



RESEARCH ARTICLE

IMPROVING THE LEAST MASTERED COMPETENCIES ON NUMBER AND NUMBER SENSE OF GRADE 7 LEARNERS

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Abstract

Monitoring the quality of Mathematics education and taking actions to address its challenges is one of the many ways in attaining a country's growth and development. The national mean percentage score (MPS) of Filipino learners in the National Achievement Test (NAT) for Grade 6 and Year IV along Mathematics subtest is still not yet at 75% passing rate. Thus, the study identified the proficiency level of the Grade 7 learners' least mastered competencies along topics in Numbers and Number Sense with an end view of improving their proficiency levels. A one group pretest-posttest design type of research using a test instrument with a computed reliability coefficient of 0.83 was utilized. Moreover, the developed lessons on Number and Number Sense served as the intervention in improving the competencies of the respondents. Generally, there were significant increases on the proficiency level of the students after the implementation of the lessons, however, the fact that the learners were still "low proficient" on conceptual understanding and procedural skills along the identified competencies is undeniable. Hence, continuous monitoring of the learners focusing on the identified competencies maybe considered as part of the pre-evaluation of teachers to their grade 7 classes to integrate reinforcement in the improvement of the learners' proficiency in the identified least mastered competencies.

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Introduction:-

The 21st century learners need to be equipped with the necessary numeracy skills in order to cope with the demands of the modern society. The quality of country's workforce will depend on the quality of education that the school children receive. Investing in education should not be considered as fiscal liability, rather as an investment (Frederiksen, 2017). Filipino learners in the 21st century should be functionally literate.

Mathematics is present in every aspect of our daily activities at home, at work and beyond. The goal of a Mathematics teacher in the early grades should be geared towards developing school children who are both literates and numerates. It is not enough that a child learns only how to read and write, rather, he must also be equipped with the adequate numeracy skills in order for him to better understand the world around him and come up with sound decision.

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The Philippine Statistics Authority, (2015) reported that the functional literacy rate of Filipinos aged 10-14, is only 50%. This means that 5 out of 10 learners in the age range are considered to be functionally literate. UNESCO Institute of Statistics (2017) also confirms that a “learning crisis” exists which could hinder progress towards attaining the United Nations Sustainable Development Agenda. Included in the data are 617 million children and adolescents worldwide who are not achieving the minimum proficiency level in Mathematics and reading of which 387 million (62.72%) are children of primary school age and 230 million (37.27%) are adolescents of lower secondary age.

The status of Mathematics performance of Filipinos is yet to improve as revealed in the results in both the international and national level assessments. The Philippines is not performing well as it ranked 115th out of 142 countries in perceived quality of Mathematics and Science Education (World Economic Forum, 2012), 34th out of 38 for High School Mathematics (TIMMS, 2003) and the lowest among ten countries in Advanced Mathematics test (TIMMS, 2008). Moreover, in the previous years, we can say that the national mean percentage score (MPS) of the Filipino learners in the National Achievement Test (NAT) for Grade 6 and Year IV along Mathematics subtest is still not yet at 75% passing rate.

In 2017, the Grade 7 learners took the National Achievement Test for Grade 6. Their cumulative examination result along Mathematics subtest was below the national target of 75% MPS. The result is alarming for teachers in the Secondary levels. A strong foundation in Mathematics in the early grades should be acquired in order to attain success in higher level Mathematics. Thus, it necessary to identify and improve the proficiency level of the learners’ least mastered competencies along the identified competencies through subjecting them to an intervention.

Objectives/purpose of the Study:-

The study identified the proficiency level of the Grade 7 learners’ least mastered competencies along topics in Numbers and Number Sense with an end view of improving their proficiency levels. Specifically, the study (1) determined the proficiency level of learners’ conceptual understanding and procedural skills in the least mastered competencies, (2) utilized the developed lessons as intervention (3) determined the improvement in the proficiency levels of the learners. (4) Analyzed the learners’ written solutions before and after the intervention.

Methodology:-

The study utilized a one group pretest-posttest design type of research. The respondents were tested using the test instrument with a computed reliability coefficient of 0.83 (Reliability Scale and Interpretation, University of Washington, 2018). The developed lessons on Number and Number Sense served as the intervention in improving the competencies of the respondents. (Domanais, M.G., 2019)

Only thirty (30) students were randomly picked to compose the experimental group. The test instrument determined the level of conceptual and procedural skills in number and number sense of the experimental group before and after the utilization of the developed lessons. The test was composed of 40 items. Out of the 40 items, 21 were identified as items assessing conceptual understanding while 19 are for procedural skills. The test includes the least mastered competencies based on the result of the 2017 NAT 6. These are comparing integers with other numbers such as whole numbers, fractions and decimals; solving routine and non-routine problems involving addition and or subtraction of fractions using appropriate problem-solving skills; performing two or more operations on whole numbers without or with exponents, and grouping symbols; and finding the percentage, rate, percent in a given problem. Appropriate statistical tools were used in the analysis of the gathered data. Moreover, in scoring the procedural skills performance, a 3-point rubric was utilized.

Results and Discussion:-

This section presents the proficiency level of the learners’ least mastered skills on selected topics in number and number sense and the implementation of the developed lessons as intervention for improving their proficiency level.

The Proficiency Level of the Grade 7 Learners in the Least Mastered Competencies on Selected Topics in Number and Number Sense.

Table 1 shows the proficiency level of the learners on the different competencies tested along Numbers and Number Sense. In this study, the proficiency level is based on the test score at which students are ranked at below, on, or above grade level. It is determined by getting the percentage of the mean over number of items for each assessed

competency and is described using the scale used by the Bureau of Educational Assessment for 2017 NAT 6. There are two (2) skills considered, these are the conceptual understanding skill and procedural skill. Conceptual understanding refers to the knowledge on the key concepts while procedural skills refer to the skills in performing the procedures or algorithms along the identified least mastered competencies (LMC). The following are the identified competencies (a) Comparing integers with other numbers such as whole numbers, fractions and decimals; (b) Solving routine and non-routine problems involving addition and or subtraction of fractions using appropriate problem-solving skills; (c) Performing two or more operations on whole numbers without or with exponents, and grouping symbols; and (d) Finding the percentage/rate/percent in a given problem.

Conceptual Skills.

It can be gleaned from the table that in comparing integers with other numbers such as whole numbers, fractions, and decimals, the respondents' mean rating is 0.43 with a Proficiency Level (PL) of 14.44%. Such PL is interpreted as "Not Proficient". In solving routine and non-routine problems involving addition and or subtraction of fractions using appropriate problem-solving skills, the respondents' mean rating is 3.30 with a PL of 33.00%. Such PL is interpreted as "Low Proficient". In performing two or more operations on whole numbers with or without exponents and grouping symbols, the respondents' mean rating of 3.07 with a PL of 51.11%. Such PL is interpreted as "Nearly Proficient". In finding the percentage/rate/percent in a given problem, the respondents got a mean rating of 0.50 with a PL of 25%. Such PL is interpreted as "Low Proficient". Based on the empirical results, the respondents' conceptual understanding acquired relative to the tested competencies still did not meet the "Proficient" level and are inadequate.

Table 1:- The Proficiency Level of the Learners on Conceptual and Procedural Skills.

Competencies	Conceptual Understanding			Procedural Skills		
	$\bar{x}$	PL	P	$\bar{x}$	PL	P
1. Comparing integers with other numbers such as whole numbers, fractions and decimals	0.43	14.44%	Not Proficient	1.10	9.17%	Not Proficient
2. Solving routine and non-routine problems involving addition and or subtraction of fractions using appropriate problem-solving skills	3.30	33.00%	Low Proficient	5.70	21.11%	Not Proficient
3. Performing two or more operations on whole numbers without or with exponents, and grouping symbols	3.07	51.11%	Nearly Proficient	4.17	34.72%	Low Proficient
4. Finding the percentage/rate/percent in a given problem.	0.50	25.00%	Low Proficient	0.43	7.22%	Not Proficient

Legend: $\bar{x}$ - Mean, PL- Proficiency level, P- Proficiency

In order to further describe the learners' proficiency on the identified competencies, the responses of the students on selected items during the Pre-Test were reviewed and analyzed. Pre-Test Item No. 33 is one of the three questions designed to assess the conceptual understanding of the learners along the competency on comparing integers with other numbers such as whole numbers, fractions and decimals. In this item, the learners were asked to consider the given objects, compare their given weights and determine the heaviest among them. Furthermore, the learners need to compare the numbers 4.360, 4.300, 4.8 and 4 and determine which of them has the greatest value. Among the 30 learners who took the test, only 26.67% was able to correctly identify the right response. While one of the learners did not choose any of the given choices, the remaining 70% of them chose the wrong option. One of the findings in the present study is the misconceptions in comparing decimals is that learners may think that "longer" is larger decimal.

Pre-Test Item No. 35 is one of the ten items designed to assess the conceptual understanding of the learners along solving routine and non-routine problems involving addition and/or subtraction of fractions using appropriate problem-solving skills. The problem required the learners to determine the operation suited to the problem given.

This problem is an example of a problem on addition of dissimilar fractions. Only 5 out of 30 or 16.67% were able to recognize the correct answer while 90.00% selected the incorrect responses and 3.33% did not choose any of the given options. This indicates that majority of the learners were unable to apply the conceptual understanding required in the problem. This finding is the same with the findings in the study conducted by Aksoy & Yazlik (2017) who reported that the respondents in their study were confused on the operation to be used for a problem on addition of fractions. Unable to determine the operation to be used for a given problem will lead to a wrong solution even if the student is fluent in performing the algorithm for his chosen operation.

Pre-Test Item No. 12 is one of the five items designed to assess the conceptual understanding of the learners on the competency, performing two or more operations on whole numbers without or with exponents and grouping symbols. This item tested the knowledge of the learners on which operation should be processed first given a numerical expression. Only 43.44% of the learners were able to identify the correct answer. This implies that majority of the learners have no grasp of the order of operations. The finding in the study was similar to previous study completed by Alih Rahman, Shahrill, Abbas & Tan (2017) suggesting that students have difficulty performing the correct order of operations.

Pre-Test item number 19 is one of the three items designed to assess the conceptual understanding of the learners along the competency, finding the percentage/rate/percent in a given problem. The item is on changing percent into its corresponding decimal equivalent. Knowledge on converting percent into decimal is important in solving percentage problems. Majority of the learners were unable to correctly identify the decimal equivalent of 10 percent since only 26.67% of them got the correct answer. This finding agrees with the findings of Rushton (2014) on common errors in Mathematics.

Procedural Skills.

The proficiency level of the learners along procedural skills on the identified least learned competencies were sought using the pre-test designed by the researcher. The learners were asked to show a detailed solution to the identified items along procedural skills and each solution was scored using the rubric for assessing items along procedural skills. A learner will earn zero (0) point if his shaded answer is wrong, there is no written solution or if he did not attempt to write a solution. A learner will earn 1 point if he only shaded the correct final answer and no solution is presented. Consequently, a learner will earn 2 points if the shaded answer is correct but he presented a partially correct solution to the test item. Lastly, a learner will earn 3 points if he shaded the correct answer and wrote a detailed solution to the test item assessing procedural skills.

Table 1 also shows the proficiency level of the learners along procedural skills. Specifically, the respondents were “Not Proficient” on 3 out of 4 competencies tested. These competencies are (a) comparing integers with other numbers such as whole numbers, fractions and decimals, (b) solving routine and non-routine problems involving addition and or subtraction of fractions using appropriate problem-solving skills, and (c) finding the percentage/rate/percent in a given problem with a PL of 9.17%, 21.11% and 7.22%, respectively. Moreover, the learners were “Low Proficient” on performing two or more operations on whole numbers without or with exponents, and grouping symbols with a mean rating of 4.17 equivalent to 34.72% PL.

Implementation of the Developed Lessons on Selected Topics on Numbers and Number Sense.

There are 11 lessons on selected topics on numbers and number sense (Domanais, 2019). They were implemented for 48 days to improve the proficiency level of the learners. The lessons are as follows: the developed lessons on selected topics on Numbers and Number Sense includes the following features: 5Es instructional model, cooperative learning strategy, and contextualized learning activities. The development of the lessons underwent the following steps: (1) identification of least mastered competencies and its pre-requisite skills and (2) development of the developed lessons using the constructivist approach, cooperative learning strategy and contextualized learning activities. The K to 12 Mathematics Curriculum Guide was accessed in identifying the lessons and the pre-requisite lessons needed.

5Es Instructional Model.

Bybee’s 5Es instructional model was used in the presentation of the lesson. The 5 Phases were as follows: Engage, Explore, Explain, Elaborate and Evaluate. In the Engage Phase, engaging activities, both mental and physical activities, which could make connections to past and future activities will be introduced. In the Explore Phase, the teacher’s role is just a facilitator since the learners should be the one to investigate objects, materials, and situations

to build knowledge and skills. In the Explain Phase, the learners explain their understanding of the concept and demonstrate their conceptual understanding, process skills, or behaviors. Also, this phase will allow the teacher to directly introduce a concept, process or skill. In the Elaborate Phase, the teacher challenges and extend the learners' conceptual understanding and skills by having them apply their understanding of the concept by conducting additional activities. Lastly, the Evaluate Phase is geared towards the assessment of the learners' understanding and skills and provide opportunities for the teacher to evaluate the learners' progress towards the achievement of learning objectives.

In lesson 1, for example, there were different learning tasks in each phase of learning such as Engage Phase, Explore Phase, Explain Phase, Elaborate Phase, and Evaluate Phase. In the Engage Phase, the lesson starts with a game "Order in Disorder" where learners were asked to assemble the jumbled words to form words related to the topic simplifying numerical expressions. Also included in this phase is the recall of the four fundamental operations on whole numbers and vocabulary words such as numerical expression, grouping symbols and simplifying. These terms are needed to facilitate conceptual understanding on simplifying numerical expression. In the Explore Phase, the learners were asked to compare and simplify the two numerical expressions. The first numerical expression contains more than one operation while the second numerical expression has additional exponents and grouping symbols. These tasks were given so that the learners may be able to explore several strategies on how they can simplify the given numerical expressions. In the Explain Phase, the activity in the Explore phase was discussed. Learners with different answers to each numerical expression were called to show their solution to the class. In this phase, the misconceptions and errors regarding simplifying numerical expressions were addressed through the facilitating skill of the teacher while the learners utilized the acronym PMDAS (Parenthesis, Multiplication, Division, Addition, Subtraction), PEMDAS (Parenthesis, Exponent, Multiplication, Division, Addition, Subtraction) and/or GEMDAS (Grouping Symbols, Exponent, Multiplication, Division, Addition, Subtraction). In the Elaborate Phase, the learners were given other illustrative examples. Also, the learners were given the task to do the think-pair-share task wherein, they create their own examples of numerical expressions and collaborate with a partner in order to come up with a solution to the numerical expression. In the Evaluate Phase, the understanding of the learners was assessed through a formative test. The formative test was in a form of a riddle-decoder type.

The 5Es instructional model was used for the lesson procedure. In Engage Phase, the learners were asked to play 3-pics-1 word, a game similar to the mobile game 4-pic-1 word. In the game, the learners were asked to guess the mystery word by means of the given three pictures. In the Explore Phase, a small group activity wherein the learners have to demonstrate the concept of equal partition needed in understanding fractions was given. In the Explain Phase, the learners were asked to tell what does $\frac{1}{2}$ means as reflected in the activity in the Explore Phase. Also, in this phase, the different terms such as fraction, fraction bar, numerator, denominator, unit fraction, proper fraction, improper fraction and mixed numbers were defined and the learners were shown examples on how to show the given fractions in area model strategy. In the Elaborate Phase, a guided practice exercise was given and a Think-Pair-Share-Task was given in order for the learners to apply the concepts learned. In the Evaluate Phase, Worksheet 2 was distributed. The worksheet contains item where the learners identify the given fraction whether the fractions are proper, improper or mixed number. Also, the learners were asked to illustrate the given fractions.

Lesson 3 also utilized 5Es instructional model. In the Engage Phase, the learners were shown a short video clip from the BangkoSentral ng Pilipinas (BSP) website showcasing the different coin denominations in the circulation. The learners were asked to relate these coins into decimals. In the Explore Phase, the learners were asked to accomplish the place value chart by group considering the different coin denominations. The learners were also asked to determine which of the given coin denomination has the highest and least value. This serves as springboard in discussing the concept of decimal comparison and ordering. In the Explain Phase, the teacher helps the learners on how to compare decimals using concept of place value. In the Elaborate Phase, a game, GEL (greater, equal, lower) was played by the learners. The goal of the game is to help the learners apply the learned concept into a new set of decimal number pairs. In the Evaluate Phase, the learners were asked to accomplish the Worksheet No. 3. This worksheet contains 3 subtests. In test A, the learners were asked to compare two given decimals. In test B, the learners were asked to arrange the given decimals in ascending order. In test C, the learners were asked to compare the prices of certain commodities and determine the cheapest. The prices of items were expressed in decimal form.

There were also different learning tasks in each phase of learning for Lesson 4 such as Engage Phase, Explore Phase, Explain Phase, Elaborate Phase, and Evaluate Phase. In the Engage Phase, a recall of the concepts of similar fractions and dissimilar fractions were elicited. The learners were also asked to provide some of their own examples

for each type of fraction pairs. In this phase, the learners were also presented a contextualized word problem. In the Explore Phase, the learners were asked to draw circular models of fractions by pair. After all of the pairs were able to draw the assigned fraction to them, they posted the outputs on the board, grouped accordingly into fourth, eighths and sixteenths. The learners were then asked to state the rule on how to compare fractions using models. In the Explain Phase, the response of the learners in the Explore phase was enhanced. Also, the concept of comparing fractions using cross-products was introduced. The story problem presented in the Engage Phase was solved at this phase. In the Elaborate Phase, additional practice exercise was given. Also, the learners were asked to complete the statements to establish a generalization. In the Evaluate Phase, Worksheet 4 was included. The test covers two subtests (1) comparing fractions using models and (2) comparing fractions using cross-products.

In Lesson 5, a recall of the pre-requisite skills such as comparing fraction to another fraction and comparing decimal to another decimal through a game was included in the Engage Phase. In this part, the learners were also asked to cite instances in the real life where the concept of comparing fractions and decimals, decimals to whole numbers and fractions to whole numbers were used. In the Explore Phase, the learners were asked to form a human number line using the different numbers (a) fractions and whole numbers such as 0, $1/4$, $2/4$, $3/4$, 1, $5/4$, $6/4$, $7/4$ and 2; and (b) decimal cards- decimal equivalent of the fraction cards, and state the rule in comparing the given numbers. In the Explain Phase, the learners were encouraged to use think-aloud strategy in summarizing the related ideas based on the concept presented. In the Elaborate Phase, the learners were asked to apply the rules that they have formulated to a guided practice exercise. In the Evaluate Phase, the learners were asked to compare given numbers using varied strategies.

Also, in Lesson 6, there were different learning tasks in each phase of learning such as Engage Phase, Explore Phase, Explain Phase, Elaborate Phase, and Evaluate Phase. In the Engage Phase, the learners were asked to recall the basic concept of fraction through a story problem involving local scenario and a task eliciting the learners' skill in identifying fractions with the same denominator and in constructing fraction models. In the Explore Phase, the learners were shown models for addition of similar fractions. Based on the models and equations involving fractions, the learners were asked to state the rule in adding similar fraction. In the Explain Phase, the learners' concept of adding similar fraction based on the rule that they have formulated in the Exploratory Phase were improved. In the Elaborate Phase, the learners were asked to apply the rule that they have formulated to other addition expressions including two similar fractions to given similar fractions. Other examples of addition word problems involving similar fractions as well as the strategies in solving such problems were presented. In the Evaluate Phase, Worksheet 6 contains a riddle-type activity wherein a question was given. In order to be able to answer the riddle, the learner have to add the similar fractions in the decoder. Also, part of Worksheet 6 is a word problem.

Lesson 7 is also anchored on 5Es learning approach. In the Engage Phase, an activity eliciting the concept of dissimilar fraction through the use of the fraction models in Lesson 4 was utilized. Also, the learners were asked to provide their own examples of dissimilar fractions. In the Explore Phase, the learners were given sets of models and equations involving addition of dissimilar fractions. The learners are to investigate on the rule on adding dissimilar fractions by pair or in a small group. In the Explain Phase, the learners state their rule on adding dissimilar fractions while the teacher verifies its correctness. Another method, the butterfly method was also discussed. In the Elaborate Phase, the learners were asked to apply the concept of adding dissimilar fractions to similar situations and in solving word problems. In the Evaluate Phase, the learners were asked to add dissimilar fractions using Worksheet 7.

In Lesson 8, a lesson on adding mixed numbers, is also anchored on 5Es. In the Engage Phase, several tasks were given to elicit prior knowledge on obtaining the sum of given fractions. Also, a contextualized word problem was presented to encourage the learners think of a process on how to add mixed numbers. In the Explore Phase, a Think-Pair-Share task was given. The learners were given a think time to think about the problem posed in the Engage Phase. Afterwards, they share their answer to a partner and discuss both of their solution until a consensus was met. They share their answer to the class afterwards. Also included in the Explore Phase are the diagrams for which the learners have to guess the number sentence and observe patterns. In the Explain Phase, the learners were asked to report their findings in the Explore Phase. The teacher processes all of the information until the learners were able to arrive at the desired generalization. In the Elaborate Phase, the learners were asked to solve addition problems. In the Evaluate Phase, Worksheet No. 8 was given to the learners. The items in the worksheet will evaluate the procedural skills of the learners in adding mixed numbers.

Five-Es is also reflected in Lesson 9. In the Engage Phase, a contextualized word problem was posed to elicit the learners' prior knowledge regarding similar fractions. In the Explore Phase, a cooperative learning task was given for the learners to formulate a strategy in subtracting similar fractions through a cooperative learning task. In the Explain Phase, the learners were asked to present their outputs while the teacher processes all of the information. In the Elaborate Phase, the learners were asked to apply the strategy learned in subtract similar fractions. In the Evaluate Phase, a worksheet covering items on subtracting similar fractions was given. A word problem was also included in the worksheet.

Lesson 10, Subtracting dissimilar fractions and Mixed Numbers, is also on 5Es approach. In the Engage Phase, the prior knowledge of the learners regarding dissimilar fractions and mixed numbers were elicited by means of having the learners define the terms and provide their own examples for each. Also, a contextualized word problem was presented. In the Explore Phase, the learners were asked to solve the given contextualized word problem in the Engage Phase using any method or strategy that they know. The learners were also asked to formulate a rule for subtracting dissimilar fractions. In the Explain Phase, the teacher will guide the learners to discover the rule for subtracting mixed numbers. Also, the teacher gives additional inputs on the fraction subtraction algorithm. In the Elaborate Phase, the learners were asked to do a cooperative learning task using the Think-Pair-Share strategy. The activity aims to enhance the learners' competence in subtracting fractions and be able to apply this to new situations. In the Evaluate Phase, the learners were asked to accomplish Worksheet 10. The worksheet contains items assessing the procedural skills on subtracting similar fractions and dissimilar fractions.

Lastly, Lesson 11 is anchored on the same approach. In the Engage Phase, the learners were asked engaging questions relating to shopping or grocery experience of the learners. The pre-requisite concepts were also reviewed. In the Explore Phase, the learners were grouped and were presented with statements involving percentage, rate and base. The goal of the activity is for the learner to determine the percentage, base and rate in a given statement. Also, the learners were prompted to devise a formula relating percentage, base and rate. In the Explain Phase, the learners present their group outputs while the teacher facilitates the discussion. Also, the Percentage-Base-Rate (PBR) triangle was introduced to solve problems related to percentage. In the Elaborate Phase, enrichment task 11 -1 was given to the learners to apply their learning to similar situations. Two contextualized word problems were included in the enrichment task. In the Evaluate Phase, the Worksheet 11 was given to the learners. The worksheet contains items which assess the conceptual understanding and procedural skills of the learners on finding the rate, base, and percentage.

Cooperative Learning Strategy.

The use of cooperative learning strategies is used in the preparation of the developed lessons. The cooperative learning strategies include think-pair-share activities and small group activities. In the Think-Pair-Share strategy, a problem is posed, learners were given individual think time to think about the problem and then they were asked to work in pairs to discuss their ideas and arrive at a consensus, and share their collaborative ideas with the class. Casinto (2009), in his book, Handbook on Principles of Teaching 1, cites the advantages of pair or small group works. According to him, this method of teaching makes the learners actively engaged with the material, they learn from their mistakes and the success of their colleagues, the teacher can spend more time with those students or groups needing attention and the group solutions are often far superior than individual solutions among others.

Cooperative learning tasks are present in all of the developed lesson in any of the 5 phases of learning. Cooperative learning tasks included in the lessons are either in the form of small group tasks as reflected Lessons 2, 3, 5, 6, 7, and 11; in the form of Think-Pair-Share tasks as reflected in Lessons 1, 2, 4, 8, 9, and 10 or in the form of pair-work task such as in Lesson 7. These tasks promote conceptual understanding and procedural skills on the competencies included in each lesson.

Contextualized Learning Activities.

Another feature of the developed lessons is the use of contextualized learning activities. Contextualization in the Philippine educational setting has several legal bases including the RA 9155 otherwise known as Governance of Basic Education Act of 2001 and the RA 10533 or the Enhanced Basic Education Act of 2003. Contextualization may be in the form of localizing, indigenizing, and enhancing learning tasks based on the learners' educational and social contexts. Context is defined as locale, situation or set of conditions of the Filipino learners that may influence their study and use of developing critical thinking and problem-solving skills. The contexts refer to beliefs,

environment, language, and culture that includes traditions and practices, as well as the learners' prior knowledge and experiences (Mathematics Curriculum Guide, 2016).

Contextualized activities are present in all of the developed lessons in any of the 5 phases of learning. In Lesson 1, contextualized task is reflected in the Evaluation Phase. In accomplishing the worksheet, the learners were asked to determine the answer to the riddle-type question, "What Filipino word is equivalent to the English term Mathematics?" wherein the answer will be determined through solving the set of decoders containing numerical expressions to be simplified. Aside from promoting procedural skills in simplifying numerical expressions, the learners will be able to know the translation of the term "Mathematics" in Filipino. In Lesson 2, there were two contextualized learning activities such as the game "3-Pics-1-Word" in the Engage Phase and "Fair Share" in the Explore phase. The game "3-Pics-1-Word" is an adaptation of the famous mobile game "4-Pics-1-Word" where a player guesses the mystery word using given set of images. "Fair Share" is an activity where learners were asked to demonstrate the idea of equal partition and fractions using real object such as pandesal. In Lesson 3, the use of Philippine-coin denominations were used in the lesson. Also, included in Worksheet 3 are items containing objects with corresponding prices from which the learners have to compare and choose the cheapest. These tasks promote conceptual and procedural skills in comparing decimals. In Lesson 4, contextualized word problem is included in the Engage phase. The situation in the problem is something that the learners can relate to since the community where they belong is an agricultural community and cassava is one of the crops found in barangay. In Lesson 5, instead of a number line illustration, the learners were asked to act out as a number line. Each learner was given a number to represent in the human number line. In Lesson 6, contextualized learning activities can be found in the Engage phase and Evaluate phase wherein the scenarios in the word problems involve local situations which the learners can relate to. In Lesson 7, contextualization is reflected in the evaluation phase wherein the learners were asked to determine the answer to the question, "What folkdance in the Bicol region imitates the dove's courtship and lovemaking and is performed during weddings?" through the solving of the set of decoders containing addition problems. In Lesson 8, contextualized learning activities are included in the Engage and Evaluation phases. In the Engage Phase, a contextualized word problem was included. In Evaluation phase, the learners were asked to determine the answer to the question, "What substance in pepper will make it spicy?" through solving set of decoders containing problems on addition of mixed numbers. In Lesson 9, contextualization is reflected in Engage and Evaluation phases. In the Engage phase, contextualized problem was included. In Evaluation phase, the learners were asked to answer the question, "What do you call a goat's meat?" wherein the answer will be determined through solving the set of decoders containing items on subtracting similar fractions. In Lesson 10, the contextualized learning activities are included in the Engage and Evaluation phase. The learners were asked to answer the question, "What Filipino food has basic ingredients such as vegetables like tomatoes, onions, sitaw, kangkong, eggplant, and gabi as well as meat or seafood and has distinctive sourness brought by its tamarind base?" wherein the answer will be determined through solving the set of decoders containing items on subtracting mixed numbers and improper fractions. Finally, in Lesson 11, contextualized learning activities are included in the Elaborate and Evaluation phase. In Elaborate phase, two contextualized word problems were included. In the Evaluation phase, the learners were asked to determine the answer to the question, "In Sorsogon Province, what festival serves as a celebration of the province's foundation anniversary and is highlighted by street dancers performing the traditional Bikolano dance Pantomina?" through solving the set of decoders containing items in finding the percentage/rate/percent.

Proficiency Level of the Learners after the Intervention

Table 2 shows the proficiency level of the learners on the different competencies tested along Numbers and Number Sense after the implementation of the developed lessons on the least mastered skills along number and number sense.

Table 2:- The Proficiency Level of the Learners on Conceptual and Procedural Skills After the intervention.

Competencies	Conceptual Understanding			Procedural Skills		
	$\bar{x}$	PL	P	$\bar{x}$	PL	P
1. Comparing integers with other numbers such as whole numbers, fractions and decimals	0.97	33.22%	Low Proficient	3.57	29.72%	Low Proficient
2. Solving routine and non-routine problems involving addition and or subtraction of fractions using	4.77	47.67%	Low Proficient	10.30	38.15%	Low Proficient

appropriate problem-solving skills							
3. Performing two or more operations on whole numbers without or with exponents, and grouping symbols	4.00	66.67%	Nearly Proficient	5.00	41.67%	Low Proficient	
4. Finding the percentage/rate/percent in a given problem.	0.57	28.33%	Low Proficient	2.07	34.44%	Low Proficient	

Legend: $\bar{x}$ - Mean, PL- Proficiency level, P- Proficiency

Conceptual Skills.

As reflected in Table 2, the learners were considered “Low Proficient” on comparing integers with other numbers such as whole numbers, fractions and decimals, on solving routine and non-routine problems involving addition and or subtraction of fractions using appropriate problem-solving skills and on finding the percentage/rate/percent in a given problem with a corresponding PL of 33.22%, 47.67% and 28.33% respectively.

Furthermore, the learners were “Nearly Proficient” with a PL of 66.67% on performing two or more operations on whole numbers without or with exponents and grouping symbols.

Data shows that all of the recorded means in the Post-Test were higher compared to the means in the Pre-Test across all of the competencies assessed. In comparing integers with other numbers such as whole numbers, fractions and decimals, the mean gain of 0.53 was recorded. In solving routine and non-routine problems involving addition and subtraction of fractions using appropriate problem-solving skills, the recorded mean gain is 1.47, the highest in the four competencies. In performing two or more operations on whole numbers with or without grouping symbols, the recorded mean gain is 0.93. Also, in finding the percentage/rate/percent in a given problem, a mean gain of 0.07. It is in this competency that the learners have the least mean gain among the assessed competencies for conceptual skills.

In order to determine if the increments in performances of the learners are significant, the researcher performed a t-test for paired two sample mean test using the Data Analysis Toolpak in Microsoft Excel. Table 4 shows the result of the t-test for paired two-sample for means. The t statistics were tested using 5% level of significance ($\alpha=0.05$) and 29 degrees of freedom. A computed t value whose absolute value is greater than the critical t value suggests a significant difference. Thus, it can be concluded that there is a significant difference between the performance of the learners along comparing integers with other numbers such as whole numbers, fractions and decimals, solving routine and non-routine problems involving addition and or subtraction of fractions using appropriate problem-solving skills, and performing two or more operations on whole numbers without or with exponents and grouping symbols. Moreover, even if there was a gain in the performance of the learners along finding the percentage/rate/percent in a given problem, still that increase was not significant. This implies that along conceptual understanding the intervention using the developed lessons were successful in improving the proficiency level of the learners on the first 3 identified learning competencies but not along finding the percentage/rate/percent in a given problem.

Procedural Skills.

Table 2 shows that there was an increase in the performance of the learners along procedural skills on the identified competencies. As reflected in Table 2, the learners were considered “Low Proficient” on comparing integers with other numbers such as whole numbers, fractions and decimals, on solving routine and non-routine problems involving addition and or subtraction of fractions using appropriate problem-solving skills, on performing two or more operations on whole numbers without or with exponents and grouping symbols. and on finding the percentage/rate/percent in a given problem with a corresponding PL of 29.72%, 38.15%, 41.67 and 34.44% respectively.

Data shows that all of the Post-Test means were higher compared to the means in the Pre-Test across all of the competencies assessed. In comparing integers with other numbers such as whole numbers, fractions and decimals, the mean gain of 2.47 was recorded. In solving routine and non-routine problems involving addition and subtraction of fractions using appropriate problem-solving skills, the recorded mean gain is 4.60, the highest in the four

competencies. In performing two or more operations on whole numbers with or without grouping symbols, the recorded mean gain is 0.83. It is in this competency that the learners have the least mean gain among the assessed competencies for conceptual skills. Also, in finding the percentage/rate/percent in a given problem, a mean gain of 1.63.

In order to determine whether if this differences in their performance are significant, a t-test was conducted. The result suggests that the differences in the mean for all of the competencies were significant. This means that the increase in the performance of the learners along all of the identified competencies cannot just be attributed to chance since the absolute values of the computed t values are greater than the critical t values with $\alpha = 0.05$ and 29 degrees of freedom. This suggests that the intervention using the developed lessons were successful in improving the procedural skills of the learners on the identified least mastered competencies.

Analysis of the learners' written solutions before and after the intervention.

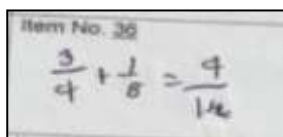
This section describes the written solutions of the learners to the procedural skills test items. It intends to show how the learners understand, comprehend or apply the procedures or algorithms to solve the problem at hand.

Before intervention.

There were 4 items designed to assess procedural skill of the learners on comparing integers with other numbers such as whole numbers, fractions and decimals. The highest possible score for this subtest is 12 since one item can be rated 3 (highest) while the least score to be given is 0.

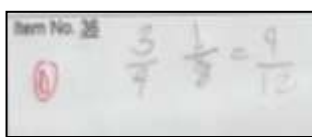
Pre-test item no. 24 is an item designed to assess procedural skills of the learners on comparing integers with whole numbers such as whole numbers, fractions and decimals. This item requires the learners to identify which inequality relations is incorrect given the numbers 11, $11/2$, $2/11$ and 0.11. Only 33.33% of the learners were able to recognize that $11/2 < 2/11$. The 66.67% of the remaining learners chose the incorrect inequality.

There were 9 items designed to assess the procedural skills of the learners along solving routine and non-routine problems involving addition and or subtraction of fractions using appropriate problem-solving skills. Item No. 36 is on addition of dissimilar fractions. The problem requires that the given fractions be converted into similar fractions before they can be added.



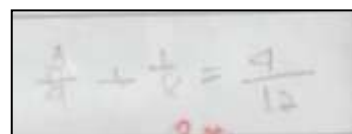
Item No. 36

$$\frac{3}{4} + \frac{1}{8} = \frac{4}{12}$$



Item No. 36

$$\frac{3}{4} + \frac{1}{8} = \frac{9}{12}$$



$$\frac{3}{4} + \frac{1}{8} = \frac{9}{12}$$

Plate 1:-

Pre-test item no. 36 was only solved by three learners whose solution appears in Plate 1. To obtain the sum, they added both the numerator and denominator. Instead of getting $7/8$ they arrived at $4/12$. Further, the other 27 learners resorted to guessing since no solution was shown on their answer sheet. This finding is parallel to the findings of Lestiana, H.T., Rejeki, S. & Setyawan, F. (2016). wherein the students were unable to correctly carry out the addition of dissimilar fractions. Their solutions revealed that they added both the numerators and denominators to come up with the sum.

There were 4 items assessing procedural skills on performing two or more operations on whole numbers without or with exponents, and grouping symbols. One of these items is Pre-test Item No. 17. Item No. 17 is on simplifying numerical expression. This item required that the students have a grasp of the conceptual understanding of order of operations, fluency in performing the algorithms in fundamental operations such as addition, subtraction, multiplication and division, and the concept of exponent. Only 4 out of 30 were able to determine the answer. However, they failed to show any solution and 17 of the learners wrote a note "I don't know how to solve this". Among the noted errors in simplifying numerical expressions as reflected in the solution of the learners are (a) learners disregard the order of operation and simplify the expression by performing all of the operations from left to right and (b) failure to recognize that exponents also need to be processed as part of the process.

There were 2 items developed to assess the procedural skills on finding the percentage/rate/percent in a given problem. Item No. 21 is an item assessing procedural skills along this competency. In item number 21, the learners

must recognize that the unknown quantity is the base. Failure to identify this, will lead to a wrong solution. Among the errors committed by the learners are the following: (a) an incomprehensible solution, not stating as to what operation was used in order to arrive at the correct answer, and (b) unable to correctly identify the operation to be used / problem on performing basic arithmetic. Also, many learners shaded one of the choices on their answer sheet however they did not write a solution to the test item. This implies that the learners resorted to guessing. Furthermore, it could be possible that the error lies in the identification of the percentage, base and rate.

After Intervention.

Similar to the pre-test, the Post-Test, have 4 items designed to assess the procedural skills of the learners on comparing integers with other numbers such as whole numbers, fractions and decimals. This constitutes 10% of the total test items. One of the items designed to assess the procedural skills of the Learner on comparing integers with other numbers such as whole numbers, fractions and decimals is Item No. 13, "Which symbol correctly replaces the box in $12 \square 64/8$ ". There are several ways to compare the given numbers. One of the procedures is to convert $64/8$ into decimal by dividing 64 by 8 before comparing it to 12. Another is to convert 12 into a fraction whose denominator is the same as in $64/8$. This item is parallel to Pre-Test Item No. 13. It can be noted that in the Pre-Test, 57% of the learners either did not attempt to solve the problem or wrote a note, "I don't know how to solve this". Based on the analysis of solutions presented for Item No. 13 in the Post-Test, 14 (46.67%) of the total number of the learners still scored 0, 1 (3.33%) scored 1, 11 (36.67%) scored 2 while 4 (13.33%) scored 3. Learner 1 belongs to the learners who did not attempt to answer the pre-test item parallel to Post-test item 13. In the Post-test however, Learner 1 expressed $64/8$ into its corresponding decimal equivalent. She was able to carry out the correct division algorithm. Thus, the intervention program worked for her. Below is a solution presented by Learner 1.

Handwritten solution for Item No. 13. The student has written:

$$\frac{64}{8} = 8$$

and

$$12 > \frac{64}{8}$$

The student has circled the number 8 and written "3 pts" at the bottom right.

Plate 2:-

There were 9 items designed to assess the procedural skills for solving routine and non-routine problems involving addition and or subtraction of fractions using appropriate problem-solving skills. These items are parallel to the Pre-Test items for the same competency. One of the examples of items assessing procedural skills along the aforementioned competency is the Post-Test Item No. 36, "James walked $\frac{1}{2}$ kilometer yesterday morning and $\frac{3}{8}$ kilometer yesterday afternoon. What was the total distance walked by James yesterday?". This item is about adding dissimilar fractions. arithmetic error in getting the cross products and in adding nor in dividing numbers. For this item, 8 learners (27%) scored 3 points, 2 (7%) scored 2, 2 (7%) scored 1 while 18 (60%) scored 0. One of the learners who scored 3 points for this item is Learner 5. She was able to correctly identify the operation to be used for the given problem. In her solution, she used the butterfly method in adding dissimilar fractions. Along the process, she did not commit reduced the answer to lowest term correctly. Her solution showed an improvement since her solution shown in the Pre-test item parallel to this shows an error in adding dissimilar fractions when she added both the numerator and denominator. Below is a copy of her solution.

Handwritten solution for Item No. 36. The student has written:

$$\frac{1}{2} + \frac{3}{8} = \frac{8+6}{10} = \frac{14}{10} = \frac{7}{5}$$

The student has written "3 pts" at the bottom right.

Plate 3:-

There were 4 items developed to assess the procedural skills of the learners on performing two or more operations on whole numbers without or with exponents, and grouping symbols. Post-Test item 17 “Evaluate $7+(8-2)^2+18$ ” is an example of an item designed to assess the aforementioned competency. In order to arrive at the correct answer, the learners must have a grasp of the order of operations. Based on the recorded scores of the learners, there were 5 (16.67%) learners who scored 3, 2 (6.67%) got 2 and 23 (76.67%) got 0. Below are some of the solutions presented by the learners for item no. 17. Learner 1 demonstrated mastery of the procedure in simplifying numerical expression. She applied the correct order of operations when she subtracted $8-2$ first, squared its difference, added it to 7 and then to 18. Thus, the sum obtained was 61. Her note “I don’t know how to solve this.” to Pre-Test Item no. 17, an item parallel to this item showed that she has improved her procedural skills in performing the order of operations.

Handwritten solution for item No. 17:

$$7 + (8-2)^2 + 18$$

$$7 + 6^2 + 18$$

$$7 + 36 + 18$$

$$43 + 18$$

$$61$$

3 pts. ✓

Plate 4:-

The Post-Test includes 2 items for procedural skills finding the percentage/rate/percent in a given problem. One of the items included for procedural skills on the aforementioned competency is Post-Test item No. 21, “Swerte Educational Supply has sold 1,575 notebooks, which is 35% of all the notebooks they had. How Much notebook did the store have at first?” In order to solve this item, one must recognize that 1575 is the percentage, 35% is the rate while the unknown is the base. The formula for computing the percentage is $P=BR$, where P is the percentage, B as the base, and R as the rate. Applying the PBR triangle, the formula for finding the base is $B=P/R$, thus, the answer to the problem is 4500. Therefore, the Swerte Educational supply has 4500 at first. Based on the analysis of scores obtained for procedural skills along the aforementioned competency, only 1 learner (3.33%) scored 3, 4 (13.33%) scored 2, 1 (3.33%) scored 1 while 24 (80%) scored 0. Learner 20’s solution is an indication that he was able to correctly identify all the given facts in the problem. Analyzing his solution, he performed the division operation correctly. However, based from the solution that he wrote, his multiplication was still based on repeated addition algorithm

Handwritten solution for item No. 21:

$$35 \overline{) 1,575.00}$$

$$140 $$

$$\underline{175} $$

$$175 $$

$$\underline{0} $$

45.00

3 pts. ✓

Plate 5:-

Conclusions and Recommendations:-

Although generally, there were increases on the proficiency level of the students after the implementation of the lessons, however, the fact that the learners were still “low proficient” on conceptual understanding and procedural skills along the identified competencies is undeniable. There may be some other factors that limit the maximum increase in the proficiency level of the students. These factors might be the implementation procedure or strategies used by the teacher, the time element in the conduct of the intervention, the language barriers, the retention component of the learners and the inadequacy in the content of the developed lessons used as an intervention.

However, testing the lessons to several but similar groups of students may help identify the factors that could possibly affect the maximum increase in the students' proficiency level in the identified least mastered competencies. Moreover, continuous monitoring of the learners focusing on the identified competencies maybe considered as part of the pre-evaluation of teachers to their grade 7 classes to integrate reinforcement in the improvement of the learners' proficiency in the identified least mastered competencies. Furthermore, the enhancement of the developed lessons as well as development of new lessons is highly recommended for future use.

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