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Improving the Mathematics Performance of Grade 8 learners of ISPSC Laboratory High School through the use of Practice Booklet

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Abstract

This action research aimed to determine the effectiveness of using the Practice Booklet in improving the Mathematics performance of Grade 8 learners. The researchers sought to answer the following questions: 1. What is the level of Mathematics performance of the Grade 8 learners before and after the use of the integer operations booklet? 2. Is there a significant difference between the pre-test and post-test results of the learners? 3. How effective is the operations on integers booklet guide in improving the Mathematics performance of the learners?

This study was conducted at Ilocos Sur Polytechnic State College Laboratory High School school year 2022-2023. There were thirty-six (36) learners as respondents. A teacher made-test was used in determining the Mathematical skills of Grade 8 learners. The researchers found out that most of them have low performance in solving operations on integers and decided to make practice booklet to develop the mathematical performance of the learners. The mean of pre-test was 10.69 and 19.72 for the post-test. This signifies that the practice booklet is effective in improving the mathematical performance of Grade 8 learners in solving operations on integers. It is concluded that the learners' interest to learn is aroused through the use of practice booklet. Based on the results and conclusion, the researchers recommend that the Mathematics teachers must use the integer operations booklet in teaching the subject to improve the learners' mathematics performance.

Keywords: Mathematics' Performance, Practice Booklet, Operations on Integers

I. Introduction

Mathematics is one of the most demanding and difficult subjects for a student to master. Mathematics is taught every year from the beginning of elementary education through post-secondary education and in graduate education. Basic mathematics skills are essential to everyday life. From shopping to traveling, "math problems" exist in every aspect of daily living. However, the emphasis placed on mathematics in education and the pervasive nature of mathematics in everyday life are not enough to motivate some students to learn, master, and retain its concepts. The four fundamental operations – addition, subtraction, multiplication and division, and their relations are basic mathematical concepts to be taught at primary education level. Acquisition of those four concepts and their relations enables students to develop their understanding for

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numbers and calculating strategies as well as associating them with daily life problems" In the Philippines' Educational Curriculum system, a basic understanding of whole numbers and Integers using number lines were introduced as early as their Elementary days. More complex concepts involving the negative sign and the rules of Integers were introduced in their 7th grade in school. However, research showing a significant number of learners in higher education who still have difficulty grasping the concept of Integers has become alarming. According to research done by M. Khalid and Embong (2016), most learners who had trouble solving integer problems lacked knowledge, could not assimilate the concept of integers, have superficial understanding, and get confused by the rules resulting in learners mixing them up.

In many situations, the students tend to use their previous knowledge and strategies that they used to apply for whole numbers, when dealing with addition and subtraction of integers. This makes the teachers' approaches in teaching integers as an important investigation in understanding how teachers think when they teach this subject and what their level of knowledge in this topic is. By conducting such an investigation, a proper solution could be identified to overcome more problems with regards to students' misconceptions of integers. An earlier paper of this research has reported students' performance from a related diagnostic test, where it was found that students performed worst in the subtraction of integers and best in the multiplication of integers (Khalid et al., 2018).

It is in view of the above that the researchers became interested in looking at current issues on the use of practice booklet in the Teaching and Learning of Mathematics to the Grade 8 learners of ISPSCLaboratory High School. Thus, this study is to investigate if students' achievement may be attributable to inaccuracy in computation in which the integer operations booklet may minimize. Hence, the researchers derived with the concept of Practice Booklet that contains different steps and ways on adding, subtracting, multiplying and dividing integers.

The study aimed to determine the Mathematics performance of Grade 8 learners of ISPSC-LHS in Operations on Integers through the use of Practice Booklet for the School Year 2022-2023. Specifically, it sought to answer the following sub-problems: 1. What is the level of Mathematics performance of the Grade 8 learners before and after the use of the practice booklet? 2. Is there a significant difference between the pre-test and posttest results of the learners? 3. How effective is the practice booklet guide in improving the Mathematics performance of the learners?

This action research tested the null hypothesis which states that "There is no significant difference between the pre-test and post-test scores of the Grade 8 learners using Integer Operations Practice Booklet."

II. Literature

The following readings of the researchers which are culled from different sources have given more comprehensive background and conceptualization on the present study.

Research shows that students have difficulties in solving basic problems involving operations on integers, especially when it involves addition and subtraction (Khalid et al., 2018; Toh, Tengah, Shahrill, Tan & Leong, 2017; Makonye & Fakude, 2016; Schindler & Hubman, 2013; Sadler, 2012; Widjaya, Stacey & Steinle, 2011; Badarudin & Khalid, 2009; 2008; Steiner, 2009; Hayes & Stacey, 1999). One of the causes mentioned by Khalid and Embong (2020) is due to "students being taught to follow rules and procedures in a very abstract manner without going through the models for better conceptual understanding". Many researches have been conducted to document students‟ errors and misconception, but only a few of the researches involved intervention study to lessen the errors and enhance students‟ understanding of integers (Fuadiah,

Suryadi & Turmudi, 2017; Makonye & Fakude, 2016; Okpube, 2016). "Operations on integers" means routine problems involving integers that are set up with the basic operations of addition (+), subtraction (-), multiplication ( ) and division ( ).

Mathematics Performance

The skills, whether learned or perceived as a natural capability to process numerical data conclude a mathematical calculation based on the data. Individuals should be able to productively transfer their mathematical concepts and skills, as well as problem-solving abilities, from mathematics classroom to other situation in their lives. Mathematics achievement extends beyond the acquisition of concepts and related skills, to include individual' attitudes and motivation in mathematical situations. While mathematics problem worked in class often have little relationship to reality, individuals should be able to successfully deal with mathematics problems in their everyday lives and the classroom, by solving them and verifying their solutions. In addition, the use of manipulative in the teaching and learning of integers could affect students' performances in adding and subtracting integers. The intervention lessons used different colored counters to represent different signs of integers, followed by the adding and removal actions of these counters to mirror the addition and subtraction operations, with the added concept of zero-pair. Any improvement or beneficial outcome of the prior lesson was used to adapt the initially prepared following lesson as part of the Design Research process. (Sahat et al, 2018).

Intervention materials

Kautzman (2012) presented in the National Council of Teachers of Mathematics (NCTM) standards stated that early and appropriate identification is important for students at all levels of achievement. Any student may require intervention as he or she works with mathematics. Even those students who are excellent in one topic may require the support of intervention in other topics. When students are struggling, teachers should use various assessments to spot areas of need, and that they should use the information that they obtain to decide on interventions that may help the learners move in targeted and structured ways to greater and brighter success with important concepts and mathematical ideas.

Moreover, Kautzman (2012) added that interventions have many models and are flexible in nature. They can be carried out in the classroom setting as well as in tutoring or tiered support sessions conducted by tutors or mentors. Regardless of the model, intervention should put premium on supporting students' understanding through explicit instruction anchored on diagnostic assessments. Intervention should strengthen conceptual and procedural knowledge to close an existing gap so students can move smoothly to and make connections with other mathematics. The long-term goal of intervention should be to assist students gain independent strategies and take responsibility for his or her own learning. This approach to intervention ends up with an emphasis on bigger ideas in mathematics and their applications so important skills do not become trivial, isolated, or fragmented.

Furthermore, every intervention model relies on teachers' knowledge of mathematics content and evidence-based teaching strategies, ensuring that people who deliver interventions can take advantage of students' prior mathematics knowledge. An educator who uses multiple models and ways of sequencing or structuring topics can present rich adaptations of the mathematics content to support students' needs effectively (nctm.org, 2011).

Conceptual Understanding in Integers and Operations on Integers

Students find understanding integers itself and solving problems involving operations on integers difficult and challenging (Fuadiah et al., 2017). The fact that the value of -17 is less than -12 is opposite to their belief when dealing with positive whole numbers. To understand this concept, students are required to build schemas and models that enable them to visualise the contrast and relationships between numbers. The subtraction operation, especially when the

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number is negative, is difficult for the students to comprehend. The notion of subtracting a negative number giving the same result as adding the opposite of negative numbers is difficult for many students to comprehend. When students have limited understanding of subtracting negative numbers, they may result to blindly following the rules.

According to Fuadiah, Suryadi and Turmudi (2017), students tend to be taught that adding two negative numbers will produce a negative answer but multiplying two negative numbers will result in a positive one. It is difficult for students to understand these concepts and the reason why the numbers behave that way. The difficulty in understanding the multiplication of negative numbers is due to the reason that it is not something that the students apply in their everyday lives. However, it is important for them to master the skills of adding, subtracting, multiplying and dividing integers which are fundamental in algebra. If students struggle at this stage and fail to master the skills, they will likely become more frustrated in facing more complicated and challenging topics. Fortunately, there are many ways to teach them the operations of integers. Some available strategies are able to help them master these vital skills, and simultaneously build their self confidence in doing mathematics. The key to a successful method is not to let them memorise a bunch of rules prior to understanding. Instead, students‟ understanding may be enhanced using pictures or handling manipulative, to allow them to translate the concepts into images. One of the strategies is to apply concrete representation, and combining of a few other representations in a single teaching and learning process.

III. Research Methods

This chapter presents the research design, subjects of the study, research instrument, data gathering procedure and statistical tools to be used in the study.

Research Design

The study used one-group pre-test post-test design. As stated by Choueiry (2019), one-group pretest-posttest design is a type of quasiexperiment in which the outcome of interest is measured 2 times: once before and once after exposing a non-random group of participants to a certain intervention/treatment. Therein, this is to determine the effectiveness of the Practice Booklet as a strategy in improving the Mathematics performance of the learners specifically in solving operations on integers.

Subjects of the study

The data needed in this study were from 36 Grade 8 learners of ISPSC LHS composed of 12 males and 24 females for the school year 2022-2023.

Research Instrument

The researchers started by seeking permission from the principal of ISPSC LHS, to conduct a study on Improving the Mathematics Performance of Grade 8 learners of ISPSC Laboratory High School through the use of Practice Booklet.

After identifying the problem or weaknesses of the learners, the researchers made multiplechoice type of test composed of twenty-five (25) items used as the main instrument in gathering the data. The test was checked and validated by three Mathematics experts before it was administered. Thus, the researchers came up with a plan of preparing a Practice Booklet. After preparing the learning intervention material, an instrument was used to validate the level of acceptability of the prepared Practice Booklet.

For the level of effectiveness of the material, the researchers administered the post-test to determine the effectiveness of the Practice Booklet. Before the post-test, the learners were given the chance to attend a session. The researchers showed and discussed to the respondents the intervention material. The result of the test was reviewed and checked by the researchers and the adviser.

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Data Gathering Procedure

The pre-test was administered on January 10, 2023 upon the approval of cooperating teacher and the principal of the school. The researcher-made pre-test and post-test was validated by three Mathematics experts. The mean of the validated researcher-made test is 4.6 described as "Very much acceptable". The learners were given 60 minutes to answer the twenty-five (25) items multiple-choice test. The test papers were checked and the scores were recorded, tabulated and analyzed to determine the strengths and weaknesses of the students.

After administering the pre-test, the researchers right away teach the learners through the use of the Practice Booklet to improve the mathematical ability in performing the operations on integers. The practice booklet was validated by three Mathematics experts. The mean of the validated intervention material is 4.27 described as "Very much acceptable". The recommendations and suggestions were applied in the revision of the practice booklet. On January 16 and 17, 2023, the lessons discussed were Addition and Subtraction of integers. The researchers gave assessment test to the learners for Wednesday and Thursday to master the topic being discussed. On January 23 and 24, the researchers discussed the Multiplication and Division of Integers. It took the researchers 4 days to teach the learners through the booklet. After a week, the researchers reviewed all the lessons discussed to the Grade 8 learners to know whether they mastered the lesson or not.

The post-test was administered on February 10, 2023 after the intervention learning. The learners answered the post-test through Google form and were monitored by the researchers. This was the same question as the pre-test but the items were jumbled. The answers were checked and the scores were recorded and tabulated. The results of both pre-test and post-test were analyzed and compared.

Statistical treatment of data

To be able to draw valid reliable information from the data to be gathered appropriate statistical tools were employed. Frequency count and percentage were used for sub problems 1 and 3 which called for the performance of Grade 8 Junior High School learners in the pre-test and post-test, before and after the use of the Practice Booklet in improving Mathematics performance along with the topic operations on integers.

Sub problem number 2 was treated with t-test for dependent samples to look for significant differences on the results of the pre-test and post-test of the learners.

Computation of the Mean

$$\bar{x} = \frac{\sum x}{n}$$

Where:

$\bar{x}$ =mean

x= individual scores

n= total number of respondents

Computed T-value Formula

$$t = \frac{\sum D}{\sqrt{\frac{(N)(D^2) - (\sum D)^2}{N-1}}}$$

Where:

D- Mean Difference

D^2-Summation of the Square Difference

N- Total number of participants

Categorization of Data

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For the purpose of analyzing the scores of the learners, frequency counting and data categorization were used. They were clustered into class intervals to quantify the gathered data. The following scales used to interpret the data:

A. The scores of the learners on the pre-test and post-test was adapted on the study of Lapitan (2021).

Range of Scores	Descriptive Equivalent Rating
21-25	Outstanding (O)
16-20	Very Satisfactory (VS)
11-15	Satisfactory (S)
6-10	Fair (F)
0-5	Poor

B. For the level of effectiveness of the Integer Operations Booklet

Statistical Range	Descriptive Equivalent Rating
21.00-25.00	Very Much Effective
16.00-20.00	Much Effective
11.00-15.00	Effective
6.00-10.00	Slightly Effective
0.00-5.00	Not Effective

The data gathered were examined by using the frequency test, percentage, mean and t-test. By getting the mean, the sum scores were divided by the count of the subjects, which is to determine the learners' performance before and after using the practice booklet.

The t-test for the dependent sample was used to determine if there is a difference between the pre-test and post-test to improve the mathematics performance of the Grade 8 learners in solving operations on integers.

IV. Results and Findings

This chapter shows the analysis and interpretation of data gathered from the result of the pre-test and post-test. It likewise presents the conclusion arrived at the recommendations forwarded.

Range Scores of the Pre-test and Post-test

This table presents the range scores of Grade 8 learners in the pre-test and post-test results, frequency, weight and the descriptive equivalent rating of their scores.

Table 1: Level of Performance of the Learners

	Pre-test		**Post-test**		**Descriptive Equivalent Rating**
Range of Scores	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)	
21-25	0	0	16	44.44%	Outstanding
16-20	3	8.33%	15	41.67%	Very Satisfactory
11-15	11	30.56%	5	13.89%	Satisfactory
6-10	20	55.56%	0	0	Fair
0-5	2	5.55%	0	0	Poor
Total	36	100%	36	100%	
Mean	10.69		19.72		

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The range scores of Grade 8 learners during pre-test and post-test as seen on the table above. In the pre-test, three (3) learners or 8.33% got the score from 16-20, eleven (11) or 30.56% from the respondents got 11-15 scores, twenty (20) or 55.56% got the score ranging from 6 to 10 and two (2) or 5.55% of them got the score from 0-5. The findings imply that solving operations on integers belong to the least mastered skills of Grade 8 learners. The findings are similar in the study of Cabbat et.al (2017) where they found out that the learners have a low performance level of ability in solving integers.

In the post-test result, there is an increase in the performance scores wherein no one got scores ranging 0-5 and 6-10, 13.89% or 5 learners got the score from 11-15 or "Satisfactory", 41.67% or 15 learners got a score ranging from 16-20 or "Very Satisfactory", and 44.44% or 16 learners got the score from 21-25 or "Outstanding". This implies that Grade 8 learners had really improved their solving through Operations on Integers in using the Practice Booklet. This result is similar in the study of Rodriguez (2018) where it showed that the use of Strategic Intervention Materials (SIM) in operation on integers was effective in terms of problems presented in the SIM. The positive result of the survey revealed that the Strategic Intervention Materials (SIM) in Operation on Integers was appreciated by the learners and is very effective in enhancing the skills on mathematical operation on integers of the students.

T-test Analysis of the Pre-test and Post-test

Table 2 shows the t-test analysis of the pre-test and post-test scores of the students as basis of testing the effectiveness of the strategy or intervention.

Table 2.Comparison of the pre-test and post-test

Source of Variation	Mean	Mean Difference	Computed t-value	Tabular t-value	Decision	Interpretation
Pre-test	10.69					
Post-test	19.72	9.03	23.311	1.690	Reject H_o	Significant

Level of Significance: 0.05

This table presents the comparative t-test analysis between the pre-test and post-test scores of learners. The mean of the pre-test is 10.69 while the post-test is 19.72 with a mean difference of 9.03. Since the computed t-value is 23.311 which is higher than the tabular value 1.690 at 5% level of significance with a degree of freedom of 35, there is a need to reject the null hypothesis. There is a significant difference in the performance of Grade 8 learners after administering the Practice Booklet in enhancing the mathematical abilities of the students in solving operations on integers.

V. Statements and Declarations

(a) Funding: Please add: "This research received no external funding
(b) Conflicts of Interest: "The authors declare no conflict of interest."
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VI. Conclusion

After a thorough analysis of the data gathered in this study, the researchers came up with the following findings. The result of the pre-test showed that out of 25 items, the highest score obtained was 16 and the lowest score obtained was 5. The obtained main value was 10.69. The post-test result showed that the highest score was 25 and the lowest

score was 12. The total mean value was 19.72. This means that most of the learners understood the lesson very well. There is a significant difference in the pre-test and post-test scores of the learners. This was proven by the result of the mean value of the pre-test and post-test. The mean difference was in 9.03 in favour of the post-test. The use of the Practice Booklet to improve the mathematics' performance in solving operations on integers of Grade 8 learners was effective. This was supported by the t-value 1.690 at 5% level of significance with degree of freedom of 35.

Based on the gathered data, the conclusion was formulated as; the Grade 8 learners' level of Mathematics performance in solving operations on integers increased after the researchers presented the Practice Booklet. The use of booklet in teaching and learning is an effective strategy in improving the Mathematics performance of the learners.

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