

Content Validity and Acceptability of a Developed Worktext in Basic Mathematics 2

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Abstract—Teaching tertiary mathematics entails the use of instructional materials which lead to independent learning. The study evaluated the content validity and level of acceptability of a developed worktext in Basic Mathematics 2. It also found the significant difference between the respondents' evaluation. Likewise, the study found the significant difference in the pretest and posttest performance between experimental and the control group and the difference between the posttest of the experimental and control groups. The study utilized the descriptive comparative method in determining the validity and acceptability of the developed worktext and the difference between the evaluation of experts/teachers and the student respondents. Quasi-experimental design was also used to find out if the worktext is effective in teaching the course employing t-test for correlated samples and t-test for independent samples. The result showed that the content validity and acceptability is very much valid and very much acceptable. The difference in the post-test between the experimental and the control groups was significant. It is concluded that the worktext is effective to be used in teaching the course.

Keywords— Basic Mathematics 2, Content validity, developed worktext, descriptive-comparative and quasi-experimental design

I. INTRODUCTION

Effective mathematics teaching requires understanding of what the students know and need to learn and inspiring and supporting them to learn it well. To be effective, teachers need to understand and be committed to their students as learners of mathematics and as human beings and be skillful in choosing and using a variety of pedagogical strategies and learning materials. 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 or would not accomplish of their own (Brown, 2009). Workbooks/Worktexts are often used in schools and favored because students can work directly in their books (Anderson, 2003).

However, the College of Education, UEP Main Campus mathematics teachers is experiencing difficulty in looking for some textbooks where all the lessons of the course Basic Mathematics 2 could be found. It is deemed important to have textbooks or other learning materials because this will by and large, improve the students' learning performance, which is noted to be below average as indicated in the general average of the COED freshman students of Basic Mathematics 2 of two

point fifteen (2.15) in S.Y. 2011-2012, two point two (2.2) in S.Y. 2012-2013, and two point eighteen (2.18) in S.Y. 2013-2014.

In addition, the large number of students with low grades in this subject and the complaint of mathematics teachers about the students' poor mathematical skills are some alarming proofs of the students' mathematical difficulty. One reason perceived by the researcher as well as by other mathematics teachers is the lack of textbooks suited to students' level. Gibbon (2004) stressed the need to developed self-instructional materials with the current shift toward individualized programs in all levels of instruction; it is an approach that provides opportunities to develop a coherent instructional program that tolerates and nurture widely divergent goals and accomplishments. The teachers must develop or prepare instructional materials suited to special groups of individuals in her class, whether the instruction is intended for a whole class, or a student. Smith (2007) says that teachers were encouraged by their immediate superiors to make use of instructional materials in teaching mathematics to make the subject better understood by the students. Furthermore, workbook/worktext provide practice materials and suggestions design to make what would otherwise be trial and error learning definite, fool proof, economical and interesting (Gates, 2005). Similarly, Gray(2007), concluded that the use of workbooks/worktexts is beneficial, resulting in not only higher scores on standardized but also in n increase power of self-direction, helps in retention, skill in fundamental processes, reasoning ability and solving problems.

Being in mind the total learning and development of students taking up Basic Mathematics 2 and knowing the fact that learning materials are important because they can significantly increase students' achievements, validating and identifying the level of acceptability of a developed worktext in this course is just fitting. This will allow the students to learn the materials in the easier way because the lessons are presented in the language suited to the students' level.

The main objective of the study was to validate and find out the level of acceptability of a developed worktext in Basic Mathematics 2. The study determined the significant difference between the evaluation of the teacher and student-respondents. It also determined the significant difference in the pretest performance between the experimental and the control group; find the difference between the pretest and posttest of the experimental group; find the difference in the posttest between the experimental and the control group. Likewise, this study also looked into which area of the worktext needs revision.

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II. METHODOLOGY

Based on the syllabus of the course Basic Mathematics 2, the worktext was developed. Various textbooks on Algebra, Statistics and Probability, some existing supplementary materials and internet sources were used in developing the worktext. The worktext was evaluated/validated by 30 professor/mathematics teachers in the University and in the Department of Education, Northern Samar and by 71 freshman students currently enrolled in the course Basic Mathematics 2 second semester of School Year 2014-2015.

The study utilized the descriptive-correlational method in determining the validity and acceptability of the developed worktext and the significant difference between the evaluation of experts/teachers and the student respondents. Quasi-experimental design was also used to find out if the worktext is effective in teaching the course employing t-test for correlated/uncorrelated samples and t-test for independent samples.

Thirty experts/mathematics teachers of the University and of the Department of Education, Division of Northern Samar and 71 freshman students currently enrolled in the course were asked to evaluate the worktext using a checklist in terms of its different parts. A checklist which was patterned from the study of Adora (2013) was used to evaluate the worktext in terms of its parts namely: Lesson Objectives, Lesson Inputs, Lesson Application, Lesson Enrichment and in terms of its clarity, usefulness, suitability, adequacy, timeliness, language, style, and format, illustrations, and its presentation.

To further test if the worktext is acceptable and effective, an experimental method was utilized between two intact classes of Basic Mathematics 2. Thirty six students from BeedHe served as the experimental group, the group who was exposed to the worktext. The other thirty five students belonging to BSHE served as the control group, the group who was subjected to traditional lecture instruction. Since the groups are intact, the students were not chosen randomly for each group. These two sections were chosen based on their Math 101 grades to ensure comparability of the groups. The grades in the pre-requisite subject of the two groups were compared using t-test for independent means. The difference was found to be non-significant at .05 level. Hence, the two groups were comparable. A pretest was conducted first between the two groups before they undergone through the experimentation process. The experimental group were exposed to the worktext and taught with the use of it for three chapters or 16 different lessons. While the control group, were taught without exposing from the worktext. After the 16 lessons, both groups took a posttest with the same test items.

To test the differences, t-test for correlated samples, t-test for uncorrelated samples, and t-test for independent sample were used.

III. RESULTS AND DISCUSSION

Evaluation on the Validity of the Developed Worktext

As far as the validity of the worktext is concerned, the teachers and students registered a grand mean evaluation of 4.62 and 4.64 with an overall grand mean of 4.64, which means

that the content validity as a whole is “very much valid”. This indicates that the respondents strongly agreed that its different parts as to the lesson objectives; lesson inputs, lesson application, and lesson enrichment are useful, appropriate and very much related to the different topics included in the course Basic Mathematics 2. This further indicates that the validity measures done by the evaluators determine the students’ knowledge, skills, and other attributes. This conforms to the findings of Gayagay’s (2014) study on validating a learning package for Grade seven Mathematics.

The lesson objectives section revealed the highest average of 4.72, which is an indicator that this is the strongest point among the four parts of the worktext. This is supported by the comments of the respondents to wit: objectives clearly coincides its respective lesson inputs; the objectives are stated following the SMART principle; reflects the application; authentic and suitable. In contrary, the lesson inputs section has the lowest mean of 4.51 among the different parts of the worktext, although this still falls on the “very much valid” category, there is a need to improve this part of the worktext.

TABLE 1: EVALUATION ON THE WORKTEXT’S VALIDITY

Part of the Worktext	Section Mean		Average Evaluation	Interpretation
	Teachers	Students		
Lesson Objectives	4.87	4.56	4.72	Very Much Valid
Lesson Inputs	4.39	4.63	4.51	Very Much Valid
Lesson Application	4.55	4.65	4.60	Very Much Valid
Lesson Enrichment	4.68	4.73	4.71	Very Much Valid
Grand Mean	4.62	4.64	4.64	Very Much Valid

Evaluation on the Level of Acceptability of the Developed Worktext

The worktexts’ level of acceptability was determined by the teacher and student respondents evaluating the different aspects as to clarity, usefulness, suitability, adequacy, timeliness, language, style, format, illustrations, and presentation. The result of evaluation is hereby presented. Table 2 shows the summary result of the worktext’s level of acceptability. The teachers and students rated this with grand means of 4.62 and 4.71, respectively and an overall grand mean of 4.67. This indicates that both groups of respondents strongly agreed that the worktext met the criteria set and therefore rated as “very much acceptable”. This study supports the study of Gayagay (2014) and Menor and Limjap(2011).

The table reflects that among the eight criteria, the “Language, style and format” got the lowest section mean of 4.56. This is supported by the respondents’ suggestions to provide exercises where varied situation strategies could be employed and to improve the worktext’s font size/style, and to check the spacing on some texts. As shown also in the table, the section “timeliness” got the highest section mean of 4.80. This indicates that the development of the worktext is timely and appropriate to be used in the course Basic Mathematics 2. As a

whole, it was shown that the worktext is ready to be used as evaluated by the respondents, though minor modifications were suggested to further improve the material.

TABLE 2: EVALUATION ON THE WORKTEXT'S LEVEL OF ACCEPTABILITY

Criteria	Mean		Average Evaluation	Interpretation
	Teachers	Students		
Clarity	4.74	4.62	4.68	Very Much Acceptable
Usefulness	4.61	4.69	4.65	Very Much Acceptable
Suitability	4.50	4.77	4.64	Very Much Acceptable
Adequacy	4.48	4.68	4.58	Very Much Acceptable
Timeliness	4.84	4.76	4.80	Very Much Acceptable
Language, Style, Format	4.45	4.67	4.56	Very Much Acceptable
Illustrations	4.50	4.72	4.61	Very Much Acceptable
Presentations	4.86	4.75	4.72	Very Much Acceptable
Grand Mean	4.62	4.71	4.67	Very Much Acceptable

TEST OF DIFFERENCE

Table 3.1 presents the difference between the evaluation of teachers and students on the content validity of the worktext. The mean of the teacher respondents was 4.6255 while the student respondents had a mean of 4.6425. It is indicated that the t-computed value of -0.1861 was less than the critical value of 2.7764. Hence, there is no significant difference between the evaluations of the two groups on the worktext's validity.

TABLE 3.1: MEAN DIFFERENCE ON THE WORKTEXT'S VALIDITY

	Mean	Variance	df	t-Stat	t-Critical Two Tail	I
Teachers	4.62	0.041	8	-0.186	2.776	NS
Students	4.64	0.0049				

Table 3.2 presents the difference between the evaluation of teachers and students on the worktext's level of acceptability. The mean of the teacher respondents was 4.6225 while the student respondents had a mean of 4.7075. It is indicated that the t-computed value of -1.3670 was less than the critical value of 2.3060. Hence, there is no significant difference between the evaluations of the two groups on the worktext's level of acceptability.

TABLE 3.2: MEAN DIFFERENCE ON THE WORKTEXT'S LEVEL OF ACCEPTABILITY

	Mean	Variance	df	t-Stat	T-Critical Two Tail	I
Teachers	4.62	0.041	8	-0.186	2.776	NS
Students	4.64	0.0049				

As shown in Table 3.3 the difference of the pretest performance of the experimental and control group was found to be insignificant at 0.05 level of significance, because the obtained t-computed value which was 1.649 was less than the critical value of 1.995. This means that the two groups of respondents were almost in the same level of abilities at the

start of the experimental. Hence, they showed comparable results of pretest.

TABLE 3.3: COMPARISON OF THE PRETEST PERFORMANCE OF EXPERIMENTAL AND CONTROL GROUP

	Mean	Variance	df	t-Stat	t-Critical Two Tail	I
Experimental_Pre	10.69	3.018	68	1.649	1.9954	NS
Control_Pre	10.06	2.2907				

It can be viewed from Table 3.4 that the performance of the experimental group has improved as evidence of their pretest and posttest mean scores of 10.69 to 37. Moreover, when the mean difference between their pretest and posttest mean scores was subjected to t-test, it was found out to be significant at 0.05 level, because the obtained t-computed value which was -44.916 is beyond the critical value of 2.03. Hence, the experimental group performed better in the posttest than in their pretest. Based on the results of the comparison of the pretest and posttest of the experimental group, it can be said that the worktext is valid instructional materials. This result supports the findings of Pedrera (2012), Belecina (1999), Reyes (1984), and Coz (2008).

TABLE 3.4: COMPARISON OF THE PRETEST AND POSTTEST PERFORMANCE OF EXPERIMENTAL GROUP

Experimental Group	Mean	Variance	df	t-Stat	t-Critical Two Tail	I
PreTest	10.69	3.018	35	-44.96	2.776	S
Posttest	37.58	9.45				

To determine the effectiveness of the instruction using worktext as compared to the usual lecture-discussion method of teaching Basic Mathematics 2, the posttest results of both groups were treated statistically using the t-test for uncorrelated means. Table 3.5 shows the difference of the posttest scores of the experimental and control group. It is evident from the table that the posttest mean scores in the experimental group are significantly higher than the posttest mean scores of the control group at 0.05 level of significance, the obtained t-computed value which was 24.474 was beyond the critical value of 1.994. This implies that the experimental group performed significantly better than the control group. This further implies that the worktext effectively taught the lessons of the subject better than the usual lecture instruction. The result of the study conforms to Pedrera's study (2012) and Ali's study (2005) which concluded that using modular method in teaching Elementary Algebra and Biology is more effective compared to traditional teaching method.

TABLE 3.5: POSTTEST PERFORMANCE OF EXPERIMENTAL AND CONTROL GROUP

	Mean	Variance	df	t-Stat	t-Critical Two Tail	I
Experimental_Post	37.58	9.45	69	24.47	1.99	S
Control_Post	20.37	8.12				

Comments /Suggestion for the Revision of the Worktext

While both content validity and acceptability were rated very high by both teachers and students, there were specific comments and suggestions on the different aspects of the worktext from the teacher and student respondents. Comments and suggestions on the revisions of the different parts were provided in the open-ended part of the evaluation questionnaire. For lesson objectives, suggestions for improvement focused on providing time allotment to every lesson. This is the only suggestion of the respondents in this area. The time allotment will be a guide on how long the students will work on a certain lesson.

As to the Lesson inputs, revisions are suggested on the provision of more illustrations to visualize mathematical concepts with the highest frequency; additional real life examples with the second highest frequency; a detailed explanation on the process be shown the third in rank; and more background information, adequate explanation of terms used, and improving the font size/style. These are the focus of the revisions under the lesson inputs.

For the lesson application, the provision of an achievement test/chapter test and improvement of spacing of items were the most suggested. Other suggestions were the improvement of directions or instructions and the provision of more exercises.

As to the lesson enrichment, revisions of the worktext include provisions of games, puzzle and mind bloggers and trivia. Online resources/mathematics websites were also suggested to provide additional resources to the worktext.

IV. CONCLUSION

Based on the result of this study, the two groups of respondents agreed that the developed worktext possesses content validity and it is in line with the course syllabus of Basic Mathematics 2; the lesson objectives is content valid and the objectives followed the principle of SMART and relevant to the course topics of Basic Mathematics 2; the lesson inputs section has content validity and the lessons presented clearly the key concepts and the background information needed to understand the lesson; similarly, the lesson application of the worktext possesses content validity. The activities and exercises in this section are relevant and in consonance with the course syllabus. All activities are adequate, sufficient and appropriate to its intended users. The lesson enrichment section also holds content validity. This part of the worktext is challenging and enhances the mathematical skills of the students.

The worktext is accepted by both the teachers and the students. This could be used as a tool in enhancing the teaching-learning processes in Basic Mathematics 2. The lessons, activities, exercises, and information presented are clear, simple and easy to understand. Likewise, the lessons in the worktext provide adequate information and stimulate the learners' analytical thinking skills. The activities are relevant, interesting, self-motivating, and are adaptable to classes with large number of students. It covers all topics in the course syllabus of Basic Mathematics 2 and presents adequate and sufficient activities and information. The development of

worktext was timely and both respondents were in favor of its development and validation. In general, it provides appropriate language, structure, style, and format and warrants clear and comprehensive language. The illustrations used are clear, simple, and relevant to the topic. It arouses the students' interest. The topics are logically and orderly sequenced according to the course.

The respondents are in agreement that the developed worktext meets the criteria in designing an instructional material. This could be used as a tool in enhancing teaching-learning process. The quasi-experimental procedure also showed that the use of worktext in teaching Basic Mathematics 2 enhances students' achievement. Comments for improvement on content validity focused on time allotment for lesson objectives; explanations, illustrations, and examples for lesson inputs; test and instructions for lesson application; trivia and online resources for lesson enrichment. Comments for the level of acceptability focused on clarity of instructions, spelling and definition of terms, additional illustrations, editing and detailed discussions. There were no comments for revisions on usefulness, suitability, and timeliness.

V. RECOMMENDATION

Based on the findings and conclusions of this study, the following are hereby recommended:

1. The worktext should be considered as an instructional material and be used in the teaching-learning process of the course.
2. The worktext may be tried out in other school to further improve its effectiveness and practicability.
3. Teachers/professors should be motivated to make their own worktext/module/instructional materials.
4. The school administration provides support in the production of this worktext and other instructional materials produced by teachers.

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