

# Development and Evaluation of a Self-Instructional Material on Selected Topics in Mathematics in the Modern World

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**Abstract:** The success of teaching and learning process can be attained by planning instructional materials. As mathematics teachers, effectiveness can be secured if the instructional materials are done by the teachers themselves. Hence, this study aimed to develop and evaluate self-instructional material on selected topics in Mathematics in the Modern World which focused on the first three chapters included in the course outline. Specifically, it dealt with the respondents' assessment on the quality elements of the self-instructional material; significant difference in the assessments of the two groups of respondents along the aforementioned elements; and the implication of the findings to mathematics instruction in the institution.

By employing the descriptive type of research and using questionnaire and the material, the researchers found that the respondents evaluated the self-instructional material as very good which means they are satisfied with the developed material. The results also showed that there is no significant difference in the rating on the quality elements of the self-instructional material as assessed by the two groups of respondents. With this, the researchers proposed the self-instructional material as a material fitted for the intended users.

**Keywords:** Development and evaluation, self-instructional material, mathematics in the modern world.

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## Introduction

Education is an integral part of human life because it is a life-long process. As it is normally understood, it is not only what is taught to the students in schools, colleges, and universities, nor a method of reading books and memorizing concepts. It is how people encompass all the learning experiences they may have during their lives. It is also a never ending development which can give them a new meaning and direction.

Education aims to provide learning and knowledge to enhance the skills and abilities of every student, to bring competence, and offer guidance with positive attitudes and values (Borsoto *et al.*, 2014). An educational institution has to deliver products and services necessary to achieve outcomes it intends to produce (Javier, 2014).

To support the quality assurance in Philippine education, the K-12 was implemented with the passage of the Enhanced Basic Education Act of 2013 (Republic Act 10533). It emphasizes that the K-12 reform is not only for Department of Education (DepEd), but also includes the entire Philippine education and labor. It has the end goal of creating a distinctive influence on each sector, while at the same time requiring all these organizations to work together to guarantee a smooth transition into the new system.

The Commission on Higher Education is mandated to affiliate with Department of Education and other institutions for teacher training and education which includes the attainment of quality standards of the curricula of teacher education institutions. This guarantees that the teachers of the next generation are ready to teach young Filipinos under the new educational system. As prime molders of young minds, their role in the development of the society's future are deemed important (Marasigan, 2019).

In consideration of the College Readiness Standards (CEB Resolution No. 298-2011), the Enhanced Basic Education curriculum through K-12 has integrated GE courses in the high school core courses of higher education programs which resulted to the revision of the current GE curriculum (CHED Memorandum No. 59 Series 1996). The new GE curriculum targets to expose undergraduate students to diverse domains of knowledge and ways of understanding social and natural realities understanding, development in the process, intellectual competencies and civic capacities.

Mathematics in the Modern World is one of the courses stated under the new curriculum. It contains the introduction to the nature of mathematics as an exploration of patterns and as an application of inductive and deductive reasoning. By studying these topics, students are encouraged to go beyond the typical interpretation of mathematics as simply a bunch of formulas, but as a source of aesthetics in patterns of nature, for instance, and a rich language itself governed by logic and reasoning.

The course then proceeds to survey ways in which mathematics provides a tool for understanding and dealing with various aspects of present day living, such as managing personal finances, making social choices, appreciating geometric designs, understanding codes used in data transmission and security, and diving limited resources fairly. These aspects will provide opportunities for doing mathematics in a broad range of exercises that bring out the various dimensions of mathematics as a way of knowing and test the students' understanding and capacity.

Prior to the entry of the first batch of Grade 12 students to college in AY 2018-2019, higher education institutions with higher education development assistance of CHED shall prepare the basic requirements in the implementation of the revised GE curriculum. One of these is to develop up to date and appropriate course syllabi, readings, materials and resources.

People in the educational institution recognize that instructional planning is essential to successful teaching and learning. Instructional planning is the process of determining what learning opportunities students in school will have by planning the content of instruction,

selecting teaching materials, designing the learning activities and grouping methods, and deciding on the pacing and allocation of instructional time. Indeed, the success of teaching and learning process can be attained by planning instructional materials. As mathematics teachers, effectiveness can be served if the instructional materials are done by the teachers themselves. It would also be better if these teachers would develop self-instructional materials that they will use in teaching their students for they will have the control over instruction and they can ensure that the learning objectives will be attained.

Faced with such a challenge, the researchers have a purpose of developing and evaluating self-instructional material that can benefit both the teacher and the students. The self-instructional material consists of series of exercises on selected topics in Mathematics in the Modern World. With this, the researchers hope that the developed self-instructional material can be used in teaching the concepts of Mathematics in the Modern World under the new curriculum. This can be useful to the first batch of students who will enter college in the academic year 2018-2019 knowing that instructional materials are necessary to reinforce the teaching strategies of the teacher.

### Objectives of the Study

The primary objective of the study is to develop and evaluate a self-instructional material on selected topics in Mathematics in the Modern World, that would serve as an additional resource material in teaching the course. The topics which were included are the first three chapters which focus on nature and the world.

Specifically, this study sought answers to the following questions; How do the two groups of respondents assess the quality elements of the self-instructional material in terms of objectives, content, design characteristics, suitability of approach and clarity?; Is there a significant difference in the assessments of the two groups of respondents along the aforementioned elements?; and lastly is, what is the implication of the findings of this study to mathematics instruction of the institution?

### Methodology

The purpose of the study is to develop and evaluate a self-instructional material on selected topics in Mathematics in the Modern World. The use of descriptive method was employed in conducting this study as the researchers' purpose is to describe result of the evaluated module which was developed by them. Information was obtained using the adopted questionnaires prepared by the Colombo Plan Staff for Technical Education with some modification to conform the needs of the investigation. The set of questionnaires was used for the evaluation of the material by mathematics instructors and students. To interpret their responses, mean was computed and the results were analyzed using the given scale, mean ranges and verbal interpretation.

### Results and Discussion

This chapter presents the data gathered together with their corresponding analysis and interpretation. The data were presented in tabular form which followed a sequential order and resembled the arrangement of the problems posed at the beginning of the study.

### Respondents' Rating on the Quality Elements of the Self-Instructional Material

In this portion, the rating on the quality elements of the self-instructional material as assessed by the two groups of respondents in terms of objectives, content, design characteristics, suitability of approach and clarity are presented. These are found on the succeeding tables.

**Table 1. Respondents’ Rating on the Quality Elements of the Self-Instructional Material in Terms of Objectives**

Item Statements	Faculty		V.I	Students		V.I
	Mean	S.D		Mean	S.D	
1. The self-instructional material meets evidently the defined needs.	3.88	0.34	Strongly Agree	3.94	0.25	Strongly Agree
2. The purpose of the self-instructional material has been made evident clear to all likely users.	3.75	0.45	Strongly Agree	3.81	0.40	Strongly Agree
3. The self-instructional material introduction provides a clear coverage of the scope.	3.69	0.48	Strongly Agree	3.75	0.45	Strongly Agree
4. The objective is evidently related to the purpose of the self-instructional material.	3.81	0.40	Strongly Agree	3.81	0.40	Strongly Agree
5. All the general objectives are associated to the purpose of self-instructional material.	3.56	0.73	Strongly Agree	3.81	0.40	Strongly Agree
6. The accomplishment of the general objectives is due to the clear set of specific objectives.	3.63	0.50	Strongly Agree	3.69	0.48	Strongly Agree
7. The self-instructional material is clearly aligned to the purpose of the suitability of objectives.	3.56	0.51	Strongly Agree	3.81	0.40	Strongly Agree
8. The objectives are attainable and measurable.	3.88	0.34	Strongly Agree	3.75	0.45	Strongly Agree
<b>Overall</b>	<b>3.72</b>	<b>0.47</b>	<b>Very Good</b>	<b>3.80</b>	<b>0.40</b>	<b>Very Good</b>

It can be gleaned from the table that the highest mean were 3.88 for the faculty-respondents and 3.94 for the student-respondents which states that the self-instructional material meets evidently the defined needs. On the other hand, the lowest mean acquired were 3.56 and 3.69, respectively, which focused on the general objectives when associated to the specific purpose of the self-instructional material and its accomplishment was due to the clear set of specific objectives. According to Cedefop (2017), the objectives or statements of what a learner is expected to know, be able to do and understand at the end of a learning sequence, play an increasingly important role in effort to improve the quality and relevance of education and training. Objective statements help to clarify programme and qualifications intentions and

make it easier for those involved—learners, parents, teachers or assessors – to work towards these expectations.

**Table 2. Respondents’ Rating on the Quality Elements of the Self-Instructional Material in Terms of Content**

Item Statements	Faculty		V.I	Students		V.I
	Mean	S.D		Mean	S.D	
1. All the contents are aligned to the objectives.	3.75	0.45	Strongly Agree	3.69	0.48	Strongly Agree
2. The content has been arranged in simple to complex sequence.	3.63	0.50	Strongly Agree	3.69	0.48	Strongly Agree
3. The material forms systematic procedures of steps.	3.69	0.48	Agree	3.81	0.40	Strongly Agree
4. The material provides pre-tests to measure prior knowledge/schema .	3.50	0.82	Strongly Agree	3.69	0.48	Strongly Agree
5. Appropriate self-check questions and answers are provided for formative assessment.	3.75	0.45	Strongly Agree	3.63	0.50	Strongly Agree
6. All self-check are directly relevant to the content of each selected topics.	3.88	0.34	Strongly Agree	3.75	0.45	Strongly Agree
7. All activities on selected topics are appropriate for their content and objectives.	3.50	0.52	Agree	3.63	0.50	Strongly Agree
8. The self-instructional material contains well-organized definition of terms.	3.81	0.40	Strongly Agree	3.75	0.45	Strongly Agree
<b>Overall</b>	<b>3.69</b>	<b>0.49</b>	<b>Very Good</b>	<b>3.70</b>	<b>0.47</b>	<b>Very Good</b>

As shown, it can be identified that the highest mean were 3.88 for the faculty-respondents and 3.81 for the student-respondents which state that the material forms a systematic procedure of steps.

It can be gleaned that the lowest mean acquired were 3.5 and 3.63. Though getting the lowest mean, the result is still positive. It focused on the activities on selected topics which are appropriate for the content and objectives.

The content and context of learning objectives for activities directly relate to the content and context of the module objectives and broader course objectives. The objectives should be aligned across activities, modules and the course overall, The Board of Regents of the University of Wisconsin System (2016).

**Table 3. Respondents' Rating on the Quality Elements of the Self-Instructional Material in Terms of Characteristics**

Item Statements	Faculty		V.I	Students		V.I
	Mean	S.D		Mean	S.D	
1. Layouts and overall design is appropriate.	3.75	0.45	Strongly Agree	4.00	0.00	Strongly Agree
2. Still pictures contribute to the understanding of the subject matter.	3.88	0.34	Strongly Agree	3.75	0.45	Strongly Agree
3. Visual presentations aid to understand easily the topic.	3.69	0.48	Strongly Agree	3.81	0.40	Strongly Agree
4. Reading while focusing attention in key points and concepts are well-highlighted.	3.69	0.48	Strongly Agree	3.56	0.51	Strongly Agree
5. Learning activities promote active participation and response.	3.50	0.52	Agree	3.75	0.45	Strongly Agree
6. Self-instructional material maps are creatively highlighted to help students understand better the subject matter.	3.44	0.81	Agree	3.56	0.51	Strongly Agree
7. Self-instructional material appears interesting to the learners.	3.63	0.50	Strongly Agree	3.88	0.34	Strongly Agree
8. Visual elements have been successfully integrated into the learning sequence.	3.25	0.77	Agree	3.94	0.25	Strongly Agree
<b>Overall</b>	<b>3.60</b>	<b>0.54</b>	<b>Very Good</b>	<b>3.78</b>	<b>0.36</b>	<b>Very Good</b>

Acquiring the highest mean of 3.88 for the faculty respondents and 4.00 for the student-respondents, it can be identified that the layout and overall design is appropriate and still pictures help the students to understand the subject matter. On the contrary, the lowest mean acquired by the respondents were 3.25 and 3.56. Though getting the lowest mean, the result is still positive. This implies that the visual elements have been integrated into the learning sequence and the key points and the self-instructional maps are well-highlighted for the understanding of the subject matter.

**Table 4. Respondents' Rating on the Quality Elements of the Self-Instructional Material in Terms of Suitability of Approach**

Item Statements	Faculty		V.I	Students		V.I
	Mean	S.D		Mean	S.D	
1. The varying abilities of the learners are in consideration with the module.	3.63	0.50	Strongly Agree	3.75	0.45	Strongly Agree
1. The activities fit the interest of the learners.	3.81	0.40	Strongly Agree	3.81	0.40	Strongly Agree
2. The activities provide the needs of the learners.	3.44	0.81	Agree	3.88	0.34	Strongly Agree
3. The vocabulary load is appropriate to the learning level of the intended users.	3.69	0.48	Strongly Agree	3.75	0.45	Strongly Agree
4. The language fragment used is suited to the prospective users.	3.88	0.34	Strongly Agree	3.69	0.48	Strongly Agree
5. The form and wording used are appropriate to level of needs and interests of the prospective users.	3.63	0.50	Strongly Agree	3.56	0.51	Strongly Agree
6. The level of knowledge is suitable to the target learners.	3.44	0.81	Agree	3.75	0.45	Strongly Agree
7. The activities are appropriate to the level of needed skills of the target learners.	3.63	0.50	Strongly Agree	3.75	0.45	Strongly Agree
<b>Overall</b>	<b>3.64</b>	<b>0.54</b>	<b>Very Good</b>	<b>3.74</b>	<b>0.44</b>	<b>Very Good</b>

As shown, the computed highest mean was 3.88 for faculty-respondents and student-respondents. This means that language fragment used is accurate to the intended users and activities have met the needs of the learners. On the other hand, the lowest mean acquired by the faculty-respondents were 3.44 and for the student-respondents were 3.56. Though getting the lowest mean, the result is still positive. It can be gleaned that the level of knowledge is suitable for learning targets and usage of form and word are accurate to level of needs and interests of the prospective users.

**Table 5. Respondents' Rating on the Quality Elements of the Self-Instructional Material in Terms of Clarity**

Item Statements	Faculty		V.I	Students		V.I
	Mean	S.D		Mean	S.D	
1. The instructions are clear and easy.	4.00	0.00	Strongly Agree	3.88	0.34	Strongly Agree
2. The pictures used in the self-instructional material are related to the scope of the lesson.	3.81	0.40	Strongly Agree	3.81	0.40	Strongly Agree
3. The layout of the pages fits to the level of the intended users.	3.75	0.45	Strongly Agree	3.63	0.50	Strongly Agree
4. The explanations in the self-instructional material are comprehensible to the users.	3.38	0.81	Agree	3.88	0.34	Strongly Agree
5. The examples presented in the module are organized and clear.	3.81	0.40	Strongly Agree	3.63	0.50	Strongly Agree
6. The sizes of the text are legible and clear to understand the concept or idea.	3.75	0.45	Agree	3.75	0.45	Strongly Agree
7. The exercises or self-assessment is in relation with the lesson in the self-instructional material.	3.69	0.48	Strongly Agree	3.81	0.40	Strongly Agree
8. The vocabulary used in the self-instructional material is easily understandable.	3.63	0.50	Strongly Agree	3.88	0.34	Strongly Agree
<b>Overall</b>	<b>3.73</b>	<b>0.44</b>	<b>Very Good</b>	<b>3.78</b>	<b>0.41</b>	<b>Very Good</b>



Acquiring the highest mean of 4.00 for the faculty-respondents and 3.88 for the student-respondents, this indicates that the provided instructions are clear and easy. On the other hand, the acquired lowest mean is 3.38 for the faculty-respondents and 3.63 for the student-respondents. Though getting the lowest mean, the result is still positive. This signifies that the explanations used in the self-instructional material are comprehensible to the users and the layout of the pages fit to the level of the intended users.

### Comparison in the Rating on the Quality Elements of the Self-instructional Material

The table presents the comparison of the respondents' rating on the quality elements of the self-instructional material. The significant difference of their ratings was tested using the t-test formula.

**Table 6. Comparison in the Rating on the Quality Elements of the Self-instructional Material**

Respondents	Mean	S.D	Computed t	P Value	Decision Ho	Interpretation
Mathematics Faculty	3.678	0.318	1.030	0.317	Fail to Reject	Not Significant
Students	3.765	0.122				

As shown, there is no sufficient evidence at the 0.05 level of significance to show that there is no significant difference in the rating on the quality elements of the self-instructional material as assessed by the two groups of respondents. This means that the assessments of the faculty experts and students are comparable. They are both satisfied in the self-instructional material. The result of the study reflects that the self-instructional material is fitted to use for the intended users. This also signifies that the self-instructional material is a possible teaching material for the course Mathematics in the Modern World.

### Implication to Mathematics Instruction in the Institution

The result of the study implies that the use of self-instructional materials in the teaching of Mathematics in the Modern World developed by the researchers may be considered as a great help to better understand and appreciate the significance of Mathematics in their daily lives. They learn easily and comprehend complex concepts while enjoying and doing the activities and games included in the materials. In problem solving, the instructor may incorporate trivia and recreational activities which are found in the self-instructional material.

The students, as the heart of teaching and learning, are the primary beneficiaries of the material. The instructor, to facilitate learning among students must have the knowledge, skills and enthusiasm to be effective and efficient in front of the students especially in teaching Mathematics in the Modern World because students oftentimes find difficulty in understanding Mathematics concepts. Before understanding higher levels of Mathematics, students should first appreciate the course by determining its importance in their daily lives. With all these, the researchers believe that learning Mathematics would be easier for the students if self-instructional materials are provided to them with the help and effort of their teachers for an improved mathematics instruction.

### Conclusion and Recommendation

The developed self-instructional material is rated very good by the two groups of respondents. There is no significant difference in the assessments of the two groups of respondents on the quality elements of the self-instructional material. The use of self-

instructional material in the teaching of Mathematics in the Modern World developed by the researchers may be considered for this may be a great help to better understand and appreciate the significance of Mathematics in their daily lives.

In the light of the findings and conclusions, the following recommendations are hereby given: The self-instructional material in Mathematics in the Modern World may be upgraded by considering the remaining chapters included in the course outline mandated by the Commission on Higher Education. The self-instructional material may be used by Mathematics instructors not only in the College of Teacher Education but in other Colleges as well. Similar studies may be conducted focusing on other disciplines.

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