptions when solving problems involving integer addition, subtraction, multiplication, and division. This study is a qualitative study that is designed to identify the errors and misconceptions in solving the operation of integers. The researchers used a descriptive research design using an adopted survey questionnaire. The findings concluded that: the common error of the students in solving addition and subtraction of integers is procedural errors, common error in solving multiplication and division of integers is careless error. A common misconception of the respondents in solving addition and subtraction of integers are can't assimilate concepts and poor knowledge, a common misconception in solving multiplication and division of integers is signed rules misconception. Researcher offers the following recommendations: Teacher should teach the students that when two negatives are right next to each other with nothing except maybe a parenthesis in between, they become positive. – (-) = +. Teachers should have students' portfolios to help them reflect on the wrong answers they've got and for them to figure out where they have mistaken and areas that need improvements. Teachers need to develop contextualized strategic materials about the operations of integers with application in real-life situations in order to understand more about the operation of integers. Teachers should provide a daily/weekly activity on the operations of integers this will help to enhance and develop the skills/knowledge of the students.

Keywords: Procedural error, Careless error, can't assimilate concept, Poor knowledge, Sign rules misconception

INTRODUCTION

Many daily activities are inseparable from mathematics. According to Pertiwi & Marsigit (2017), a few competencies are very important in learning mathematics subjects, such as tracking patterns and relationships, developing and improving creativity, intuition, discovery, communication and social activities, and problem-solving. Therefore, the main focus in the learning of mathematics must shift and move to the understanding and comprehending of mathematical concepts. School mathematics skills or capacity include operations of numbers, algebra, geometry, trigonometry or measurement, and data analysis or processing. Every learner must learn and understand the number concept. An important part of the concept of numbers is integers. An integer means whole numbers it's either positive or negative. An integer could be a number that implies no decimals point or any fraction, from negative and positive numbers including zero. The following are four arithmetic operations related to integers: addition, subtraction, multiplication, and division. Mastering the concept of integers, the operation of integers can help students not only in their studies but also in their real-life situations.

Many students still did some mistakes when assisting using the utilization of number coins. As an example, to calculate the subtraction of negative numbers like – 4 – 5 = …, some students answered – 1. It is concluded that students' understanding of a concept remains wrong or incorrect. This can be called a misconception. According to Makonye, J. P., & Fakude, F. (2016), misconceptions are latent false beliefs and principles in a person's mind and misunderstood of some idea, which can lead to a series of errors. In operating on integers usually, students do a mistake that needs to give focused on it to resolve the incorrect way of solving it and to understand what action is responsible for errors and misconceptions in the operation of integers students. In some cases, if there's no interaction between the teacher and students then it's difficult to spot and identify what kind of misconception the students have. As an example, if students answer (–5) + (–5) = 10, a teacher doesn't know whether the students take the absolute value of or the

concept and idea of using two negative numbers as positive numbers. Teachers must hear each student's idea in this kind of situation to work out what's the exact misconception in operation the of integers.

Students must understand the essential operations of integers to solve problems. To teach students about the integers, it is important to explain first the idea and the concept about it and its operation to unravel or resolve the misconceptions of students about the integers. Teaching integers to a grade 7 student that don't have prior knowledge about the integer are often difficult and challenging that needs a full effort. Students must first understand what is the meaning of integers. Since integers are close to being positive or negative, there are some common misconceptions and errors related to the learning of integers. Some of the students may attempt to add and subtract positive and negative integers and then choose the sign of the number they used in the beginning as the solution. This is a problem and not all signs used in the first number are always correct for the solution. And if students don't have strong and sufficient knowledge regarding integers then this may lead to a misconception and error when students encounter the four-fundamental operation of integers. Students first need to learn the concept of integers before the operation of integers so that they can answer the mathematical problem correctly.

This study is about the errors and misconceptions grade 7 learners have once they do tasks on operations on integers. This research aims to determine the errors and misconceptions of learners in answering questions on the operations of integers. Many of the students made errors in the operation of integers. The researchers as well as the teachers need to know where exactly the students have errors and misconceptions so that they can focus on solving them. It is important to know it because this topic is part of another math lesson. It would help them to learn easily, especially in the lower grades.

METHODS

A qualitative research approach has been used in this research. Of the challenges in answering tasks on the addition of directed numbers with no preconceived hypothesis to be tested, this approach was preferable to the others because one would be able to describe the systematic observation of the study (McMillan & Schumacher, 2014). It is used to obtain information to systematically describe a phenomenon, situation, or people involved in this research. It aims to find out the "what, where, when, and how questions, but not why questions" related to the phenomenon. According to Nassaji (2015), it is a type of research design that collects data in a qualitative manner. Thus, data is collected through surveys or questionnaires.

The researchers used a guided questionnaire as the main instrument. The first part contains the profile of the respondents. The Second part contains the guided questions in solving the operations of integers. And the last part contains the problems involving operations of integers. To improve the content validity and reliability of the questionnaire, the researchers followed the suggestions, recommendations, and comments of the panel of examiners and the adviser on the proposal defense.

A letter of permission to conduct the research has been forwarded to the principal of Amungan National High School where the student-respondents were officially enrolled prior to data collection. Through limited face-to-face classes, researchers were able to conduct the survey in the school and personally manage the float of the questionnaire.

The research method used in this research is the qualitative research method. The respondents in this study were students who experienced errors and misconceptions in solving operations on integers. The process of gathering the data was obtained in several ways, namely: giving open-ended questions and interviews. The process of data analysis is as follows: raw data collection and data analysis. It categorized learners' errors in the addition and subtraction of integers and multiplication and division of integers. Also, the misconceptions are categorized into addition and subtraction of integers, and multiplication and division of integers.

In error and misconception, researchers come up with the theme based on what the respondents answered in the questionnaire. In the theme includes the major error and misconception made by the respondents on operation on integers like in addition and subtraction on integers and multiplication and division of integers. The sub theme is depending on what would be the theme. It is the categories of the theme, what exactly errors and misconception made and where it would fall under on the said theme.

RESULTS AND DISCUSSIONS

1. Errors in Solving Operation on Integers

Addition and Subtraction of Integer

Table 1. Annotated Exemplars on Adding Integers with Similar Sign

Students	Responses	Problem Solving on Operation of Integers	Errors
Student 2	*"Add the two integers then copy the negative sign also"*	*"(−120) + (−35) = 155"*	Rule mix up
Student 6	*"ipagpaplus ang sagot at makukuha na ang sagot"*	*"(−120) + (−35) = 155"*	Rule mix up
Student 14	*"pinapalitan ito ng negative ng dahil pareho sila kaya papalitan ko ito ng negative"*	*"(−120) + (−35) = 95"*	Used inaccurate procedure
Student 2	*"Ipag plus at kunin ang sign ng positive o negative"*	*"(−120) + (−35) = 155"*	Rule mix up

In problem solving (−120) + (−35) = - 155 the researchers' observations of students 1, 6, and 26 show that the learners have an error in that regard. According to Makonye & Fakude (2016) addition of numbers with the same signs requires that they be added up and the sum be assigned that common sign. Learners tend to add the two integers with a similar sign without doing the proper procedure on how to solve it like the sign rules of multiplication applied in addition of two negative integers. Some apply this rule when adding or subtracting integers although this rule is used when multiplying or dividing numbers (Khalid & Embong, 2020). Rule mix-up happens when students apply rules of multiplication in addition. Researchers' observation in students 1, 6, 14, and 26 seem to have some procedural errors, which sometimes fail the learner to show his or her understanding of the concepts.

Multiplication and Division of Integers

Table 2. Annotated Exemplars on Integers that Will Give a Negative Sign When Multiplying Two Integers

Students	Responses	Problem Solving on Operation of Integers	Errors
Student 8	*"Negative"*	*"(−2) × −2 × −4 = 16"*	Disregarding positive sign
Student 10	*"yung pangalawang number ang mabibigyan ng negative sign"*	*"(−2) × −2 × −4 = 16"*	Disregarding negative sign
Student 25	*"Pag isa ang negative magiging negative ang sagot"*	*"(−2) × −2 × −4 = 16"*	Disregarding positive sign

Student 44	*"Multiply negative sign to negative sign"*	*"(−2) × −2 × −4 = 16"*	Disregarding positive sign

Multiplying two or more integers with unlike signs would result in negative integers. If *a* is a positive integer and *b* is a negative integer or vice versa, then the product *ab* is a negative integer (Arnold, 2022). Most of the students confused between two or more positive and negative integers. They tend to forget positive or negative sign and for them the value of negative integers is same with the value of positive integers (Zurbano, 2019).

Researchers observed that based on the answer of students 8, 10, 25, and 44 they disregard one of the signs of integers when multiplying as a result of it they got the wrong answer and what they did is considered an error.

2. Misconceptions in Solving Operation on Integers

Addition and Subtraction of Integers

Table 3. Annotated Exemplars on Adding Integers with Similar Sign

Students	**Responses**	**Problem Solving on Operation of Integers**	**Misconception**
Student 4	*"Ipag plus ang dalawang subject"*	*"(−20) +(−14) = −6"*	Poor knowledge
Student 14	*"pinapalitan ito ng negative gn dahil pareho sila kaya papalitan koito ng negative"*	*"(−20) + (−14) = +6"*	Poor knowledge.
Student 28	*"Ipagpapaplus at ang sagot ay lalagyan ng sign na nasa number"*	*"(−20) + (−14) = 34"*	Can't Assimilate Concept
Student 42	*"Mapapalitan po, magiging negative"*	*"(−20) + (−14) = 34"*	Can't Assimilate Concept

One common disbelief when solving the addition of integers with similar signs is when two negative signs were added the negative sign won't affect the result of the wrong answer that came up with an answer where the process used was the operation of adding whole numbers. Another misconception made by some students just like students 4 and 14 is the misconception that rules for adding similar signs and dissimilar signs were the same if you could notice they subtract the integers a process done when solving the addition of integers with a different sign. The reason behind this action is due to the confusion of symbols and values. Many students are confused about the sign of subtraction and negative. They think the both are the same (Khalid & Embong, 2020).

Multiplication and Division of Integers

Table 4. Annotated Exemplars on Integers that Will Give a Positive Sign When Multiplying Two Integers

Students	**Responses**	**Problem Solving on Operation of Integers**	**Misconception**

Student 2	*"if it has a plus sign on it"*	*"(−2) × (−4) = - 8"*	Sign Rules Misconception
Student 6	*"ipagmultiply mong dalawang positive sign tapos dapat may positive sign dapat ang sagot mo"*	*"(−2) × (−4) = - 8"*	Sign Rules Misconception
Student 24	*"Multiply the digits and ilalaga ang positive sign sa no."*	*"(−2) × (−4) = - 16"*	Sign Rules Misconception
Student 25	*"Pag positive at negative ang magiging sagot ay positive o negative"*	*"(−2) × (−4) = - 16"*	Sign Rules Misconception

To multiply two integers that have the same sign, multiply their absolute values and the product would be positive. That is $(+)(+) = +$ or $(-)(-) = +$(Burzynski & Ellis, 2021). Most of the respondents who made a mistake on the product of two similar signs mostly with a negative sign have the misconception that multiplying negatives would also result in a negative just like in the problem $(-2) \times (-4)$, the integers here both have negative and most of the respondents who made mistake on this has a negative sign on their answer -8, -16 some even combine this misconception with the error of computing the right answer.

Table 5. Theme and Subtheme of Error and Misconception in Solving Operation on Integers

	Theme	**Sub Theme**
Errors	Procedural error	Rule mix-up. Students apply the sign rules of multiplication in addition to integers. Students used inaccurate procedures. The wrong operation was used.
	Careless error	Misapplied sign rules. Students didn't apply the rules of multiplication and division of integers. Disregarding positive/negative sign
Misconceptions	Can't Assimilate Concept	Treat integers as whole numbers. Disregard negative signs. Can't occur that the concept is possible.
	Poor Knowledge	Unable to differentiate between the subtraction symbol and negative sign. Unable to understand the concept of negative values. Answers do not connect to the process at all. Believe that all rules can be applied in any case.
	Sign Rules Misconception	A negative integer multiplied/divided by another negative integer will result in a negative integer. A negative integer multiplied/divided by a positive integer will result in a positive integer.

Procedural error. This error is made by students due to intelligibility in sizing integer operations in the form of incorrect summation and subtraction, simplifying the form of operation, mistaken in the order of operation, and not writing down answers in full (Baharuddin, Muhammad., Baharuddin Hendra., and Beta, Pancana., 2021). This error was made by failure to follow the steps for solving an operation in integers. This error was observed as many of the

respondents failed to give the right answer when asked about adding integers with like and unlike signs and students didn't subtract integers when adding integers with unlike signs.

Careless error. 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 (Rosyidah, A., Maulyda, M., Jiwandono, I., Oktaviyanti, I., & Gunawan, G., 2021). This was an error made by ignoring or disregarding the negative sign and misapplied sign rules. It is one of the types of errors made by students. This error was noticed in the answers of the respondents on what integers will give a positive sign when multiplying two integers and what integers will give a negative sign when multiplying two integers; the sign of the quotient of integers with a similar and dissimilar sign.

Can't Assimilate Concept. The concept of Addition and Subtraction are most likely the same, both of the operations follow the rules of addition of integers. In this research, the researchers observed the responses of the respondents in regards to the operation of addition and subtraction of integers. Adding two integers with a similar sign was the least complicated process for it was the easiest one, you'll just simply add and then copy its sign. When it comes to two integers with different signs the process became more complex because it needs to consider some rules like proceeding to subtract the numbers of the integers and then taking the sign of the larger integer. Change the sign first of the subtrahend then proceed with the rules of addition of integer. But since most of the respondents don't have a clear understanding of these notions, the respondents had this misconception by not being able to assimilate the concept. Given that the two operations use the same rules, mastering it seems easy but learning and teaching it is one of the struggles of many students and teachers. As shown in their answers the respondents were conflicted by the negative signs with the numbers and they clearly do not understand the rules well, resulting in the conception that negative signs could be ignoredand integers could be treated as whole numbers (Khalid & Embong, 2020).

Poor Knowledge. This misconception comes from the respondents' disability to completely understand the concept of integer. It is common for student to make mistake when solving for addition and subtraction of integers especially when dealing with the negative and positive signs. According to Khalid & Embong (2020) the reason behind this was respondents' inability to differentiate subtraction symbol and negative sign and to think that they are the same. To be more precise respondents lead to this misconception because they do not fully understand the concept of negative values.

Sign Rules Misconception. When multiplying integers there are certain rules that need to follow, and from what the researchers have noticed one of the misconceptions that occur to the students has regarded the sign used for both multiplication and division of integers. Rules in the division of integers are the same as rules in the multiplication of integers, whether the operation is multiplication or division the concept that a similar sign (either both positive or negative) should always be equal to a positive, and dissimilar sign (have both positive and negative) should always be equal to negative. Having other beliefs that influence which sign to use is considered a mistake. When multiplying integers, believe that if one integer has a positive sign, the product will have a positive sign, and if one integer has a negative sign, the product would have a positive sign. Some students disregard the sign of the divisor or the sign of the dividend when dividing a similar sign. They simply divide the number, and the sign of their answer is determined by the sign of the integers in the equation. Respondents believe that if the sign is both negative and positive, the solution would be the same as the given sign in the equation. And when it comes to dividing different signs, all they know is that if one integer is positive, the quotient is also positive. Other students have stated that they would use the first integer's sign as the sign of their answer. Researchers discovered that respondents do not pay attention to or value each of the signs of the integers. For example, they value the sign of the first integer more than the sign of the remaining integer. Sadler (2012) this demonstrates that misconception on sign rules rooted from respondents' confusion on rules of addition of integer with those of multiplication of integers, as most the respondents whose answers were incorrect was due to use of a wrong sign. This also apply in division of integers as they use same rules when it comes to its sign.

CONCLUSIONS

Based on the summary of the investigations conducted, it has been concluded that the common errors of the respondents in solving addition and subtraction of integers are procedural errors and common errors in solving multiplication and division of integers are careless errors. And the common misconception of the respondents about

solving addition and subtraction of integers is that they can't assimilate concepts and have poor knowledge. The common misconception about solving multiplication and division of integers is a sign rules misconception.

RECOMMENDATIONS

In light of the information that the researchers have gathered and the research findings, the researcher offers the following recommendations: The teacher should teach the students that when two negatives are right next to each other (with nothing except maybe a parenthesis in between, they become positive. – (-) = +; The teachers should have students' portfolios to help them reflect on the wrong answers they've got and for them to figure out where they have mistaken and areas that need improvements. It also motivates students to learn more about the subject. The teachers need to develop contextualized strategic materials about the operations of integers with application in real-life situations in order to understand more about the operation of integers. The teachers should provide a daily/weekly activity on the operations of integers, this will help to enhance and develop the skills/knowledge of the students about the operations of integers. And, future researchers may adapt the current study for further or deepening for them to show the common errors and misconceptions that they need to address to correct it.

References

1. Baharuddin, Muhammad & Baharuddin, Hendra & Jumarniati, & Beta, Pancana. (2021). "Investigating Students Error When Solving Whole Number Problem": Case in Procedural Error and Concept Error. 10.2991/assehr.k.210430.016.
2. Khalid, M., & Embong, Z. (2020). Sources and Possible Causes of Errors and Misconceptions in Operations of Integers. International Electronic Journal of Mathematics Education, 15(2) em0568.https://doi.org/10.29333/iejme/626
3. Makonye, J. P., & Fakude, F. (2016). A Study of Errors and Misconceptions in the Learning of Addition and Subtraction of Directed Numbers in Grade 8. SAGE Open. SAGE Open (October-December, 2016), 1- 10. from. https://doi.org/10.1177/2158244016671375
4. McMillan, J. H., & Schumacher, S. (2014). Research in education: Evidence-based inquiry. Harlow, UK: Pearson.
5. Nassaji, H. (2015) 'Qualitative and descriptive reseach: Data type versus data analysis', Language Teaching Research, 19(2).
6. Rosyidah, A. & Maulyda, Mohammad & Jiwandono, IIham & Oktaviyanti, Itsna & Gunawan, Ganda. (2021). Misconceptions and Errors in Integer Operation: A Study in Preservice Elementary School Teachers (PGSD). Journal of Physics: Conference Series. 1779. 012078. 10. 1088/1742-6596/1779/1/012078
7. Sadler, J. T. (2013). The positives about negatives: a study of errors and misconceptions with integer operations in adult education (Doctoral dissertation)..
8. Julie, C. (2017). The introduction to integers in a grade 7 classroom through an intentional teaching strategy.
9. Zurbano, E. (2019, January 18). Analysis of Errors Encountered by Grade 7 Students in the Study of Integers: Basis for Proposed Action Plan. Retrieved from ojs.aaresearchindex.com: https://ojs.aaresearchindex.com/index.php/AAJMRA/article/view/5285