

Development and Validation of A Work Text in Precalculus

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ABSTRACT

Work text 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 work texts 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 work text in PreCalculus based on the curriculum guide provided by the Department of Education. After which, the work text 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 work text 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 work text 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 work text and results showed that both Calculus experts and PreCalculus teachers strongly agreed that the work text is valid and highly acceptable. Revisions of the work text were made based on the suggested comments of the respondents.

Keywords

development, validation, instructional materials, PreCalculus

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Introduction

The use of work text 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 work text. Work text or modular 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 work text. 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 work text 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 work text or textbook feel secure and have a sense of progress in learning the lessons.

The lack of instructional materials in Pre-calculus such as work text 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.

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 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 work text was also descriptive in nature.

The evaluative part in this study was to determine the validity of the work text 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 work text 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 work text 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 work text 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 work text in Pre-calculus, the t test for independent samples was used in this study.

Results and Discussion

On Development of the Work text

Table 1 shows the procedure on how the work text was developed. It utilized the curriculum guide provided by the Department of Education (DepEd) as basis for developing the work text. 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.

Table 1. Procedure on the Development of a Work text in Pre-Calculus

Steps	Procedure in Developing the Work text
1	Analysis of the content of the work text.
2	The content of the work text was identified.
3	The curriculum guide provided by the Department of Education was utilized as basis for developing the work text in Pre-Calculus.
4	The content of the work text includes: a. Analytic Geometry a.1 Conic Sections a.2 General Second Degree Equations

	b. Series and Mathematical Induction b.1 Series, Sequences and Sigma Notation b.2 Mathematical Induction and the Binomial Theorem c. Trigonometry c.1 Angles in a Unit Circle c.2 Circular Functions c.3 Fundamental Trigonometric Identities c.4 Inverse Trigonometric Functions c.5 Polar Coordinates
5	The work text was validated.

Evaluation of the Content Validity of the Developed Work text

Table 2 presents the evaluation of the work text’s content validity in terms of its aims. Both calculus experts and Pre-calculus teachers evaluated the work text’s aims “very much valid” with evaluation means of 4.53 and 4.73, respectively and a section mean of 4.63. This further indicates that the respondents strongly agreed that the work texts’ aims are clearly stated, measurable, attainable, result oriented, time-bounded, and relevant to the topics covered in Pre-calculus. As shown in the table, Pre-calculus teachers have higher rating than the calculus experts. This means that teachers were more knowledgeable in terms of its scope and coverage of the subject. This result conforms to the idea of Stein (2017) that setting mathematical learning goals provides teachers with guidance on how to design and structure their lesson, making clear to students what they are to grasp and make use of from the lesson.

Table 2. Content Validity of the Work Text’s Aim as Evaluated by Calculus Experts and Pre-Calculus Teachers

Criteria	Mean		Average	Interpretation
	Calculus Experts	Pre-calculus Teachers		
1. Aims				
The aims of the work text are...				
1.1 relevant to the topics in Pre-calculus.	4.72	4.89	4.802	Very Much Valid
1.2 specific and clearly stated	4.51	4.90	4.702	Very Much Valid
1.3 measurable	4.50	4.73	4.613	Very Much Valid
1.4 attainable	4.50	4.66	4.577	Very Much Valid
1.5 result oriented	4.51	4.59	4.552	Very Much Valid
1.6 time bound	4.45	4.61	4.53	Very Much Valid
Section Mean	4.53	4.73	4.63	Very Much Valid

Presented in Table 3 is the evaluation of the work text’s content validity of the Knowledge part. Calculus experts and Pre-calculus teachers rated this section as “very much valid” with a mean of 4.39 and 4.43, respectively and a section mean of 4.41. This means that a majority of the respondents strongly agreed that the work text is very much valid in the knowlege section. The result also showed a slight difference of the respondents’ computed means. This further indicates that the Knowledge part of the work text

gives insight and ideas of what the activity is all about, are geared towards the development of the desired skills, provide background of concepts and information about the topic, attract student’s attention and arouse students’ interest. These finding is in accord to the idea of Ravitch (2006) that development of the instructional materials must be based on the interests, knowledge, understanding, abilities, needs and experiences of students.

Table 3. Content Validity of the Work Text’s Knowledge as Evaluated by Calculus Experts and Pre-calculus Teachers

Criteria	Mean		Average	Interpretation
	Calculus Experts	PreCalculus Teachers		
2. Knowledge				
The contents of the work text...				
2.1 give insights and ideas of what the activity is all about.	4.70	4.64	4.67	Very Much Valid
2.2 are geared towards the development of the desired skills.	4.50	4.57	4.54	Very Much Valid
2.3 provide background of concepts and information about the topic.	4.28	4.38	4.33	Very Much Valid
2.4 attract student’s attention.	4.24	4.29	4.27	Very Much Valid
2.5 arouse student’s interest.	4.23	4.29	4.26	Very Much Valid
Section Mean	4.39	4.43	4.41	Very Much Valid

Table 4 shows the work text’s content validity in terms of the Contextualization part. The respondents rated this part of the work text as

“very much valid” with a mean of 4.32 for Calculus experts while Pre-calculus teachers have 4.29 and the section mean is 4.369. This result

indicates that a majority of the respondents rated this section as very much valid. Espinar’s (2014) study on content validity and acceptability showed that the respondents agreed that the lesson

application is valid and acceptable, but they suggested that the work text must be interesting, relevant and sufficient enough to determine the mastery level of the students.

Table 4. Content Validity of the Work text’s Contextualization as Evaluated by Calculus Experts and Pre-calculus Teachers

Criteria	Mean		Average	Interpretation
	Calculus Experts	Pre-calculus Teachers		
3. Contextualization				
The contextualization of the work text..				
3.1 is in consonance with the curriculum guide.	4.58	4.62	4.602	Very Much Valid
3.2 is relevant to the learning competences	4.49	4.54	4.514	Very Much Valid
3.3 is properly sequenced	4.46	4.33	4.397	Very Much Valid
3.4 can be accomplished accurately to schedule	4.39	4.31	4.353	Very Much Valid
3.5 is interesting	4.29	4.25	4.27	Very Much Valid
3.6 is adequate to develop students mathematical knowledge	4.22	4.32	4.271	Very Much Valid
3.7 is appropriate to students abilities	4.31	4.28	4.292	Very Much Valid
3.8 is sufficient enough to determine the mastery level of students.	4.24	4.26	4.25	Very Much Valid
Section Mean	4.32	4.29	4.369	Very Much Valid

The content validity of a work text’s Summing Up was shown in Table 5. As shown in the table, a majority of the respondents rated this part of the work text as “very much valid” with a mean of 4.52 and 4.44, respectively and a section mean of 4.48. This indicates that the Summing Up section of the work text gives a clear picture of the lesson, highlights the key points of the lesson, and

relevant to the topic. These finding is in accord with the study of San Andres (2012) on construction and validation of instructional motivations in Physics where most of the evaluators strongly agreed the validity and acceptability of the workbook which stated that the summary of the lesson must reflect the clear picture of the lesson and highlights its key points.

Table 5. Content Validity of the Work text’s Summing Up as Evaluated by Calculus Experts and Pre-calculus Teachers

Criteria	Mean		Average	Interpretation
	Calculus Experts	Pre-calculus Teachers		
4. Summing Up				
The summary of the work text...				
4.1 gives a clear picture of the lesson	4.52	4.46	4.486	Very Much Valid
4.2 highlights the key points/important points of the lesson.	4.6	4.46	4.532	Very Much Valid
4.3 restate the main points of the topic.	4.45	4.38	4.418	Very Much Valid
4.4 relevant to the topic.	4.51	4.46	4.484	Very Much Valid
Section Mean	4.52	4.44	4.48	Very Much Valid

The content validity of the work text’s Practice exercises is shown in Table 6 with the mean values 4.47 and 4.29, respectively, and the section mean is 4.380. This means that the respondents rated this section as “very much valid”. This means that the work text practice exercises were relevant to the objectives, adequate and appropriate to develop student’s mathematical knowledge, skills and abilities. The results of this

study are congruent to the study of Rogayan and Dollette (2019) on development and validation of Physical Science workbook where a majority of the evaluators strongly agreed on the validity and acceptability of the work text which stated that it is not necessary to modify teaching styles, but there is a need to design activities to increase educational outcomes and student satisfaction.

Table 6. Content Validity of the Work text’s Practice as Evaluated by Calculus Experts and Pre-calculus Teachers

Criteria	Mean		Average	Interpretation
	Calculus Experts	Pre-calculus Teachers		
5. Practice				
The practice exercises are...				
5.1 relevant to the objectives.	4.62	4.41	4.515	Very Much Valid
5.2 adequate to develop student’s mathematical knowledge and skills.	4.43	4.29	4.360	Very Much Valid
5.3 appropriate to student’s abilities.	4.48	4.20	4.340	Very Much Valid
5.4 sufficient enough to determine mastery of the students.	4.35	4.15	4.250	Very Much Valid
Section Mean	4.47	4.29	4.380	Very Much Valid

In similar manner, the result of the content validity of the work text’s Reinforcement has a mean of 4.53 and 4.43 with a section mean of 4.48 as shown in Table 7. This section of the work text was rated by the majority of the respondents as “very much valid”. This indicates that the additional practice exercises are relevant, adequate, appropriate, and sufficient enough to determine the mastery of the students’

mathematical knowledge and skills. The study of Terano (2015) on development and acceptability of the simplified text in Differential Calculus where experts strongly agreed on the validity and acceptability of the work text and suggested that the assessment must be parallel to and able to measure the learner’s ability to perform what is described in the objectives.

Table 7. Content Validity of the Work text’s Reinforcement as Evaluated by Calculus Experts and Pre-calculus Teachers

Criteria	Mean		Average	Interpretation
	Calculus Experts	Pre-calculus Teachers		
6. Reinforcement				
The reinforcements of the work text are...				
6.1 relevant to the objectives.	4.64	4.59	4.616	Very Much Valid
6.2 adequate to develop student’s mathematical knowledge and skills.	4.53	4.45	4.492	Very Much Valid
6.3 appropriate to student’s abilities.	4.49	4.35	4.418	Very Much Valid
6.4 sufficient enough to determine mastery of the students.	4.46	4.33	4.393	Very Much Valid
Section Mean	4.53	4.43	4.48	Very Much Valid

Table 8 shows the work text’s Enrichment activities content validity. Results show that Calculus experts and Pre-calculus teachers has a mean of 4.35 and 4.11, respectively with a section mean of 4.227 and rated as “very much valid”. This indicates that this part of the work text

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.

Table 8. Content Validity of the Work text’s Enrichment as Evaluated by Calculus Experts and Pre-calculus Teachers

Criteria	Mean		Average	Interpretation
	Calculus Experts	Pre-calculus Teachers		
7. Enrichment				
The enrichment activities...				
7.1 are adapted to the students’ level of comprehension.	4.55	4.18	4.364	Very Much Valid
7.2 are challenging.	4.47	4.21	4.345	Very Much Valid
7.3 are well-constructed.	4.36	4.02	4.193	Much Valid
7.4 stimulate higher order thinking skills.	4.29	4.14	4.218	Very Much Valid
7.5 are adequate and enough to determine student’s mastery level.	4.2	3.98	4.09	Much Valid
7.6 measure what has been learned.	4.35	4.07	4.208	Very Much Valid
7.7 enhance mathematical understanding and skills	4.31	4.19	4.25	Very Much Valid
7.8 facilitate developing high level mathematical problem solving and thinking skills.	4.24	4.06	4.145	Much Valid
Section Mean	4.35	4.11	4.227	Very Much Valid

Evaluation of the Acceptability level of the Work text

Table 9 reveals the average evaluation of Calculus experts and Pre-calculus teachers on the work text’s level of acceptability in terms of clarity with a value of 4.39 and 4.51 and a section mean of 4.448 which is interpreted as “very much acceptable”. This indicates that a majority of the respondents strongly agreed that the work text is

very highly acceptable. This finding conforms to the study of Reyes (2015) which stated that IMs must be user friendly and that the organization of ideas and the clarity of the presentation of concepts are clear enough to facilitate the performance of the different tasks in the work text.

Table 9. Level of Acceptability of the Work text’s Clarity as Evaluated by Calculus Experts and Pre-calculus Teachers

Criteria	Mean		Average	Interpretation
	Calculus Experts	Pre-calculus Teachers		
1. Clarity				
The work texts’...				
1.1 information is clear and simple.	4.36	4.62	4.487	Very Highly Acceptable
1.2 language use is clear and easy to	4.39	4.62	4.508	Very Highly Acceptable

understand.				
1.3 concepts for each activity are arranged logically to ensure that there is no duplication of concepts.	4.33	4.45	4.392	Very Highly Acceptable
1.4 information suit the students level of comprehension	4.47	4.34	4.404	Very Highly Acceptable
Section Mean	4.39	4.51	4.448	Very Highly Acceptable

Results are shown in Table 10 on the level of acceptability of the work text in terms of usefulness whose average evaluation of the experts and teachers were 4.43 and 4.26, respectively with a section mean of 4.345. This indicates that the work text is very much

acceptable. The result also conforms to the idea of Ravitch (2006) that the development of the instructional materials must be based on the interests, knowledge, understanding, abilities, needs and experiences of students.

Table 10. Level of Acceptability of the Work text’s Usefulness as Evaluated by Calculus Experts and Pre-calculus Teachers

Criteria	Mean		Average	Interpretation
	Calculus Experts	Pre-calculus Teachers		
2. Usefulness				
The work text...				
2.1 prepares the students to think logically and critically.	4.4	4.34	4.371	Very Highly Acceptable
2.2 is simple and comprehensible.	4.63	4.45	4.540	Very Highly Acceptable
2.3 has contents that increase the student’s knowledge, understanding and proficient.	4.43	4.26	4.345	Very Highly Acceptable
2.4 provides opportunity for the development or enhancement of mathematical skills.	4.43	4.19	4.312	Very Highly Acceptable
2.5 has learning contents that provide adequate information on the topic presented.	4.47	4.26	4.368	Very Highly Acceptable
2.6 encourages the students to become actively involved in the learning activities.	4.34	4.18	4.257	Very Highly Acceptable
2.7 stimulates the learner’s analytical thinking skills.	4.42	4.21	4.317	Very Highly Acceptable
2.8 presents activities that seek to relate new concepts from previous learning.	4.34	4.16	4.249	Very Highly Acceptable
Section Mean	4.43	4.26	4.345	Very Highly Acceptable

Table 11 shows the average evaluation on the level of acceptability of the work text in terms of language, style and format whose values are 4.34 and 4.49 with a section mean of 4.417. This

means that the work texts’ language, style and format were very much acceptable. This further indicates that the work text warrants appropriate structure, style and format to the target level of the

students. This result conforms to the idea of Torrefranca (2017) in his study on development and validation of modules which stated that

language, style and format must be well-organized, clear, concise, motivating, and easy to understand.

Table 11. Level of Acceptability of the Work text’s Language, Style and Format as Evaluated by Calculus Experts and Pre-calculus Teachers

Criteria	Mean		Average	Interpretation
	Calculus Experts	Pre-calculus Teachers		
3. Language, style and format				
The language, style and format of the work text warrant...				
3.1 variation in positioning of response sections.	4.22	4.47	4.345	Very Highly Acceptable
3.2 proper spacing of items per page.	4.33	4.50	4.417	Very Highly Acceptable
3.3 use of optimum print size.	4.49	4.56	4.527	Very Highly Acceptable
3.4 appropriate use of illustrations	4.24	4.37	4.305	Very Highly Acceptable
3.5 the observation of correct grammar.	4.44	4.50	4.472	Very Highly Acceptable
3.6 clear and comprehensive language in terms of vocabulary.	4.37	4.54	4.455	Very Highly Acceptable
3.7 sufficient familiar vocabulary to ensure learning.	4.33	4.57	4.447	Very Highly Acceptable
3.8 appropriate structure, style and format to the target level.	4.31	4.42	4.368	Very Highly Acceptable
Section Mean	4.34	4.49	4.417	Very Highly Acceptable

As shown in Table 12 the level of acceptability of the work text in terms of illustration has an average evaluation of 4.26 and 4.36 with a section mean of 4.309. A majority of the respondents rated this section as very highly acceptable. This

means that the illustrations and figures of the work text are clear and simple, guide students to follow directions, and are relevant to the topics in Pre-calculus.

Table 12. Level of Acceptability of the Work text’s Illustration as Evaluated by Calculus Experts and Pre-calculus Teachers

Criteria	Mean		Average	Interpretation
	Calculus Experts	Pre-calculus Teachers		
4. Illustration				
The illustration of the work text used...				
4.1 is clear and simple	4.49	4.68	4.584	Very Highly Acceptable
4.2 arouses student’s interest, making learning effective and enjoyable.	4.11	4.27	4.192	Highly Acceptable
4.3 provides concrete visual clues.	4.14	4.15	4.147	Highly Acceptable
4.4 guides students to follow directions.	4.19	4.29	4.242	Very Highly Acceptable
4.5 is relevant to the topics.	4.35	4.40	4.379	Very Highly Acceptable
Section Mean	4.26	4.36	4.309	Very Highly Acceptable

Table 13 shows the average evaluation of the work text’s level of acceptability in terms of presentation as determined by the calculus experts and Pre-calculus teachers whose values are 4.39 and 4.45 with a section mean of 4.419, respectively. This means that the topics’ presentation were very highly acceptable as

evaluated by the majority of respondents. The findings conform to the study of Selga (2015) on instructional materials development which find the work text presentation as engaging, interesting, comprehensible, logical and indicate smooth flow of ideas. The material is highly valid and acceptable as assessed by expert evaluators.

Table 13. Level of Acceptability of the Work text’s Presentation as Evaluated by Calculus Experts and Pre-calculus Teachers

Criteria	Mean		Average	Interpretation
	Calculus Experts	Pre-calculus Teachers		
5. Presentation				
The presentation of the work text’s...				
5.1 topics is logical and orderly sequenced.	4.42	4.46	4.444	Very Highly Acceptable
5.2 directions is concise, readable and easy to follow.	4.42	4.46	4.440	Very Highly Acceptable
5.3 fits the sequence of the course.	4.32	4.42	4.372	Very Highly Acceptable
Section Mean	4.39	4.45	4.419	Very Highly Acceptable

Shown in Table 14 is the average evaluation of the Calculus experts and Pre-calculus teachers on the level of acceptability of the work text in terms of suitability whose values are 4.27 and 4.24 with a section mean of 4.252, respectively. This indicates that the developed work text is very highly acceptable. This further indicates that the work text’s activities take into consideration the varying attitudes and capabilities of the students and

activities are also suitable, relevant, interesting and self motivating to the Pre-calculus students. As mentioned by Rogayan and Dollente (2019), the developed workbook should provide more differentiated activities, provide immediate needs, and encourage creative and critical thinking among the students and the content knowledge is very important and must be related to student learning.

Table 14. Level of Acceptability of the Work text’s Suitability as Evaluated by Calculus Experts and Pre-calculus Teachers

Criteria	Mean		Average	Interpretation
	Calculus Experts	Pre-calculus Teachers		
6. Suitability				
The work text’s...				
6.1 activities take into consideration the varying attitudes and capabilities of the learner.	4.31	4.29	4.297	Very Highly Acceptable
6.2 activities are suitable to the subject matter.	4.29	4.38	4.334	Very Highly Acceptable
6.3 activities are relevant, interesting and self-motivating to the learner.	4.23	4.19	4.21	Very Highly Acceptable
6.4 enrichment activity used is adaptable to classes with large number of students.	4.23	4.1	4.168	Highly Acceptable
Section Mean	4.27	4.24	4.252	Very Highly Acceptable

The average evaluation of experts and teachers on the level of acceptability of the work text in terms of adequacy is shown in Table 15. Their values are 4.35 and 4.29, respectively with a section mean of 4.318. This means that the work text is

very highly acceptable. This further indicates that the work text covers all the topics in the curriculum guide, provides sufficient information and expected learning outcomes, and contains a variety of situation strategies.

Table 15. Level of Acceptability of the Work text’s Adequacy as Evaluated by Calculus Experts and Pre-calculus Teachers

Criteria	Mean		Average	Interpretation
	Calculus Experts	Pre-calculus Teachers		
7. Adequacy				
The work text...				
7.1 covers all topics in the curriculum guides	4.46	4.52	4.489	Very Highly Acceptable
7.2 provides sufficient information on each topic	4.36	4.35	4.352	Very Highly Acceptable
7.3 provides expected learning outcomes	4.33	4.27	4.299	Very Highly Acceptable
7.4 contains a variety of situation strategies	4.34	4.22	4.281	Very Highly Acceptable
7.5 defines important terms for reinforcement	4.28	4.29	4.288	Very Highly Acceptable
7.6 provides enough activities to increase students’ knowledge, skills and attitudes	4.41	4.21	4.309	Very Highly Acceptable
7.7 explains and applies concepts and principles	4.25	4.17	4.212	Very Highly Acceptable
Section Mean	4.35	4.29	4.318	Very Highly Acceptable

Table 16 shows the average evaluation of Calculus experts and Pre-calculus teachers on the level of acceptability of the work text in terms of timeliness. The mean values are 4.52 and 4.57 with a section mean of 4.543, respectively. This means that a majority of the respondents strongly agreed that the work text is very highly

acceptable. This further indicates that the validation and the use of work text are timely because the work text is one of the tools for quality learning and students need instructional materials where they could apply what had been discussed in the classroom.

Table 16. Level of Acceptability of the Work text’s Timeliness as Evaluated by Calculus Experts and Pre-calculus Teachers

Criteria	Mean		Average	Interpretation
	Calculus Experts	Pre-calculus Teachers		
8. Timeliness				
The validation and the use of work text are timely because				
8.1 it is one of the tools for quality learning	4.51	4.6	4.558	Very Highly Acceptable

8.2 teachers are encouraged to produce workbook/work text to make teaching-learning effective.	4.52	4.55	4.535	Very Highly Acceptable
8.3 students need instructional materials where they could apply what had been discussed in the classroom.	4.52	4.55	4.535	Very Highly Acceptable
Section Mean	4.52	4.57	4.543	Very Highly Acceptable

TEST OF DIFFERENCE

Table 17 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 work text 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 work text is very much valid and acceptable.

Table 17. Summary Results on the Significant Difference between the Evaluation of Calculus Experts and Pre-Calculus Teachers on the Content Validity of the Work text

Groups	Mean	N	Variance	Std. Error Mean	df	t-stat	t-Critical (2-tailed)	Inter-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 18 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 work text in Pre-calculus. It can also be implied that the Calculus experts and Pre-calculus teachers find

the developed work text highly acceptable. Thus, findings on the test of difference confirm 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 18. Summary Results on the Significant Difference between the Evaluation of Calculus Experts and Pre-Calculus Teachers on the Level of Acceptability of the Work text

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				

Comments and Suggestions of the Calculus Experts and Pre-calculus Teachers for the Revision of the Developed Work text

In the light of the content validity and level of acceptability of the developed work text in Pre-calculus, both the Calculus experts and Pre-calculus teachers evaluated the work text very much valid and very highly acceptable. However, there were still comments and suggestions from the respondents on the different parts of the work text. Comments and suggestions were solicited from the respondents through open ended questions in the evaluation questionnaire.

The Aims section of the work text had the least suggested comments among the other parts. It consisted only additional and rewording the aims and performance standard. There were only two (2) respondents who suggested this section.

In the Knowledge part of the work text, a majority of the respondents suggested to improve the figures and graphs, specifically on the colors and labels to arouse students' interests and understanding of the lesson. Other comments were additional sample problems that students could relate/appreciate to their line of interest in science, technology, engineering, and mathematics and other related comments for improvement of the work text.

In the Contextualization section of the work text, a majority of the respondents suggested to include more examples on real life problem solving so that students could relate/appreciate the lessons. Other comments and suggestions concerned on stating the mathematical concepts used to come up with the solution to the problem and to provide graph of the polar coordinates.

On the other hand, majority of the comments and suggested revisions in the Summing Up section were to have more concepts or points to remember. While on the Practice part of the work text, a majority of the respondents suggested to increase the number of items to meet the aims of each topic and providing space such as to include detachable worksheet.

A majority of the respondents also suggested to include additional word problem solving in the Reinforcement and Enrichment part of the work text.

Conclusions

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

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

The work text 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 work text possesses also validity. This concludes that the work text 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 work text has content validity. The activities of the work text are relevant, interesting, and appropriate to the lessons presented and in consonance with the curriculum guide.

The Summing Up part of the work text 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 work text 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 work text has content validity also. This concludes that this part of the work text 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 work text in terms of clarity, usefulness, language, style and format, illustration, presentation, adequacy and timeliness is highly acceptable.

It further concludes that the work text's language use is clear and easy to understand, and the information presented suit the students' level of comprehension. Furthermore, the work text 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 work text in Pre-calculus.

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