Development and Validation of a Workbook in Elementary Mathematics VI

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***Abstract*—**Despite the implementation of the BEC Curriculum, significant problems still exist especially on the level of knowledge, mastery and skills of the learners, lack of instructional materials, laboratory apparatuses and physical equipment, as manifested in results of the National Achievement Test (NAT).

The study developed a workbook for Grade VI mathematics based on most and least learned competencies in the mathematics component of the NAT. The study assessed the validity and acceptability of the workbook as rated by teacher-respondents. The study made use of the descriptive evaluative research design. Statistical tools used were frequency counts, percentages, and weighted means.

Indentified competencies in Grade 6 mathematics served as inputs in the development of the workbook. The respondents rated all indicators on content validity as Very Much Valid. Majority of the respondents strongly agreed that the workbook possessed clarity, usefulness, language and style, illustrations, presentation, and suitability. The study recommended the use of the developed workbook in elementary mathematics classes. A study to assess the effectiveness of the workbook is also suggested.

***Keywords*—**Development, validation, elementary mathematics, workbook.

I. Introduction

Despite the implementation of the BEC Curriculum, significant problems still exist especially on the level of knowledge, mastery and skills of the learners, lack of instructional materials, laboratory apparatuses and physical equipment, as manifested in results of the National Achievement Test (NAT). In the National Achievement Test (NAT)results of 2012, there are only few high performing schools with mean percentage score (MPS) of 86% which is still categorized as Closely Approximating Mastery while there are sizable number of low performing schools with MPS of 34% and categorized as Low to Absolutely No Mastery. Furthermore, the Percentage of Correct Responses (PCR) per learning competency measured by subject area showed that the pupils' performance in Mathematics is very low.

The act of teaching is so complex that it is nearly impossible to claim that a specific way of teaching is superior to other ways. But, one way of maintaining the interest of the learners is to provide them with activities which they could perform individually after being given the proper guidance, instruction as a teaching tool such as workbook or module which could make learning interesting. It is at this point, the emphasis in instruction is for the teachers to be equipped with the necessary resource materials to facilitate the development of the cognitive learning skills for all learners.

Taking into consideration the challenges in Mathematics, a workbook on elementary Mathematics is a necessity to meet the learners' needs and equip them with skills required for their level. Learners with different needs and interests were target users of this workbook. This workbook would be the output of this study based on the needs of the Grade VI pupils in the different schools in the Division of Northern Samar. Both the quality and the quantity of time spent in instruction were critical variables in pupils' achievement. The quality of time spent could be determined by the teachers' and pupils' behavior in instruction, application and practice which demanded sufficient time to ensure pupils' mastery of the skills and competence through understanding the material.

II. Statement Of Objectives/Problem

The study aimed to:

1. Determine the mastery level of the Grade VI pupils' performance in Mathematics in the National Achievement Test in the Division of Northern Samar based on the Percentage of Correct Responses (PCR) per learning competency;
2. Determine the most and least learned competencies of the Grade VI pupils in Mathematics;
3. Draw inputs from the findings based on the mastery level and learning competencies of Grade VI pupils in Mathematics in the NAT that can be included in developing a workbook;
4. Ascertain the content validity of the developed Mathematics VI workbook in terms of objectives, key concepts, direction/instructions, practical exercises, reflections and topics; and
5. Identify the level of acceptability of the workbook in terms of clarity, usefulness, language and style, illustrations, presentations, and suitability.

III. Methodology

After determining the most and least learned competencies in Mathematics VI in the National Achievement Test as found out from the certification rating issued by the National Education Testing and Resource Center (NETRC), the workbook was developed following the competencies covered by Mathematics VI in the National Achievement Test. The

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developed workbook in Mathematics VI was evaluated in the study by mathematics teachers in 39 elementary schools in Northern Samar. Descriptive-evaluative research design was employed. Before the workbook was evaluated by mathematics teachers, it underwent critiquing by senior faculty members of the College of Education who have produced modules, workbooks and textbooks in mathematics. The level of validity was categorized into Very Much Valid, Much Valid, Moderately Valid, Least Valid, Not Valid. The level of acceptability of the workbook was categorized into Highly Acceptable, Acceptable, Moderately Acceptable, Least Acceptable and Not Acceptable. Statistical tools used were frequency counts, percentages, and weighted means.

IV. Results And Discussion

As shown in table 1. Majority of the Grade VI pupils in mathematics for SY 2009-2010 and 2010-2011 were moving towards mastery and closely approximating mastery levels. However for 2011-2012, majority of the pupils were on the average and moving towards mastery level. It means that there was an improvement on mastery level from 2010 to 2011 and there was a decline of the respondents NAT performance on year 2011-2012. Hence it can be inferred that the pupils in Northern Samar have not yet reached the mastery level in mathematics VI.

TABLE I
MASTERY LEVEL OF THE GRADE VI PUPILS' PERFORMANCE IN MATHEMATICS IN THE NATIONAL ACHIEVEMENT TEST IN THE DIVISION OF NORTHERN SAMAR FOR SCHOOL YEARS 2010-2012 BASED ON THE PERCENTAGE OF CORRECT RESPONSES (PCR) PER LEARNING AREA.

MASTERY LEVEL	YEAR						TOTAL	
	2010		2011		2012			
	f	%	F	%	f	%	f	%
Mastery (M)	3	0.90	30	8.96	1	0.30	34	3.38
Closely Approximating Mastery (CAM)	6	17.91	85	25.37	42	12.54	187	18.61
Moving Towards Mastery (MTM)	168	50.15	160	47.76	112	33.43	440	43.78
Average Mastery (AM)	97	28.96	55	16.42	125	37.31	277	27.56
Low Mastery (LM)	7	2.09	5	1.49	55	16.42	67	6.67
TOTAL	335	100	335	100	335	100	1005	100

On the learning competencies in mathematics VI presented in table 2, the most learned competencies were identifying congruent polygons, interpreting data presented in a line graphs followed by reading and interpreting reading from electric meter/water meter. The least learned mathematics competency was in solving word problems involving measurements of solids-prism, finding rates and measurement of surface area of triangles. It could be observed that the most learned competency is in geometry while the least learned concept is also in geometry. The least learned competencies are focused on problem solving. Since there is no competency which was mastered, all competencies served as inputs in developing the workbook for Mathematics VI.

V. Conclusions

The Grade VI pupils have not mastered the learning competencies. There is a need for elementary math teachers to devise ways to teach word problems, particularly applied to triangles, prisms and finding the rate. The developed workbook is valid and acceptable. This signifies that the material could be a potential tool to enhance learning in Mathematics VI.

VI. Recommendations

1. Teachers should devise innovative ways to teach the least learned skills.
2. The developed workbook should be published, disseminated, and used by teachers in mathematics classes to enhance pupils' academic performance and to elicit feedback for the improvement of the material.
3. The government should financially support teachers who have the interest and potentials in developing workbook and other instructional materials to provide quality education. This could also serve as an income-generating project in school.
4. A study should be conducted to assess the relevance and usefulness of the workbook by subjecting it to the use of Grade VI pupils.

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TABLE II
THE MOST AND LEAST LEARNED LEARNING COMPETENCIES OF GRADE SIX PUPILS IN MATHEMATICS IN THE NATIONAL ACHIEVEMENT TEST RESULTS

Competencies	Percentage Of Correct Responses	Mastery Level	Rank
Identifying congruent polygons	**73.31**	**MTM**	**1**
Interpreting data presented in a line graph	**70.70**	**MTM**	**2**
Reading and interpreting reading from –electric meter/water meter	**67.81**	**MTM**	**3**
Subtracting dissimilar fractions in mixed forms with regrouping	**67.62**	**MTM**	**4**
Solving word problems involving body temperature	**67.15**	**MTM**	**5**
Solving word problems involving finding the percentage	**66.15**	**MTM**	**6**
Solving 1 to 3 step word problems involving addition and subtraction of decimals including money	**65.99**	**AM**	**7**
Reading and interpreting data presented in a circle graph	**65.80**	**AM**	**8**
Solving 1-step word problem involving addition of fractions	**65.57**	**AM**	**9**
Subtracting dissimilar fractions	**64.20**	**AM**	**10**
Multiplying mixed form by a fraction	**62.55**	**AM**	**11**
Solving word problems with proportions	**61.95**	**AM**	**12**
Adding similar fractions in mixed forms with regrouping	**59.27**	**AM**	**13**
Solving word problems involving measurement of surface area-trapezoid	**57.06**	**AM**	**14**
Solving word problems involving measurement of surface area-triangles	**53.81**	**AM**	**15**
Solving word problems involving finding the rate	**49.82**	**AM**	**16**
Solving word problems involving measurement of solids-prism	**45.29**	**AM**	**17**

Legend: MTM (Moving Towards Mastery) AM (Average Mastery)

Table 3 shows the assessment of the developed workbook in terms of content validity. The respondents rated the objectives, key concepts, directions, practical exercises, reflection, topics as "very much valid". The indicator with the highest mean is that the workbook is "easy to follow".

TABLE III
ASSESSMENT OF THE DEVELOPED WORKBOOK IN TERMS OF CONTENT VALIDITY

Indicator	Mean	Description	Interpretation
Objectives			
relevant to the topics covered in Mathematics VI	4.79	Strongly Agree	Very Much Valid
specific and clearly stated	4.77	Strongly Agree	Very Much Valid
measurable	4.79	Strongly Agree	Very Much Valid
attainable	4.82	Strongly Agree	Very Much Valid
result oriented	4.69	Strongly Agree	Very Much Valid
time bounded	4.74	Strongly Agree	Very Much Valid
Section Mean	**4.77**	**Strongly Agree**	**Very Much Valid**
Concepts/Principles			
gives insights and ideas what the activity is all about	4.85	Strongly Agree	Very Much Valid
provides background of concepts and information about the topic to be solved	4.77	Strongly Agree	Very Much Valid
arouses pupils' interest to solve the exercises	4.79	Strongly Agree	Very Much Valid
attracts pupils' attention	4.79	Strongly Agree	Very Much Valid
Section Mean	**4.80**	**Strongly Agree**	**Very Much Valid**
Directions			
simple and clear	4.82	Strongly Agree	Very Much Valid
easy to follow	4.87	Strongly Agree	Very Much Valid
properly sequenced	4.77	Strongly Agree	Very Much Valid
can be done independently	4.56	Strongly Agree	Very Much Valid
Section Mean	**4.76**	**Strongly Agree**	**Very Much Valid**
Practical Exercises		Strongly Agree	Very Much Valid
relevance to objectives	4.7	Strongly Agree	Very Much Valid
adequate to develop pupils' mathematical knowledge and skills	4.7		
appropriate to pupils abilities		Strongly Agree	Very Much Valid
sufficient enough to determine mastery level of pupils	4.7	Strongly Agree	Very Much Valid
	4.6		
Section Mean	**4.66**	**Strongly Agree**	**Very Much Valid**
Reflection			
motivates pupils to express their learning experience	4.6	Strongly Agree	Very Much Valid
gives insights to teacher if the pupils need remediation or enrichment	4.7	Strongly Agree	Very Much Valid
Section Mean	**4.67**	**Strongly Agree**	**Very Much Valid**
Topics			
sequence according to PELC	4.6	Strongly Agree	Very Much Valid
carefully organized	4.8	Strongly Agree	Very Much Valid
well constructed	4.8	Strongly Agree	Very Much Valid
logically presented	4.6	Strongly Agree	Very Much Valid
Section Mean	**4.76**	**Strongly Agree**	**Very Much Valid**
GRAND MEAN	**4.74**	**Strongly Agree**	**Very Much Valid**

Table 4 revealed the acceptability level of the workbook in terms of clarity, usefulness, language and style, illustrations, presentations and suitability. All indicators were rated Very Acceptable. The highest mean is on the workbook being "relevant to the topic"

TABLE IV
LEVEL OF ACCEPTABILITY OF THE WORKBOOK

Indicators	Mean	Description	Interpretation
Clarity			
information is clear and simple	4.31	Strongly Agree	Very Acceptable
language used is clear and easy to understand	4.69	Strongly Agree	Very Acceptable
the concepts for each activity are arranged logically to ensure that there is no duplication	4.33	Strongly Agree	Very Acceptable
Section Mean	**4.44**	**Strongly Agree**	**Very Acceptable**
Usefulness			
the materials prepare the pupils to think logically and critically	4.62	Strongly Agree	Very Acceptable
the concepts in the material are simple and comprehensible	4.77	Strongly Agree	Very Acceptable
as a whole the enrichment activity is teachable	4.79	Strongly Agree	Very Acceptable
the material provides opportunity for the development/ enhancement of mathematical skills	4.74	Strongly Agree	Very Acceptable
the learning contents provide adequate information on the topics presented	4.69	Strongly Agree	Very Acceptable
it encourages the pupils to become actively involved in the learning activities	4.74	Strongly Agree	Very Acceptable
it stimulates the learners to intellectual activities	4.74	Strongly Agree	Very Acceptable
the activities seek to relate new concepts from previous learning	4.69	Strongly Agree	Very Acceptable
Section Mean	**4.70**	**Strongly Agree**	**Very Acceptable**
Language and Style			
the presentation is clear observing correct grammar	4.67	Strongly Agree	Very Acceptable
the language is clear and comprehensive in terms of vocabulary	4.69	Strongly Agree	Very Acceptable
there is sufficient familiar vocabulary to ensure learning	4.69	Strongly Agree	Very Acceptable
the structure, style and format are appropriate to the target level	4.62	Strongly Agree	Very Acceptable
Section Mean	**4.68**	**Strongly Agree**	**Very Acceptable**
Illustrations			
clear and simple	4.72	Strongly Agree	Very Acceptable
arouses pupils' interest making learning effective and enjoyable	4.66	Strongly Agree	Very Acceptable
provides concrete visual clues	4.58	Strongly Agree	Very Acceptable
guides pupils to follow direction	4.74	Strongly Agree	Very Acceptable
relevant to the topic	4.81	Strongly Agree	Very Acceptable
Section Mean	**4.70**	**Strongly Agree**	**Very Acceptable**
Presentations			
topics presented in logical and orderly sequences	4.70	Strongly Agree	**Very Much Acceptable**
the direction is concise, readable and easy to follow	4.73	Strongly Agree	**Very Much Acceptable**
topics fit the sequence of the course	4.70	Strongly Agree	Very Acceptable
Section Mean	**4.71**	**Strongly Agree**	**Very Acceptable**
Suitability			
the activity takes in consideration the varying attitudes and capabilities of the learner	4.47	Strongly Agree	Very Acceptable
the activities are suitable to the subject matter	4.74	Strongly Agree	Very Acceptable
the activities are relevant, interesting and self-motivating to the learner	4.69	Strongly Agree	Very Acceptable
the use of enrichment activity is adaptable to classes with large number of pupils	4.59	Strongly Agree	Very Acceptable
Section Mean	**4.64**	**Strongly Agree**	**Very Acceptable**
Grand Mean	**4.66**	**Strongly Agree**	**Very Acceptable**