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## Development and Validation of Contextualized Remediation Workbook in General Mathematics for TVL Senior High School Students

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**Abstract:** This study primarily aimed to develop and to validate a contextualized remediation workbook in General Mathematics specifically for Technical-Vocational-Livelihood students to help improve their academic performance in the said learning area. The topics included in the Workbook were solving rational equations, graphs of rational functions, solving exponential equations and inequalities, graphs of exponential functions, solving logarithmic equations and inequalities, and graphs of logarithmic functions. This study employed a Research and Development (R & D) design. Three groups of validators such as ten Mathematics Teachers, ten Mathematics Master Teachers and ten Learning Resources Management and Development System (LRMDS) Members evaluated the contextualized remediation Workbook according to its level of validity and acceptability using an adopted validation tool. Mean and One-Way Analysis of Variance were used in the statistical treatment. Based on the results, the Contextualized Remediation Workbook was very much valid and very much acceptable. Moreover, there was no significant difference in the level of validity and acceptability among the mean responses of the three groups of evaluators. It was recommended that other teachers should also develop contextualized materials to help create more meaningful teaching and learning experiences.

### Introduction

The Enhanced Basic Education Act of 2013 was passed to provide Philippine education with enough time for mastery of concepts and skills, to develop life-long learners, and to prepare the K to 12 graduates upon entering at least one of the four exits - the tertiary education, middle-level skills development, employment, and entrepreneurship, in the rapidly changing and increasingly globalized environment. As stated in its declaration of policy, the state shall establish, maintain and support a complete, adequate, and integrated system of education that is relevant to the needs of the people, the country and society-at-large (Republic Act No. 10533, 2013).

The Senior High School curriculum of the Philippine K to 12 program offers four tracks. One of these is the Technical-Vocational-Livelihood (TVL) Track which consists of four strands: Agri-Fishery Arts, Home Economics, Information and Communications Technology, and Industrial Arts. As part of the curriculum requirements, all TVL-Senior High School students should be able to satisfactorily pass General Mathematics as one of its core subjects. Hence, each student in the TVL, though not an academic track, should still be able to master all the competencies in General Mathematics.

However, according to the academic performance of Bawing National High School TVL students in General Mathematics during the first semester of School Year 2018-2019 and even of the previous school years, a significant number of these students had some difficulties in solving mathematical problems and exercises due to the lack of basic skills in Mathematics, absenteeism and other factors that affect their school performance. This signifies that they have not mastered the basic learning competencies in Junior High School. Hence, the researcher endeavored to develop and to validate a Contextualized Remediation Workbook in General Mathematics for TVL Senior High School Students for them to better understand and master the concepts and skills in the said subject area.

### **Statement of the Problem**

This study aimed to develop and to validate a Contextualized Remediation Workbook in General Mathematics for TVL Senior High School students. Specifically, this research sought to answer the following questions:

1. What were the mean responses of the Math Teacher-evaluators, Math Master Teacher-evaluators and LRMS members to the level of validity of the Contextualized Remediation Workbook in terms of Lesson Objectives; Lesson Inputs; Lesson Application; and Lesson Enrichment?
2. What were the mean responses of the Math Teacher-evaluators, Math Master Teacher-evaluators and LRMS members to the level of acceptability of the Contextualized Remediation Workbook in terms of Clarity; Usefulness; Suitability; Adequacy; Timeliness; Language, Style and Format; Illustrations; and Presentations?
3. Was there any significant difference in the level of validity of the Contextualized Remediation Workbook among the mean responses of the Math Teachers, Mathematics Master Teachers and LRMS members?
4. Was there any significant difference in the level of acceptability of the Contextualized Remediation Workbook among the mean responses of the Math Teachers, Math Master Teachers and LRMS members?

### **Related Literature** **Remedial**

According to the Department of Education (2018), remedial is any form of organized instructional interventions provided to all learners who are having learning gaps, difficulties in the lessons or subject area deficiency. The Department of Education also stated that the remediation program can be conducted to all the learners "by giving them tutorial, mentoring, coaching, or any other ways of delivering the organized learning experiences." Many research studies have proven that remedial instruction programs have been effective and helpful to alleviate the academic performances of the learners.

The Department of Education (2005) also has given an official order through DepEd Order No. 27 saying that "public secondary schools all over the nation should initiate, organize and provide remedial instruction programs to the learners to increase the chances that all of them will all complete high school with sufficient mastery of its coverage".

The Department of Education (2018) ensured that all learners will be able to complete the basic education with mastery in the learning competencies and with necessary skills for higher education, specialized skills development, employment or entrepreneurship. For this reason, the Department of Education recognized the need to provide remediation classes to the learners to help bridge the gap and to ensure their continuous moving up from one grade level to the next.

### **Learning Materials**

As cited by Bungag (2018) in her study, within the various learning environments, there are many alternative teaching-learning strategies as pointed which the teacher can use in his class. Within the learning setting, how the teacher acts concerning his learning objective is very vital. Hence, a teacher as a facilitator of learning must be aware that lots of alternatives can be used and that several learning strategies must be employed to facilitate a more enjoyable learning. She also said that Mathematics teachers must be armed with physical devices such as workbooks for them to introduce new lessons in Mathematics. For this reason, she recommended that teachers must have proper training on bookmaking to reinforce the teaching process. This is because the use of workbooks promotes individualized learning.

According to Golding (2011), modules, workbooks and similar resource materials reinforce learning. She also stated that "self-activity is the way to go". It implies that the experience gained by students while answering the resource material is very crucial in improving their view and understanding of the lesson, and their performance.

Hence, students should be provided with enough necessary learning materials to aid them individually in the teaching-learning process. The provision of such learning materials is of great help since it allows the learners to learn better just by themselves. The use of these instructional materials allows the learners to individually apply their skills in solving mathematical problems. These appropriate contextualized instructional materials could also serve as a guide for the learners in understanding better the mathematical concepts and procedures.

### **Contextualization**

Contextualization is the localization of instructional materials used in the teaching and learning process. This aids the learners to better understand and relate to situations or problems. This is done by using specific names, places, events or things that can be found in the locality.

The Enhanced Basic Education Act of 2013 stated that "the curriculum should be flexible enough" to enable and to allow all schools in elementary and in secondary level both in public and in private to indigenize, to localize and to enhance classroom lessons and activities based on learners' respective educational and social contexts. This clearly means that the classroom teaching, and learning should be contextualized.

Many learners are challenged in Mathematics. They find it difficult to understand the concepts in mathematical problems. With this difficulty, one way to address this is through the provision of supplemental contextualized instructional materials that will aid the students to relate to the examples and presentations as they can relate these in their field of study and to their own lives. As mentioned by Baker, Hope and Karandjef (2009), Contextualized Teaching and Learning (CTL) is found to be a

teaching strategy that could potentially enhance the academic ability of the students as it actively involves the learners and develop their skills. Berns and Erickson (2001) defines it as “conception of teaching and learning that helps teachers relate subject matter content to real-world situations.”

Also, according to Carim (2018), the Department of Education may have claimed that it has made the K to 12 curricula contextualized and enhanced however the textbooks provided by the government and circulated by different publishing houses to aid the teaching of core subjects were still written generally. These textbooks could have been very useful as a reference books for students' learning and retention of different concepts. However, this could be further improved by specializing the instructional materials intended for different fields the learners take.

### **Development and Validation of Remediation Workbook**

As cited by Cutamora (2016) in his study, there are stages involved in the production of a workbook. These four stages are design, construction, validation and revision.

During the design stage, the teachers identifies the topics or learning competencies that are included in the development of the Workbook. In the validation stage, the draft of the Workbook is evaluated and is rated by different groups of validators – the Mathematics teachers, the Mathematics master teachers and School Heads/Supervisors. The evaluation is directed on the criteria and features that makes a quality Workbook complying with the validity and acceptability of the materials. The assessment and validation of the Workbook is done with the use of the following: questionnaires and checklist with a portion for comments or recommendations. In the revision stage, the Workbook is revised according to the assessment procedures that are employed during the validation stage. The comments and recommendations of the evaluators are taken into consideration improving the Workbook developed.

### **Related Studies**

Many studies have proven that the development and the use of remediation materials have improved the poor academic performances of the learners in school especially in Mathematics. This suggests that teachers should be more creative in doing interventions just to facilitate learners to develop the skills needed in every learning competency. Since the learners need more support for them to cope with every learning competency, the development and production of a remediation Workbook is considered.

Bungag (2018) developed a Mathematics Workbook for Grade 8 Remediation Classes in Glan School of Arts and Trades in Glan, Sarangani Province. The workbook contains lessons on special products, factoring and an introduction to probability. Her study concluded that there is no significant difference among the mean responses of the teachers, master teachers, and school heads/supervisors which implies that they agree on the objectives, concepts, skills, usability, appropriateness and adequacy of the developed workbook as they rated Very High. She recommended in her study that workbooks should be developed for remediation classes for other grade levels after having developed a workbook for Mathematics Grade 8. Also, she stated that the production of workbooks and other instructional materials should be given with more emphasis and budget allocation of school administrators.

In 2016, Cutamora was also able to develop a workbook for Grade 7 students enrolled in Open High School Program of Leonard Young National High School in Glan, Sarangani Province. The

workbook contained skills and concepts on integers; operations on integers; rational numbers; forms, operations and properties of rational numbers which was validated by teachers, school heads and supervisors in Sarangani Province. The results in his study showed that the groups of validators agreed on their evaluation of the usability, appropriateness and adequacy of the workbook.

Galanida (2005) developed instructional materials for Basic Mathematics, aimed to determine the validity and applicability of his developed instructional material as perceived by experts in Mathematics. He conducted the study by following the three phases of research process which were (1) the planning phase, (2) the writing phase, and (3) the validation phase. As indicated in the findings, 71 out of 72 activities of the developed materials were satisfactorily applicable which implies that the materials were useful in teaching basic college Mathematics. Thus, the researcher recommended that school administrators should encourage and support teachers in developing more instructional materials.

### **Conceptual Framework**

The input of the study is the set of learning competencies in General Mathematics which includes the concepts/topics skills that need to be developed in the students. These are the least mastered learning competencies that they should master before the end of the semester.

The process is the development of the first draft of the Workbook which includes the identification of the contents/topics and skills, construction of the exercises and activities and the validation of the first draft of the Workbook according to its validity in terms of: lesson objectives, lesson inputs, lesson application and lesson enrichment; and also, according to its acceptability in terms of: clarity, usefulness, suitability, adequacy, timeliness, language, style and format, illustrations, and presentations.

Finally, the output is the development of the final draft of the contextualized remediation Workbook in General Mathematics which contains the Introduction, the Table of Contents, Definition of terms, and the remediation exercises. It is in the output that all comments and suggestions of the evaluators and panel members are considered for the improvement of the Workbook.

### **Definition of Terms**

The following terms are defined operationally for a better understanding of the study.

**General Mathematics.** This is one of the Core Subjects in the K to 12 Senior High Curriculum. This is one of the Mathematics subjects offered to Grade 11 students.

**Contextualization.** This refers to the using of examples, names, stories, places, events, illustrations, etc. that are based on local culture, history, and reality which makes lessons relevant to learners and easy to understand.

**Evaluators.** These are the experts who rated the first draft of the contextualized remediation Workbook according to its validity and acceptability. There are the three sets of evaluators: Math Teachers, Math Master Teachers and LRMS members.

**Math Teachers.** These are Mathematics teachers who have positions from Teacher I to Teacher III.

Math Master teachers. These are Mathematics teachers who have a Master Teacher position.

LRMDS Members. These refer to individuals who have the knowledge and skills and are trained in making learning resources or instructional materials that are suited for K-12 learners.

Validity. This refers to the quality of an instructional material being valid as it satisfactorily meets the standards of the evaluators with regards to lesson objectives, lesson inputs, lesson application and lesson enrichment.

Acceptability. This refers to the quality of an instructional material being acceptable as it satisfactorily meets the standards of the evaluators with regards to clarity, usefulness, suitability, adequacy, timeliness, language, style and format, illustrations and presentations.

Remediation Workbook. This pertains to the instructional material that can be used for remediation classes. This Workbook consists of contextualized simplified samples, illustrations and exercises which can be easily understood by the students and which can help the students to better understand the lessons. The development of this workbook was based on the least mastered competencies of the TVL students in General Mathematics.

TVL Senior High School Students. These are students in Senior High School curriculum who are enrolled in one of the four strands in Technical-Vocational-Livelihood Track which includes Agri-Fishery Arts, Home Economics, Information and Communications Technology and Industrial Arts.

## **Research Design**

This study utilized the Research and Development (R&D) scheme. To come up with the desired output of the study, this study went through several stages. Based on the content and skills that were incorporated and given emphasis in the learning competencies of General Mathematics as provided in the K to 12 Curriculum of the Department of Education, the Workbook was developed. The Workbook was evaluated to ensure its validity in terms of Lesson Objectives, Lesson Inputs, Lesson Application and Lesson Enrichment; and its acceptability in terms of Clarity, Usefulness, Suitability, Adequacy, Timeliness, Language, Style and Format, Illustrations and Presentations. After considering all factors and suggestions that were given by the evaluators relating to the principles of high-quality development of the Workbook, the final output was the validated Contextualized Remediation Workbook in General Mathematics for TVL Senior High School Students.

## **Evaluators**

The validation of the Contextualized Remediation Workbook is the heart of this study. There were three groups of validators who evaluated the first draft of the Workbook.

The first group was the Teacher-evaluators consisting of 10 Mathematics Teachers while the second group was 10 Mathematics Master Teachers. To further assure the quality and standardization of the Workbook, the third group of evaluators, 10 LRMDS members, critiqued the Workbook using the criteria given for validation. The three groups of validators were from the different public schools and offices in the Division of General Santos City and Division of South Cotabato.

## Statistical Treatment

Weighted Mean was used for problem numbers 1 and 2. To interpret the results, the following five-point scale was used:

Rating	Description	Interpretation
4.50-5.00	Strongly Agree	Very Much Valid/Acceptable
3.50-4.49	Agree Much	Much Valid/Acceptable
2.50-3.49	Moderately Agree	Valid/Acceptable
1.50-2.49	Disagree	Less Valid/Acceptable
1.00-1.49	Strongly Disagree	Least Valid/Acceptable

To answer problem numbers 3 and 4, One-Way Analysis of Variance was used. Hypotheses were tested at 0.05 level of significance.

## Results and Discussions

### Evaluation on the Level of Validity of the Contextualized Remediation Workbook in General Mathematics

Ten (10) Mathematics Teachers, ten (10) Mathematics Master Teachers and ten (10) LRMS Members evaluated the level of validity of the Contextualized Remediation Workbook in General Mathematics in terms of its lesson objectives, lesson inputs, lesson application and lesson enrichment.

The following table below presents the level of validity of the Contextualized Remediation Workbook according to the three groups of validators.

**Table 1. Level of Validity of the Workbook According to the Three Groups of Validators**

Criteria	Mean			Average	Interpretation
	Math Teachers	Math Master Teachers	LRMS Members		
Lesson Objectives	4.80	4.98	4.63	4.80	Very Much Valid
Lesson Inputs	4.25	4.43	4.33	4.34	Much Valid
Lesson Application	4.53	4.71	4.46	4.57	Very Much Valid
Lesson Enrichment	4.33	4.59	4.35	4.42	Much Valid
<b>Overall Mean</b>	<b>4.48</b>	<b>4.68</b>	<b>4.44</b>	<b>4.53</b>	<b>Very Much Valid</b>

As presented, the group of Math Master Teachers strongly agreed and evaluated the Workbook's level of validity as very much valid as indicated by the mean of 4.68. However, the groups of Math Teachers and LRMS members agreed as they evaluated it as much valid as indicated by their means of 4.48 and 4.44, respectively.

The lesson objectives got the highest average rating of 4.80 as evaluated by the evaluators for they know that the objectives are aligned in the Curriculum Guide of General Mathematics. This implies that the lesson objectives of the Workbook are very much valid. This is supported by the statements of some the validators, saying, "The learning objectives are relevant and measurable." Some said that, "The learning objectives of the Workbook are very relevant since the objectives are aligned in the Curriculum

Guide.” Also, one validator said that, “The learning objectives are indeed achievable.” In the same manner, the lesson application of the Workbook is very much valid as indicated by the average rating of 4.57. This is also supported by the statements of one of the validators, saying, “The lesson applications are fitted to the strand of the students since the word problems are localized. Because of this, the students can really relate to the problems.”

The lesson enrichment of the Workbook is much valid as suggested by the average rating of 4.42. Meanwhile, the lesson inputs section has the lowest mean of 4.34 among the different parts of the Workbook. Though it falls on the category of much valid, along with lesson enrichment, there is still a need to improve this part of the Workbook.

Overall, the level of validity of the contextualized remediation Workbook is very much valid as indicated by the overall mean of 4.53. This implies that the lesson objectives, lesson inputs, lesson application and lesson enrichment of the Workbook are useful and very much related to the topics in General Mathematics. This is in concurrence to the findings of the study conducted by Tan-Espinar and Ballado (2017).

### **Evaluation on the Level of Acceptability of the Contextualized Remediation Workbook in General Mathematics**

The same three groups of validators evaluated the acceptability of the Contextualized Remediation Workbook in General Mathematics in terms of clarity, usefulness, suitability, adequacy, timeliness, language, style and format, illustrations, and presentations.

Table 2 presents the level of acceptability of the first draft of the Contextualized Remediation Workbook according to the three groups of validators.

**Table 2. Level of Acceptability of Workbook According to the Three Groups of Validators**

Criteria	Mean			Mean	Interpretation
	Math Teachers	Math Master Teachers	LRMDS Members		
Clarity	4.60	4.83	4.73	4.72	Very Much Acceptable
Usefulness	4.55	4.54	4.68	4.59	Very Much Acceptable
Suitability	4.38	4.63	4.65	4.55	Very Much Acceptable
Adequacy	4.43	4.59	4.37	4.46	Much Acceptable
Timeliness	4.77	4.93	4.67	4.79	Very Much Acceptable
Language, Style and Format	4.64	4.83	4.25	4.57	Very Much Acceptable
Illustrations	4.36	4.76	4.20	4.44	Much Acceptable
Presentations	4.80	4.93	4.57	4.77	Very Much Acceptable
<b>Overall Mean</b>	<b>4.57</b>	<b>4.76</b>	<b>4.52</b>	<b>4.62</b>	<b>Very Much Acceptable</b>

As presented, the groups of Math Teachers, Math Master Teachers and LRMDS members all strongly agreed and evaluated the Contextualized Remediation Workbook’s level of acceptability as very much acceptable as indicated by the means of 4.57, 4.76 and 4.52, respectively.

The three groups of evaluators strongly agreed and evaluated the Workbook’s level of acceptability in terms of clarity, usefulness, suitability, timeliness, language, style and format, and presentations as very much acceptable as indicated by the means of 4.72, 4.59, 4.55, 4.79, 4.57 and 4.77, respectively. While they agreed that its adequacy and illustrations are much acceptable as indicated by the means of 4.46 and 4.44, respectively.

The timeliness of the Workbook got the highest average rating which means that the development of the Contextualized Remediation Workbook is very much timely since the students don't have sufficient supply of learning materials. This Workbook could indeed help the students in understanding and mastering the least mastered learning competencies in General Mathematics.

On the other hand, the Workbook's adequacy and illustrations were the two least rated criteria. This suggests that more activities should be added to increase students' knowledge and skills on the learning competencies or the topics. The important terms should be defined for reinforcement. Since the Workbook is designed to provide remedial interventions to students who are less inclined to Mathematics, the directions should be clear and simple. Moreover, the illustrations should arouse students' interest to make learning enjoyable.

Overall, the developed Contextualized Remediation Workbook is evaluated as very much acceptable as indicated by the overall mean of 4.62.

### Comparison of the Evaluation of Contextualized Remediation Workbook According to Its Level of Validity

**Table 3. Results of One-Way Analysis of Variance of the Responses of the Three Groups of Validators for Workbook's Level of Validity**

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.3204	2	0.1602	1.5138	0.2382	3.3541
Within Groups	2.8573	27	0.1058			
Total	3.1777	29				

Based on the results, the  $F_{computed}$  value of 1.5138 is not significant as indicated by the  $p$ -value 0.2382 which is greater than 0.05 level of significance. This implies that the mean responses of the three groups of evaluators in the level of validity of the remediation Workbook have no significant difference. Hence, Math Teachers, Math Master Teachers and LRMDs members all agree on their evaluations on the level of validity of the Contextualized Remediation Workbook in General Mathematics.

### Comparison of the Evaluation of Contextualized Remediation Workbook According to Its Level of Acceptability

**Table 4. Results of One-Way Analysis of Variance of the Responses of the Three Groups of Validators for Workbook's Level of Acceptability**

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.3197	2	0.1599	1.5458	0.2314	3.3541
Within Groups	2.7925	27	0.1034			
Total	3.1122	29				

As presented on the table, the  $F_{computed}$  value of 1.5458 is not significant as indicated by the  $p$ -value 0.2314 which is greater than 0.05 level of significance. This implies that the mean responses of the

three groups of evaluators in the level of acceptability of the remediation Workbook also have no significant difference. Hence, Math Teachers, Math Master Teachers and LRMDs members also agree on their evaluation on the level of acceptability of the Contextualized Remediation Workbook in General Mathematics.

This is also in concurrence to the study conducted by Bungag (2018) wherein she concluded that there is no significant difference among the mean responses of the three groups of evaluators.

## Conclusions

Based on the results and discussions of the study, the following conclusions are drawn:

The level of validity of the Contextualized Remediation Workbook in General Mathematics for TVL Senior High School students is very much valid. The level of acceptability of the Contextualized Remediation Workbook in General Mathematics for TVL Senior High School students is very much acceptable. There is no significant difference in the level of validity among the mean responses of Math Teachers, Math Master Teachers and LRMDs members. Also, there is no significant difference in the level of acceptability among the mean responses of Math Teachers, Math Master Teachers and LRMDs members. Since the level of validity of the Contextualized Remediation Workbook is very much valid and its level of acceptability is very much acceptable, therefore, the second set of validation is no longer needed.

## Recommendations

Based on the findings and conclusion of the study, the following are recommended:

1. After the final revisions of the Contextualized Remediation Workbook in General Mathematics for TVL Senior High School students, pilot testing should be done to measure the effectiveness of the developed Workbook in enhancing the learning of students and in improving their academic performance in the learning area as well.
2. More trainings or workshops on contextualization of lessons should be conducted by the school administrators and DepEd Division personnel to teachers for them to also be able to develop more quality contextualized instructional materials to improve the academic performances of the students.

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