WORKTEXT IN PRECALCULUS: EVALUATION AND ACCEPTABILITY

ABSTRACT

Worktext plays a vital role in any classroom setting particularly in mathematics. Despite the development of the new technologies that allow high quality instructional materials, demand for textbooks or worktexts continues to grow. The era of modern technology makes students to be more inquisitive and the acquisition of new learning is high. With the implementation of the K to 12 curriculum, teachers are challenge to develop relevant and research – based instructional materials. At present, few instructional materials that could be utilized for senior high school students particularly in PreCalculus which is based on the learning competencies of the subject.

This study developed a worktext in PreCalculus based on the curriculum guide provided by the Department of Education. After which, the worktext was evaluated by the Calculus experts in selected State Universities in Region 8 and selected PreCalculus teachers in public schools in Northern Samar on the level of validity and acceptability. Results showed that the content validity of the worktext as assessed by the respondents based on aims, objectives, knowledge, contextualization, summing up, practice, reinforcement, and enrichment are very much valid. The level of acceptability of the worktext based on clarity, usefulness, language and style, illustration, presentation, suitability, adequacy, and timeliness are very highly acceptable. The t – test for independent samples was also utilized to determine the significant difference on the level of validity and acceptability of the worktext and results showed that both Calculus experts and PreCalculus teachers strongly agreed that the worktext is valid and highly acceptable. Revisions of the worktext were made based on the suggested comments of the respondents.

Keywords: development, validation, instructional materials, PreCalculus

I. INTRODUCTION

The use of worktext in teaching mathematics helps the learners develop self-contained and independent unit of instruction. In this sense, students can work at their own pace and time. On the other hand, the emphasis of instruction on the part of a teacher is to develop the necessary instructional materials to help the students develop their cognitive learning skills. As mentioned by Cruz (2014) the most prevalent factors that facilitate or heighten classroom interaction is the material availability and an adequacy of educational materials, which would be effective, suitable and adaptable to the nature or the kind of students the teacher handles without prejudice.

In learning specific skills or knowledge acquisition, teacher can help the students with individualized instruction through the use of a worktext. Worktext or modular

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learning is becoming popular because of the concrete application of principle of individual differences in which the students can proceed at a pace suited to their abilities. An educational authority stated that development of textbooks and other instructional materials is necessary in order to achieve the objectives of education. It is evident that instructional materials have been effective instruments for answering quality education (Naval et al., 2014).

Mathematics has been viewed to be a difficult subject for some. It is in this subject wherein majority of the students could hardly understand the basic concepts and real word problems which result to poor performance. The poor performance of students in mathematics has been observed by the researcher for several years now. In fact, the performance of the Grade 11 STEM strand in Pre-calculus, particularly in the University of Eastern Philippines during the two succeeding semesters, school year 2016 to 2017 and 2017 to 2018, the performances of these students were: 62.16% was below 85, and only 37.84% was above 85. This result is very low considering the fact that these students would take courses such as engineering, sciences or medical courses and mathematics after they have finished senior high school. Given these poor results, it is indeed imperative that something has to be done to solve this problem in mathematics.

The low performance of these students could be attributed to the lack of instructional resources in the classroom such as worktext. In relation to this, the study of Auditor (2014) on development and validation of a tenth grade physics module stated that the use of a worktext is effective in knowledge acquisition and is a useful tool for teaching and learning basic physics. Reyes and De Guia (2017) mentioned that many students who are using worktext or textbook feel secure and have a sense of progress in learning the lessons.

The lack of instructional materials in Pre-calculus such as worktext is one of the common problems to most Pre-calculus teachers because a majority of the Professors/Instructors in the University utilize only the teaching guide provided by the Department of Education (DepEd). The content of the teaching guide is limited, teachers resort to look for other reference books to cater the needs of the learners. A majority of the teachers utilize only the books with topics stated on the curriculum guide of the subject.

It is at this point that this study had been conceptualized to address the needs of the Pre-calculus teachers and the senior high school students as well. Hence, this study.

II. METHODOLOGY

This study was conducted in the different public schools in Northern Samar offering senior high school with STEM strand. These schools are Catarman National High School, Pambujan National High School, UEP Main, UEP Lao-ang and Catubig Campuses. These identified schools are the only public schools offering senior high school with this strand considering the fact that senior high school was just implemented last school year 2016 to 2017. These schools had been chosen due to its high regard of quality of education. The researcher identified eight (8) PreCalculus teachers and fourteen (14) Calculus experts as respondents of this study. The Calculus experts were

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from UEP main campus, NorthWest Samar State University and Samar State University.

The researcher utilized descriptive evaluative type of research. The study is descriptive in its sense for questions involving the assessment of the Pre-calculus teacher respondents and Calculus experts on the level of the content validity and acceptability of a worktext was also descriptive in nature.

The evaluative part in this study was to determine the validity of the worktext in terms of Aims, Knowledge, Contextualization, Summing Up, Practice, Reinforcement, and Enrichment and the acceptability level in terms of clarity, usefulness, language and style, illustrations, presentations, and suitability.

The research questionnaire of this study was patterned from Espinar (2014) which was composed of two parts. Part I composed the validity of the developed worktext in Pre-calculus in terms of aims, knowledge, contextualization, summing up, practice, reinforcement, and enrichment. Part II composed of the level of acceptability in terms of clarity, usefulness, language and style, illustration, presentation, suitability, adequacy, and timeliness on the level of acceptability.

Scoring and interpretation of the data that were taken from the respondents in part I and II were interpreted in terms of 5-point Likert Scale.

The level of validity of the developed worktext in terms of Aims, Knowledge, Contextualization, Summing Up, Practice, Reinforcement, and Enrichment was also interpreted on the basis of the following:

Rating		Mean Range	Verbal Interpretation
5	-	4.20 – 5.00	Very Much Valid
4	-	3.40 – 4.19	Much Valid
3	-	2.60 – 3.39	Valid
2	-	1.80 –2.59	Less Valid
1	-	1.00 – 1.79	Least Valid

To determine the level of acceptability of the worktext each statement was interpreted on the basis of the following:

Rating		Mean Range	Verbal Interpretation
5	-	4.20 – 5.00	Very Highly Acceptable
4	-	3.40 – 4.19	Highly Acceptable
3	-	2.60 – 3.39	Acceptable
2	-	1.80 – 2.59	Less Acceptable
1	-	1.00 – 1.79	Not Acceptable

To determine that there was a significant difference between the evaluation of the Pre-calculus teachers and the Calculus experts on the developed worktext in Pre-calculus, the t test for independent samples was used in this study.

III. RESULTS AND DISCUSSION

On Development of the Worktext

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The worktext was developed and utilized the curriculum guide provided by the Department of Education (DepEd) as basis for developing the worktext. The content of the curriculum guide consists of the topics Analytic Geometry, Series and Mathematical Induction and Trigonometry.

Specifically, Analytic Geometry consists of the topics conic sections such as circles, parabola, hyperbola, and ellipse and the systems of nonlinear equations. On the other hand, series and mathematical induction consist the topics on series, mathematical induction, and the binomial theorem. Topics on trigonometry include circular functions, trigonometric identities, inverse trigonometric functions, and the polar coordinates.

This study conforms to the idea of Bowman (2011) that instructional materials provide ideas and practices which frame classroom activity via text and diagrammatic representations and help teachers in achieving goals that they presumably could not accomplish on their own. The present study is in accordance to the idea of Fan (2013) that mathematics as an academic discipline requires textbooks that must provide solid foundation for the students to understand, apply, and study in their daily life, further learning in the workplace. In terms of content, the textbooks must correctly present mathematics knowledge, including mathematical concepts, facts, and methods, etc.

Evaluation of the Content Validity of the Developed Worktext

Table 1 presents the content validity of the worktext in terms of Aims, Knowledge, Contextualization, Summing Up, Practice, Reinforcement and Enrichment which were evaluated by the Calculus experts and Pre-calculus teachers has a grand mean of 4.45 and 4.40, respectively with an overall mean of 4.23, which means that the whole worktext is “very much valid”. This result shows that a majority of the respondents strongly agreed that the different parts of the worktext is useful, appropriate, and relevant to the different topics presented in the worktext. This further indicates that the evaluators strongly agreed that the worktext is appropriate and relevant to the teaching and learning process in Pre-calculus.

As far as the parts of the woktext are concerned, the Aims revealed the highest mean of 4.630, which is an indication of the strongest point of the worktext as confirmed by the study of Espinar (2014) and Villaflores (2013). The Summing Up and Reinforcement part of the worktext have the same mean of 4.480, respectively. As reflected in Table 2.8, these parts of the worktext are of second highest strongest point but as suggested by the majority of the respondents, there is still a need to add other key important points on the Summing Up part and an additional real life problem solving on the Reinforcement part to fully develop the mathematical knowledge and problem solving skills of the students.

On the other hand, the Contextualization and Practice exercises have a slight difference in terms of its mean with 4.369 and 4.368, respectively. This only indicates that majority of the respondents strongly agreed that these parts of the worktext are very much valid. However, as suggested by the majority of the respondents, there is still a need to augment these parts of the worktext such as additional real life problem solving and practice exercises.

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The weakest part of the worktext is the Enrichment activities with an average evaluation of 4.227. Although, it was rated as “very much valid”, a majority of the Pre-calculus teachers evaluated it as “much valid”, which means that this part of the worktext should be taken with consideration considering the fact that developing high level mathematical problem solving and thinking skills of each topic is at stake when dealing with teaching and learning process in Pre-calculus.

Research literature suggests that the quality of learning material is enhanced if the material is designed to take into account learners’ individual learning styles (Rogayan and Dollete, 2019).

Table 1. Evaluation on the Content Validity of the Developed Worktext

Parts of the Worktext	Section Mean		Average	Interpretation
	Calculus Experts	Pre-calculus Teachers		
Aims	4.53	4.73	4.630	Very Much Valid
Knowledge	4.39	4.43	4.412	Very Much Valid
Contextualization	4.37	4.36	4.369	Very Much Valid
Summing Up	4.52	4.44	4.480	Very Much Valid
Practice	4.47	4.26	4.368	Very Much Valid
Reinforcement	4.53	4.43	4.480	Very Much Valid
Enrichment	4.35	4.11	4.227	Very Much Valid
GRAND MEAN	**4.45**	**4.40**	**4.423**	**Very Much Valid**

Evaluation of the Level of Acceptability of the Developed Worktext

Table 2 shows the level of acceptability of the worktext in terms of clarity, usefulness, language, style and format, illustration, presentation, suitability, adequacy, and timeliness are evaluated by Calculus experts and Pre-calculus teachers. As shown in Table 3.9 the grand mean values are 4.37 and 4.40, respectively with an overall mean of 4.381. This means that majority of the respondents found the worktext very highly acceptable. These finding conforms to the study of Espinar (2014) on content validity and acceptability of a worktext in Basic Mathematics and Villaflores (2012) on validity and acceptability of a Text/Workbook in Forensic Chemistry which are both valid and acceptable as assessed by the respondents.

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Table 2. Evaluation on the Level of Acceptability of the Worktext

Level of Acceptability	Section Mean		Average	Interpretation
	Calculus Experts	Pre-calculus Teachers		
Clarity	4.39	4.51	4.448	Very Highly Acceptable
Usefulness	4.43	4.26	4.345	Very Highly Acceptable
Language, Style and Format	4.34	4.49	4.417	Very Highly Acceptable
Illustration	4.26	4.36	4.309	Very Highly Acceptable
Presentation	4.39	4.45	4.419	Very Highly Acceptable
Suitability	4.27	4.24	4.252	Very Highly Acceptable
Adequacy	4.35	4.29	4.318	Very Highly Acceptable
Timeliness	4.52	4.57	4.543	Very Highly Acceptable
GRAND MEAN	**4.37**	**4.40**	**4.381**	**Very Highly Acceptable**

Test of Difference

Table 3 presents the summary results of the difference between the evaluation of the Calculus experts and Pre-calculus teachers with respect to the content validity of the developed worktext in Pre-calculus. The mean of the Calculus experts was 4.38 while the mean of the Pre-calculus teachers was 4.01. The t – computed value of .2260 is less than t – tabular value of 2.086 with 20 degrees of freedom at 95% confidence interval, the null hypothesis that there is no significant difference between the two groups of evaluators is therefore accepted. It could further be inferred that both the Calculus experts and Pre-Calculus teachers strongly agreed that the worktext is very much valid and acceptable.

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Table 3. Summary Results on the Significant Difference between the Evaluation of Calculus Experts and Pre-Calculus Teachers on the Content Validity of the Worktext

Groups	Mean	N	Variance	Std.	df	t-stat	t-Critical	Inter-

				Error Mean			(2-tailed)	pretation
Calculus Experts	4.38	14	0.0610	.0660	20	.2260	2.086	**NOT SIGNIFICANT**
Pre-Calculus Teachers	4.01	8	1.1557	.3801				

Table 4 presents the summary results on the significant difference of the level of acceptability between the respondents. The mean of the Calculus experts is 4.291 while the mean of the Pre-calculus teachers was 4.019. The t – computed value of .4071 is less than t – tabular value of 2.086 with 20 degrees of freedom at 95% confidence interval, the null hypothesis that there is no significant difference between the two groups of evaluators is therefore accepted. It can be inferred that the two groups of evaluators have the same evaluation of the developed worktext in Pre-calculus. It can also be implied that the Calculus experts and Pre-calculus teachers find the developed worktext highly acceptable. Thus, findings on the test of difference conform to the idea of Bowman (2011) that instructional materials provide ideas and practices which frame classroom activity via text and diagrammatic representations and help teachers in achieving goals that they presumably could not accomplish on their own. Fan (2013) believed that mathematics as an academic discipline requires textbooks that must provide solid foundation for the students to understand, apply, and study in their daily life, further learning and learn in the workplace.

Table 4. Summary Results on the Significant Difference between the Evaluation of Calculus Experts and Pre-Calculus Teachers on the Level of Acceptability of the Worktext

Groups	Mean	N	Variance	Std. Error Mean	df	t-stat	t-Critical (2-tailed)	Inter-pretation
Calculus Experts	4.291	14	0.1262	.0949	20	.4071	2.086	**NOT SIGNIFICANT**
Pre-Calculus Teachers	4.019	8	1.2727	.3989				

IV. CONCLUSIONS

Based on the findings of this study, the following conclusions and implications were drawn.

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The content validity of the worktext in Pre-calculus in terms of Aims, Knowledge, Contextualization, Summing Up, Practice, Reinforcement, and Enrichment possesses validity. And the level of acceptability of the worktext in terms of clarity, usefulness, language, style and format, illustration, presentation, suitability, adequacy, and timeliness is highly acceptable.

The worktext Aims is valid and clearly stated, measurable, attainable, result oriented, time-bounded, and relevant to the topics covered in Pre-calculus.

The Knowledge part of the worktext possesses also validity. This concludes that the worktext gives insights and ideas of what the activity is all about, is geared towards the development of the desired skills, provides background of concepts and information about the topic, attracts student's attention, and arouses students' interest.

Similarly, the Contextualization part of the worktext has content validity. The activities of the worktext are relevant, interesting, and appropriate to the lessons presented and in consonance with the curriculum guide.

The Summing Up part of the worktext has also content validity. It gives a clear picture of the lesson, highlights the key points of the lesson, and relevant to the topic.

The Practice and Reinforcement part of the worktext possess content validity. This concludes that the exercises are relevant to the objectives, adequate and appropriate to develop the student's mathematical knowledge, skills and abilities.

On the other hand, the Enrichment section of the worktext has content validity also. This concludes that this part of the worktext stimulates students' higher order thinking skills, well- constructed, adapted to their level of comprehension, enhance mathematical understanding and facilitates developing high level mathematical problem solving and thinking skills.

The level of acceptability of the worktext in terms of clarity, usefulness, language, style and format, illustration, presentation, adequacy and timeliness is highly acceptable.

It further concludes that the worktext's language use is clear and easy to understand, and the information presented suit the students' level of comprehension. Furthermore, the worktext has learning contents that provide adequate information on the topic presented. The illustration presented arouses student's interest, making learning effective and enjoyable. It also provides concrete visual clues and is relevant to the topics presented.

This study further concludes that Calculus experts and Pre-calculus teachers had unanimously agreed as to the content validity and acceptability of the worktext in Pre-calculus.

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