



DEVELOPMENT AND EVALUATION OF LEARNING MODULES IN MATHEMATICS

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Abstract

This study correlated school development and evaluation of learning modules in mathematics. Specifically describing the extent of the school development and evaluation of learning modules in mathematics. Further, assessed the relationship and influence of the ratings of the evaluators in the developed learning module in Mathematics. This study used the descriptive-correlation design to analyze the gathered data through an adopted and validated survey questionnaire to 178 teachers and 21 school heads obtained through complete enumeration sampling technique. It utilized mean and weighted mean; Pearson Product Moment Correlation; and Multiple Linear Regression. The respondents strongly agreed that each lesson is accompanied by specific objectives, and that they performed very satisfactory in the preparation of modules. The ratings of the evaluators were found to have a high degree of relationship with the developed learning module in mathematics, meaning that all indicators are considered as best predictors. Further, evaluation was found to significantly influence objectives and assessments, and that all indicators are best good predictors of the study.

Keywords: evaluation, development, learning modules, descriptive-correlation, Philippines.

1. INTRODUCTION

Education is very important in everyone's life thus, learning Mathematics is very relevant in man's daily living. Some students have difficulties in learning Mathematics because of many reasons. In line with this, teachers who facilitate learning should prepare and apply different strategies and techniques in order to help students to understand the lessons especially in Mathematics. Developing a learning module is a great effort a teacher will do in supporting students' learning (Benitez, 2003).

Mathematics plays a vital role in all aspects of life, whether in everyday matters such as time tracking, driving, cooking, or jobs such as accounting, finance, banking, engineering, and software. These functions require a strong mathematical background, and scientific experiments by scientists need mathematical techniques. They are a language to describe scientists' work and achievements (Aquino, 2011).

Preparing learning materials is one of the responsibilities of a teacher so it should always be given focus. Students will understand a particular lesson individually or cooperatively by using a learning material. A learning material, especially a module should be planned and organized well by a teacher before distributing it to the students.

Sejpal (2013) mentioned that the module is a unit of work in course of instruction that is virtually self-contained and

a method of teaching that is based on the building up skills and knowledge in discrete units. Students will have their task to search ideas on their own in order to learn individually. This is very important for them to have a good study habit and self-discipline.

Teachers should provide many relevant exercises and activities in order for the students to successfully understand the lesson. They should also develop materials in facilitating learning. The study wanted to prove that the developed learning modules in Mathematics will be very helpful in the teaching learning process. Also, this will be an additional material to be used by the teachers for future learners (Lorbis, 2019). With the use of modules, teachers can make it as the motivation to focus the interest of the students to learn more. It will help the students to fully engage themselves to have their good performance.

Cruz (2002) pointed out that student's ability and competence is affected by the teachers' preparation and mastery of the subject matter. Teachers are the makers of instructional material so he/she must be properly prepared and master the subject matter. Developing a learning module is one of the greatest works that a teacher must do in order to help the performance of the students.

2. STATEMENT OF THE PROBLEM

The main purpose of the study was to evaluate the developed learning module in Mathematics. Specially, addressing the following questions:

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1. What is the level of the teacher evaluators' ratings for criteria for components of the learning module in terms of objectives, content, activities, and assessment?
2. What is the level of the expert evaluators' ratings for criteria for evaluation of the learning module in terms of relevance, appropriateness and usefulness?
3. Is there a significant relationship between the ratings of the evaluators in the developed learning module in Mathematics?
4. Is there a significant relationship influence of the ratings of the evaluators in the developed learning module in Mathematics?

3. THEORETICAL FRAMEWORK

Thorndike's (1898) Law of Effect is the concept that a gratifying aftereffect intensifies the activity that caused it. The outcome of modular education must be assessed to see whether it has a substantial impact on student performance, particularly in mathematics. A created and verified learning module in Algebra is the first step in improving students' learning.

Bruner (1966) introduced Discovery Learning as a technique of inquiry-based education; discovery learning thinks that it is better for learners to uncover truths and relationships on their own. Every learner, in their own unique way, may discover new concepts. A student who works hard and is motivated to complete the exercises in the module assigned to him might learn certain approaches for tackling issues in a specific subject. It will motivate him to excel in his academics, particularly in mathematics.

Deci and Ryan's (2000) Self-Determination Theory are an important theory of motivation that covers questions of extrinsic and intrinsic drive. People have basic psychological demands such as competence, relatedness, and autonomy. The hypothesis contends that if these demands are addressed, people will operate and grow optimally. Teachers must be dedicated and motivated in order to provide products that will benefit their pupils.

4. METHODS

Research Design

This study described the variables and the relationships that occur naturally between and among them, with focus on development and evaluation of learning modules in mathematics.

The descriptive method was used in describing the evaluation of the learning module in terms of objectives, content, activities, and assessment, evaluation of the learning module in terms of relevance, clarity, appropriateness, usefulness, organization, structural design, timeliness. Meanwhile, the correlation technique was used to explain the difference between the levels of evaluation of the learning module on criteria for evaluation of the learning module.

Data Gathering Methods

In the process of gathering data for the variables being included in this study for conduct, the researcher prepared a letter addressed to the Schools Division Supervisor (SDS) signifying the intent to conduct such study. Further, it will cover permission to gather data to the respective respondents stating therein the purpose of conducting the presented study. Upon approval, the researcher proceeds in transmitting the approved letter to the district supervisor and the school principals of the 21 public elementary schools in the Magpet East District, Municipality of Magpet.

Subsequently, the researchers determine the respondents, prepare the letter approved by the SDS and provide the questionnaire that was distributed to the respondents during the distribution of their modules. After administering the questionnaire to the respondents, the researchers retrieve it along with the submission of their modules. The data gathered was encoded, interpreted and analyzed.

Participants of the Study

The respondents in this study were 178 public elementary teachers on the Magpet East District in the Municipality of Magpet, Cotabato Division. Complete enumeration was used to identify the total number of respondents in this study.

Statistical Tools and Data Analysis

Frequency Counts and Weighted Mean. This was describing the level of the teacher evaluators' ratings for criteria for components of the learning module and level of the expert evaluators' ratings for criteria for evaluation of the learning module. Pearson Product Moment Correlation/ Pearson r . This was used to determine the significant relationship between the independent and dependent variables of the study. Multiple Regression Analysis was used to explain the significant influence of the level of development and evaluation of learning modules in mathematics and to test the hypothesis of the study.

5. RESULTS

Components of the Learning Module

Objectives. The respondents strongly agreed that each lesson was accompanied by specific objectives; and they agreed that the objectives were time-bounded, measurable, realistic, and attainable, respectively.

These results imply that the components on the learning module in mathematics clearly stated that each of the lessons is accompanied by the specific objectives in mathematics subject.

It conforms with the statements of the author that the teaching aim is not merely helping the students to attain the required knowledge in curriculum and they should be helped to be strong learners (Hopkins, 2008).

Language. The respondents strongly agreed that the words were correctly used. They also agreed that the vocabulary used is suitable to the comprehension level of students; instructions to students are clear and easy to follow; the lessons are presented in paragraphs/sentences that are grammatically correct; and the module is accompanied by

clear and specific directions for their use. These imply that on the level of the components on the learning module in Mathematics, the words are correctly used based on the lesson they imparted. Based on the statements of Yanzon (2016), the words used in the learning module must be correctly applied, accompanied by clear and specific directions for their use, the vocabulary used must be appropriate for the students' comprehension level, and the instructions to students must be clear and easy to follow.

Content. In terms of content, the respondents agreed that expected learning competencies were included; the lessons were presented at a pace that allows for reflection and review; there was adequate presentation/discussion of content; the ideas, concepts, and points presented are well-explained; and that those supplementary activities enhanced students' understanding of the content.

These results suggest that the components on the learning module, particularly on the content, were the expected learning competencies to be included, particularly in the mathematics subject.

In addition, the statements of Nepomuceno (2013) stressed that a module should be self-contained, self-pacing, short and well-defined, adequately motivating, properly sequenced, and providing opportunities for interaction with learners, clearly written with correct language, accurate, not in conflict with other subject matter and values, and utilizing every opportunity to achieve learning outcomes.

Assessment. The respondents all agreed that there were provisions for pretest, self-assessment, and posttest in each lesson; the tests/assessment activities were easy to score; the items in the assessment were congruent to the specific objectives; at least 20% of the test items measured higher-order thinking skills (HOTS); and the test items cover the important competencies to be developed.

These findings imply that the components of the learning module provisions for pretest, self-assessment, and posttest in each lesson, and the tests/assessment activities were easy to score. The results are concomitant to the statement of Chen & Hoshower (2003). This enables them to make decisions about teaching methods, content, assessments etc. in time for the next run of the module. It also provides data that can be more easily used for career advancement.

Criteria for the Evaluation of the Learning Module

Relevance. The respondents considered the following as very satisfactory: the preparation of modules was considered important for the learners and the teachers; the modules were suited to all levels of basic education; the use of modules allowed teachers to provide minimal assistance to their learners; through the modules, learners could easily understand patterns and logical reasoning; and the questions that integrate broader concepts enhance the knowledge of the learners. The results conform with the evaluation of the learning module that states on the relevance. The modules are considered important for the learners and the teachers for facilitating learning to our students. Relevant learning is interdisciplinary and contextual. It is created, for example, through authentic problems or tasks, simulations, service learning,

connecting concepts to current issues and teaching others, Daggett (2019), further articulate specific ways in which instructional materials and teacher instruction can be created and delivered to enhance students' self-esteem (Sumaryono & Ortiz, 2004).

Clarity. The evaluation of the learning module, in terms of clarity, was performed very satisfactorily. In particular, expected learning competencies were included; lessons were presented at a pace that allows for reflection and review; there was adequate presentation/discussion of content, ideas; concepts and points presented were well-explained; and supplementary activities enhanced students' understanding of the content. Results imply that the modules are clearly written.

Usefulness. The evaluation of the learning module, in terms of usefulness, is revealed. The respondents performed very satisfactorily in using module through words or language that could easily be understood by the learners; It allowed learners to do "self-study"; it consisted necessary parts to fully understand the lesson; it guided students to search relevant topics; and it helped students to apply their learning in real-life situations. The findings imply the modules useful as these are written in language that the students can easily understand.

Relationship of the Ratings of the Evaluators in the Developed Learning Module in Mathematics

Results indicate that the ratings of the evaluators are highly related to the developed learning module in Mathematics. The presented probability values which are less than the set 1% level of significance mean that the stated hypothesis is rejected.

The results, thus, imply that ratings of the evaluators are highly connected to the developed learning module in Mathematics. They should utilize modules considering important for the learners and the teachers. The questions that integrate broader concepts enhance the knowledge of the learners.

The ratings of the evaluators have a high degree of relationship with the mathematics module objectives. The results indicate that the ratings of the evaluators are highly related to the developed learning module in Mathematics. The presented probability values which are less than the set 1% level of significance mean that the stated hypothesis is rejected. These results imply that the ratings of the evaluators were highly correlated to the objectives of the developed learning module in Mathematics. It conforms to the statements of Song and Schwarz (2008) that in creating instructional materials, particularly a learning module, each aspect of it should has clarity, it should be clear to the users in order to successfully use it. Further, based on the statements of Lim (2016) the modular instruction in teaching Mathematics specifically word problem solving, is an effective teaching approach.

Influence of the Components of the Learning Module on the Criteria for Evaluation

In Table 1, the results present the combined effect of the components of the learning module on relevance (F-value = 28.438, probability = 0.000**). The stated hypothesis of the study is rejected because the probability value is

significantly lesser than 0.001% level of significance. In fact, 36.80% of the variation on relevance is due to the components of learning module to the criteria for evaluation, the remaining 63.20% was because of other factors not included in the study. Among the components of the learning module criteria, evaluation was found to be the significant predictor of the relevance.

It implies that the components of the learning module conform to the criteria for evaluation. The tests/assessment activities are easy to score, and the items in the assessment are congruent to the specific objectives. The results conform with the statements of Sumaryono and Ortiz (2004) who articulated specific ways in which instructional materials and teacher instruction can be created and delivered to enhance students' self-esteem. Culturally relevant instructional materials allow students to feel secure and self-confident in their academic capabilities.

Table 1 Influence of the components of the learning module to the criteria for evaluation in terms of Relevance

Components of Learning Module	Coef. β	Std. Error	t - value	Probability
(Constant)	1.423	0.273	5.205	0.000
Objectives	0.134	0.085	1.569	0.118ns
Language	0.164	0.100	1.635	0.104ns
Content	0.018	0.093	0.197	0.844ns
Assessment	0.325	0.079	4.098	0.000**

$R^2 = 0.368$; ** = highly significant; Probability = 0.000**; ns =not significant; F - Value = 28.438

Table 2 shows the combined effect of the components of the learning module on clarity (F-value = 66.741, probability = 0.000**). The stated hypothesis of the study is rejected because the probability value is significantly lesser than 0.001% level of significance. In fact, 57.80% of the variation in clarity was caused by the components of learning module, the remaining 42.20% was accounted to other variable not included in the context of the study. Among the components of the learning module, evaluation was found to be the significant predictor of clarity. It implies that the components of the learning module conform to the criteria for evaluation. The tests/assessment activities are easy to score, and the items in the assessment are congruent to the specific objectives.

Table 2 Influence of the components of the learning module to the criteria for evaluation in terms of Clarity

Components of Learning Module	Coef. β	Std. Error	t - value	Probability
(Constant)	0.301	0.247	1.219	0.224
Objectives	0.169	0.077	2.196	0.029*
Language	0.244	0.091	2.696	0.008**
Content	0.069	0.084	0.820	0.413ns
Assessment	0.406	0.072	5.656	0.000**

$R^2 = 0.578$; ** = highly significant; Probability = 0.000**; * = significant; F - Value = 66.741; ns =not significant

In Table 3, the results show that the combined effect of the components of the learning module on usefulness (F-value = 43.677, probability = 0.000). The stated hypothesis of the study is rejected because the probability value is significantly lesser than 0.001% level of significance. In fact, 47.30% of the variation on usefulness is due to

components of learning module, the remaining 52.70% attributed by other variables not included in the context of the study. Among the components of the learning module, evaluation was found to be the significant predictor of usefulness. It implies each lesson of the module is accompanied by specific objectives. The objectives are time bounded. The test items cover the important competencies to be developed. At least 20% of the test items measure higher-order thinking skills (HOTS).

Based on the statements of Kalantzis and Cope (2021) the Learning Modules allow teachers to make close links into curriculum frameworks and standards, literally with hyperlinks if these are online, or by citing the standards in the Knowledge Objectives area, it is also providing a Learning Outcomes space for continuous, formative and summative assessment of student learning.

Table 3 Influence of the components of the learning module to the criteria for evaluation in terms of Usefulness

Components of Learning Module	Coef. β	Std. Error	t - value	Probability
(Constant)	0.389	0.292	1.332	0.185
Objectives	0.182	0.091	1.998	0.047*
Language	0.095	0.107	0.885	0.377ns
Content	0.108	0.100	1.076	0.283ns
Assessment	0.452	0.085	5.334	0.000**

$R^2 = 0.473$; ** = highly significant; Probability = 0.000**; * = significant; F - Value = 43.677; ns =not significant

6. CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Based on the foregoing findings, the following conclusions were drawn:

School heads' practices of strategic address the dilemmas of the schools in the unprecedented time. School heads are very aware of their responsibilities in carrying out the school even in its most uncomfortable situation by investing in any strategies possible just to overcome the said dilemma.

Although school heads are hesitant and very apprehensive in dealing with school clientele, teachers and stakeholders yet there is a need to move and implement programs and projects in order to continue the delivery of education. Hence, school heads are positively learning from the experiences they have in the crisis.

Recommendations

Based from the conclusion of the study, the researcher recommends the following:

1. The components on the learning module in Mathematics such as objectives, language, content, and assessment should be revisited for innovation every year for updating the said documents for utilization of the learners.
2. The criteria for evaluation of the learning module (relevance, clarity, and usefulness) should be maintained in order to augment the needs of the learners for leveling up their knowledge and learning in mathematics subject.

3. Futures researchers are encouraged to conduct similar study in other divisions including other variables and indicators in order to validate the results of the present study.

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