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Research Article

Assessment of Learning Competencies in Mathematics: Basis for Contextualized Instructional Material Development

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Abstract

This developmental research aimed to assess the learning competencies in mathematics as basis for contextualized instructional material development. The respondents of the study were the 250 Grade VI learners in the District of Lemery, Lemery, Iloilo, who were chosen using the stratified random sampling. The researcher-made instrument was used to gather data. The instrument is a 45-item multiple choice test which was validated and reliability tested. This study employed mean and percentage in data analysis. The results of the study revealed that topics under whole numbers was in "approaching to mastery" level, number relations was in "developing" level, fractions was in "frustration" level, decimals was in "developing" level, ratio, proportion, and percent was in "approaching to mastery" level, geometry was in "developing" level, patterns and algebra was in "developing" level, topics related to measurement was in "frustration" level, statistics and probability was in "developing" level. It was further found out that the least mastered competency was in the topic related to fraction. It was concluded that learners performed best in the topics related to whole numbers and underperformed in the topics related to fractions and measurement. Contextualized instructional material was developed to improve the performance of the learners on the topics which they found difficult. The evaluation of developed instructional material revealed "exemplary" in terms of content, quality, usability, instructional design, and in over-all. It was further recommended that learners, teachers and school administrator should collaborate with each other to address the problem in mastering the learning competencies in mathematics.

Keywords: Mathematics, Learners, Least-Mastered, Learning Competency, Contextualized,Instructional Material

Introduction

Mastering of learning competencies in mathematics is one of the goals in education in the Philippines (Curriculum Guide in Mathematics, 2016). It has been identified as one of the competencies essential for personal fulfilment, active and productive citizenship, social belongingness and employability in the modern society. If learners do not acquire and possess these much needed competencies for life, then inevitably they will not possibly be very successful in personal and professional life (Wisniowski, 2014 in Ganal, 2014).

But the results in local and international assessment in mathematics showed that Philippines was behind among other countries. Among countries in Asia and Pacific, Philippines was underperformed using the country's test scores from 2013 (Cordero, 2018). Even in the recent PISA results (2018), the Philippines ranked second to the lowest among 79 countries (Philippine Star, 2019).

In the National Achievement Test, the standardized test conducted in the country, performance in mathematics revealed that in the year 2013 was 66.32% and in the year 2014 was 68.82% (Wallit, 2016). Thought it did increase in the second year, it did not reach the 75% standard level. These showed a very bleak picture of the academic standing of the Philippines in mathematics.

As observed in the school district by the researcher, teachers were using books and instructional materials provided and made by the department. Teachers were also engaged in continuing professional development training. Despite these efforts, mathematics as a subject was still difficult to learn. It was agreed on the result of the assessment conducted by the researcher that the performance of the learners in mathematics in the district of Lemery was low.

One solution that the researcher envisioned was to provide contextualized instructional material for the teachers to use in teaching mathematics. Since, using contextualized concepts made the learners engage in the context which tends to achieve a high level of success rate (Valenzuela, 2018). It is believed in this study that assisting pupils by addressing their learning needs develops them holistically and become academic performers.

Research Questions

This study aimed to determine the level of mastery of Grade VI learners in learning competencies in Mathematics V for S.Y. 2019-2020 in the District of

Lemery. Specifically, it sought answers to the following questions:

1. What is the mastery level of Grade VI learners in learning competencies in Mathematics V in the District of Lemery?
2. What is the least mastered learning competency of Grade VI learners in Mathematics V in the District of Lemery?
3. What instructional material can be made based on the results of the study?

Literature Review

Related Studies

Using Windschitl's (2015) framework of four categories of dilemmas—conceptual, pedagogical, political, and cultural—to analyze their transcripts, Suurtamm and Koch describe the types of dilemmas teachers face in changing assessment practices, based on their work with 42 teachers meeting on a regular basis over 2 years. They see conceptual dilemmas in assessment occur as teachers seek to understand the conceptual underpinnings of assessment and move their thinking from seeing assessment as an event at the end of a unit to assessment as ongoing and embedded in instruction.

Webb's study (2012) focused on middle school teachers working over a four-year period in a professional learning situation to improve their classroom assessment practice. Teachers engaged in a variety of collaborative activities, such as assessment planning, and analysis of classroom tasks and student work. Teachers tried out the assessment ideas in their classes and brought back those experiences to the group, thus providing authentic classroom connections. The project demonstrated an increase in teachers' use of higher cognitive demand tasks involving problem contexts. Webb suggested that professional learning needed to challenge teachers' prior conceptions of assessment as well as the way they saw mathematics.

Marynowski's study (2015) documented the work of secondary mathematics teachers who were supported by a coach over one year as they worked on co-constructing formative assessment opportunities and practices. One of the positive results was that teachers noticed that students were held more accountable for their learning and were more engaged in the learning process. Teachers appreciated the immediate feedback about student learning but also some teachers noted resistance on the part of students.

Lee et al. (2015) was involved with 6 colleagues in a self-study of a Professional Learning Community (PLC) set within a university course. Within this PLC they sought to refine the assessment practices they were using in their own classrooms. They focused on developing questioning techniques by role playing questioning techniques, refining those techniques, using the techniques with their own students in interviews, and bringing back the results of the conversations to the PLC. The group reported an increased level of awareness of teacher-student dialogue.

Other professional learning activities that had positive impacts on teachers' assessment expertise and practice include lesson study with a focus on assessment (Intanate 2012), working with student work samples from formative assessment opportunities in teachers' classrooms (Dempsey et al. 2015), and shifting from merely feedback to formative feedback for teachers in a Grade 1 classroom (Yamamoto 2012).

In another study using open-ended questions, it was found out that "getting the correct answer", "getting the answer quickly" and "understanding the method concerned" were the three major indicators that students put down for judgement of understanding. Yet in another study by the use of episode writing, "ability to solve mathematics problems", "having the correct answers", "accurate and fast solution", "ability to apply to daily life situations", "knowing the underlying principle", "understanding the procedure and strategies", "ability to clarify concepts", "knowing the relationships among concepts" and "ability to explain to others" were some of the indicators of understanding as perceived by the students (Wong, 2013, 2015).

In a study conducted by Avong (2013), shortage of qualified mathematics was judged to be the most contributing factor to poor performance by her participants in a study conducted in a remote in Kaduna state.

In a study on the influence of district standardized testing on mathematics instruction for Grades 3 and 8 (Koch, 2013) it was reported that in two school districts, the curriculum was aligned to test content; in a third district with an innovative mathematics program, the district test had little influence on mathematics instruction, but the program was in jeopardy because of decreasing computation scores. Kamii and Lewis (2011) also report a similar finding of achievement testing in primary mathematics as

perpetuating lower-order thinking. According to an achievement test, traditional instruction produced results as good as or better than, a constructivist program in second grade.

Adora (2017) found out poor Mathematics Performance of Grade Six pupils in National Achievement Test. A total of 335 pupils who took the test in each year (from 2010-2012) served as respondents of the study. Results revealed that the most learned Competencies were topics related to Geometry (identifying polygons) and topics related to Statistics and Probability (interpreting data presented in a line graph). Meanwhile, the least learned mathematics competencies were the topics related to Measurement (solving word problems involving measurements of solid prism, and finding rates and measurement of surface area of a triangle). Furthermore, pupils tend to get a wrong answer on the word problem questions. The results served as inputs in developing workbook.

Similarly, Juanday (2017) conducted the study to determine the recurring least mastered competencies from the perspective of NAT takers in the public elementary schools of South Cotabato City Divison. Three Hundred Seventy pupils were taken from the total population who took the test. The results revealed that in Mathematics, topics related to Measurement were identified as the least mastered competencies (solving word problems involving measurement of surface area-trapezoid, solving word problems involving measurement of solid prism, and solving word problems involving measurement of surface area-triangle. Three themes were derived out from the results which generally expressed the causes of the recurring least mastered competencies: first, ensuring learning done by the subject teacher through her explanation of the topic presented, Second, the pupils' interest, and lastly, pupils' comprehension.

Buenceso (2015) found out that out of 31 learning competencies related to fraction, 28 competencies were identified as non-mastered. Out of those 28 non-mastered competencies, 9 learning competencies were about solving word problems. This means that one of the most difficult learning competencies on fractions is solving word problems.

On the research conducted by Valenzuela (2018), which provided an understanding of how students construct mathematical knowledge via a contextualized curriculum. He found out that contextualization is effective. The effectiveness was illustrated through the student's ability to better understand mathematical problems and solve them successfully. Students were more engaged with context around the mathematical problems which lead to the high success rate of the teaching and learning process. Moreover, the recommendation focused on pedagogical practices to assist students in learning Mathematics through a contextualized curriculum, and gaining an understanding of how students construct knowledge.

Methodology

Research Design

This study used Developmental Research Design. Hence, according to Richey & Klein, 2007, developmental research is a systematic study of design, development and evaluation processes with the aim of establishing an empirical basis for the creation of instructional and non-instructional products and tools and new or enhanced models that govern their development. It involves phases as outline of the study.

This investigation involved different processes in developing localized instructional materials to be used in uplifting mastery in learning competencies in Mathematics. The material was based on the least-mastered competencies from the assessment results to Grade VI pupils in the District of Lemery, Iloilo.

Respondents of the Study

The respondents of the study were the 250 Grade VI learners enrolled in the District of Lemery taken from the population of 654 enrolees, school year 2019-2020 through stratified random sampling which is a method of sampling which come from Almiñana Elementary School (20 learners or 8%), Bantegui Elementary School (10 learners or 4%), Benjamin Aguilar Elementary School (15 learners or 6%), Concepcion Juanillo Memorial Elementary School (35 learners or 14%), Cristito Lapating Memorial Elementary School (30 learners or 12%), Gerongan Elementary School (10 learners or 4%), Jose Almiñana Memorial Elementary School (68 learners or 27%), Muyco Integrated School (18 learners or 7%), Omio Elementary School (5 learners or 2%), Pontoc Elementary School (12 learners or 5%), Sepanton Elementary School (12 learners or 5%), and Velasco Integrated School (15 learners or 6%).

Data Gathering Instrument

This study used a researcher-made test which is 45-item multiple choice type covering the 9 learning content of Grade V Mathematics Curriculum: whole numbers, number relations, fractions, decimals, ratio, proportion, and percent, geometry, patterns and algebra, measurement and, statistics and probability. It has undergone a validity testing among five experts in both research and field of mathematics and reliability tested to 30 learners who were not respondents. The instrument got 0.777 Cronbach's alpha which made it reliable. The researcher used the following scale on the percentage of correct response to determine the mastery level in each competency.

Data Gathering Procedure

The researcher sought permission addressed to Public Schools District Supervisor of District of Lemery. This letter was forwarded to the 12 public elementary school heads allowing the researcher to utilize the selected Grade VI learners. The Grade VI learners answered multiple choice test breakdown into; 5-item for Whole Numbers, 6-item for Number Relations, 4-item for Fractions, 6-item for Decimals, 4-item for Ratio, Proportion and Percent, 5-item for Geometry, 5-item for Patterns and Algebra, 6-item for measurement, and 4-item for Statistics and Probability. The researcher then analysed, interpreted, and tabulated the gathered data.

In developing the contextualized instructional material, the researcher identified the least-mastered competency based on the result. The topics under the least-mastered competency served as basis in crafting the instructional material. The crafted instructional material had undergone series of evaluation, from content, grammar, and the contextualized term done by panel of experts.

Results and Discussion

Mastery level of each learning competency of Grade VI learners in mathematics V in the District of Lemery

Mean and percentage were used to determine the mastery level of each learning competency of Grade VI learners in mathematics V in the district of Lemery. The results revealed *Approaching to Mastery* in whole numbers (*M*-3.844) with the percentage of correct response of 76.88%, *Developing level* in number relations (*M*-2.864) with percentage of correct response of 47.73%, *Frustration level* in fraction (*M*-1.276) with percentage of correct response of 31.90%, *Developing level* in decimals (*M*-2.432) with percentage of correct response of 40.53%, *Approaching to Mastery level* in ratio, proportion and percent (*M*-2.532) with percentage of correct response of 60.30%, *Developing level* in geometry (*M*-2.288) with percentage of correct response of 45.76%, *Developing level* in patterns and algebra (*M*-2.564) with percentage of correct response of 51.28%, *Frustration level* in measurement (*M*-2.004) with percentage of correct response of 33.40%, and *Developing level* in statistics and probability (*M*-2.232) with percentage of correct response of 55.80%.

The results showed that topics under word problems was the most learned competency, topics involving ratio, proportion and percent was on approaching to mastery level, topics in patterns and algebra, and statistics and probability were on the average level of mastery, topics involving number relations, decimals, and geometry were nearly non-mastered competencies, and topics involving fractions and measurement did not meet expectations or not mastered competencies. This meant that learners found it difficult to solve problems involving fractions and measurement.

This result agreed on the study of Juanday (2017) which shows that topics on measurements were found out as the least-mastered competencies in Mathematics. Moreover, Buenceso (2018) found out that the most of the topics related to fraction were the least-learned competencies and considered as the most difficult topics specifically the topics related to solving word problems involving fractions. Adora (2017)in her study, also identified that that the non-mastered competencies were topics related to Measurement. Topics in geometry and statistics and probability may not be mastered nor non-mastered topics. Table 1 shows the data.

Table 1. *Mastery Level of Each Learning Competency of Grade VI Learners in Mathematics V*

Competencies	*No. of Items*	*Mean*	*Percentage of Correct Response*	*Description*
Whole Numbers	5	3.844	76.88	Approaching to Mastery
Number Relations	6	2.864	47.73	Developing
Fractions	4	1.276	31.90	Frustration
Decimals	6	2.432	40.53	Developing
Ratio, Proportion and Percent	4	2.532	60.30	Approaching to Mastery
Geometry	5	2.288	45.76	Developing
Patterns and Algebra	5	2.564	51.28	Developing
Measurement	6	2.004	33.40	Frustration
Statistics and Probability	4	2.232	55.80	Developing

Least mastered learning competency of Grade VI learners in mathematics V in the District of Lemery

Rank was used in determining the least mastered learning competency in mathematics V in the District of Lemery. The result showed that whole numbers was on the first rank, followed by ratio, proportion, and percent on the second rank, then statistics and probability on the third rank, followed by patterns and algebra on the fourth rank, then number relations on the fifth rank, geometry on sixth rank, decimals on the seventh rank, measurement on the eighth rand, and the last, fraction on the ninth rank.

Furthermore, fraction was the least mastered competency with the Percentage of Correct Response-31.90%. This meant that learners did not meet the expected level when it comes to the topics related to fractions. The indication of the percentage of correct response meant that learners had the lowest tendency of getting the correct answer on the problems related to fraction. The results agreed on the study of Buenceso (2018) which said that most of the pupils were underperformed and not mastered most of the topics related to fraction. Table 2 shows the results.

Table 2. *Least Mastered Learning Competency of Grade VI Learners in Mathematics V in the District of Lemery*

Competencies	*Mean*	*Percentage of Correct Response*	*Description*	*Rank*
Whole Numbers	3.844	76.88	Approaching to Mastery	1
Ratio, Proportion and Percent	2.532	60.30	Approaching to Mastery	2
Statistics and Probability	2.232	55.80	Developing	3
Patterns and Algebra	2.564	51.28	Developing	4
Number Relations	2.864	47.73	Developing	5
Geometry	2.288	45.76	Developing	6
Decimals	2.432	40.53	Developing	7
Measurement	2.004	33.40	Frustration	8
Fractions	1.276	31.90	Frustration	9

Contextualized instructional material made based on the results of the study

The results of the study revealed that fraction was least mastered competency in mathematics V in the District of Lemery. Based on the results, the research opted to develop a contextualized instructional material.

According to Mouraz and Leite (2013), contextualization is a prerequisite in addressing the content and organization of activities to be undertaken in the classroom. Students' engagement in their schoolwork increases significantly when they are taught, why they are learning the concepts and how those concepts can be used in real-world contexts. Valenzuela (2018) found out that students construct mathematical knowledge via contextualized curriculum. The effectiveness was illustrated through the students' ability to better understand mathematical problems and solve them successfully. Students were more engaged in the context around the mathematical problems which lead to high success rate in mathematics classes through the use of contextualization.

In this case, the researcher made an instructional material based in the context of the culture and livelihood of the people in Lemery, Iloilo. Since, most of the people engaged in agricultural industry, each topic was applied to farming. The use of agricultural products and other scenario related to the daily activities of the farmer were used as example.

Developing the material involves different phases. Assessment Phase, A test was conducted to Grade VI pupils in the district of Lemery which involves the topics under the 9 learning content of Grade V

curriculum. This is to determine which competencies did the learners failed to master.

In Developing Phase, the use of contextualized terms as subject of the problem was used in engagement activities and application of skills. Learners best learn the topic if they usually seen in in their environment. Thus, integrating it in word problems was best in order to easily solve it. In Evaluation Phase, three experts who are major in the field of mathematics and two subject teachers handling the subject for more than ten years were tasked to evaluate the face and internal component of the module. The result showed *Exemplary* as to the Content of the Module (Mean:5.00), *Exemplary* in terms of the Quality (Mean:4.60), *Exemplary* in terms of Usability (Mean:5.00), *Exemplary* based on its instructional design (Mean:4.80), and in general the module is *Exemplary* (Mean:4.85). Table 3 showed the data.

Table 3. *Evaluation of Instructional Material*

Criteria	*Mean*	*Sd*	*Description*
Content	5.00	0.00	Exemplary
Quality	4.60	0.55	Exemplary
Usability	5.00	0.00	Exemplary
Instructional design	4.80	0.45	Exemplary
Over-all	4.85	0.14	Exemplary

Conclusion

Based on the results, the following conclusions are hereby drawn:The most mastered competency in mathematics V was Whole Numbers. Students learn and understand way better on dealing with topics on visualizations of whole numbers, its place value, and value of the number.Ratio, Proportion and Percent, Patterns and Algebra, and Statistics and Probability were competencies approaching to mastery level. There are some topics that the students had difficulty to comprehend. They hardly understood the topics on Worded Problems. Number Relations, Decimals, and Geometry were nearly non-mastered competencies. Problems involving operations of fractions, solving problems involving area and volume which fell under Fractions and Measurement, were the non-mastered competencies. It further concluded that among the 9 contents in mathematics, fraction was the most difficult topic. Hence, this was the topic in contextualized instructional material made.

Based on findings and conclusions, the recommendations below are advanced:The learners as center of educative processes may consider themselves as contributing factors in improving themselves. They need to put attention and interest on the topics and activities given by the teachers. Mathematics teachers give attention on delivering the topics. It is strongly recommended that they may use contextualized instructional materials to ensure better understanding among students. Teachers may use varied teaching techniques to make it simpler and easy to understand.School administrators- District Supervisors and School Heads may give directives to teachers and provide technical support, organizing a seminar on different strategies of teaching the least mastered competencies, providing trainings to teachers about contextualization of the topics. Future researchers may be recommended to further research on areas uncovered in this study.

Areas for further research: (1) The Effects of Schema-Based Instruction on Solving Mathematics Word Problems. (2) Problems and Difficulties in Dealing with Fractions: Basis for Remediation Program Development. (3) Self-Efficacy, Anxiety and Mathematical Fluency of the Learners in Mathematics.

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