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DEVELOPMENT AND EVALUATION OF SELF-LEARNING MODULE IN MATHEMATICS 10

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ABSTRACT

The entire world situations have abruptly change due to Corona Virus Disease (COVID-19) that affect everyone ways of living especially the education system in the country. The shift of learning from traditional face-to-face to alternative delivery mode of education and decongesting the learning competencies to focused exclusively on the Most Essential Learning Competencies (MELC). This descriptive research aimed to develop and evaluate self-Learning Module in Mathematics 10. The research respondents were 10 grade 10 Mathematics teachers and 10 Mathematics experts who were purposively selected. Based on the results, the two group of respondents fully agreed that the developed self-learning module in Mathematics 10 is highly acceptable in terms of content and pedagogy. The Self-Learning Module is useful instructional materials for teaching in distance learning modality – printed and digitized.

Keyword: self-learning module, distance learning, development and evaluation, mathematics module, instructional material

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INTRODUCTION

The entire world situations have abruptly changed due to Corona Virus Disease 2019 (COVID-19). The first case was recorded on Wuhan, China, that later spread to other countries including the Philippines. This Pandemic is having an effect not only on the world's health systems, but also in all aspects of life. All sectors worldwide, including education, have been devastated by the impacts of COVID-19 pandemic (Rotas & Cahapay, 2020).

The shift of learning from traditional face-to-face to alternative delivery mode of education has been an issue. These learning delivery modes must reach all learners regardless of their socio-economic status. It is also stipulated in Batas Pambansa Blg. 232, section 3, that "the State shall promote the right of every individual to relevant quality education, regardless of sex, age, creed socio- economic status, physical and mental conditions, racial or ethnic origin, political or other affiliation. The State shall therefore promote and maintain equality of access to education as well as the benefits of education by all its citizens".

Based on the BE-LCP in the Time of COVID-19, there are four delivery modes for education which are face-to-face, distance learning, blended learning, and homeschooling. Distance learning happens when students are away from the teachers and peers. This means that students learn remotely rather than in person with instructors or other students. In this current situation, distance learning was implemented with three types, Online Distance Learning, Modular Distance Learning, and TV-Radio Based Instruction. To assure that education of millions of Filipino students will not stop, Educators turned to online outlets to communicate; online platforms became a virtual classroom; parents were requested for home monitoring; and students were restricted physical contact with their peers.

In terms of the curriculum, learning competencies have been decongested to focus exclusively on the most essential learning competencies (MELC) that are related to the

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development of 21st century skills including critical thinking, collaboration, communication, and creativity (De Villa & Manalo, 2020).

On the Republic Act 10533 or the Enhance Basic Education of 2013, Sec. 5.e. the curriculum shall use pedagogical approaches that are constructivist, inquiry-based, reflective, collaborative, and integrative.

Also, the K to 12 Curriculum shall be learner-centered, and the production and development of locally created teaching materials shall be encouraged, as stated in various sections of this act, (Alcantara ,2015).

In constructivist, the teacher is the facilitator of learning. There are two views on constructivism theory, the individual based on Piaget's theory and the other one is the Vygotsky's theory on social constructivism. The individual constructivism is a student-centered that commonly uses discovery learning and indirect instruction. The indirect learning makes use of printed, non-printed materials and human resources. And one of the printed and non-printed materials are self-learning modules, wherein the students can read the contents and answer questions relative to the topics. It also applies the law of exercise by Lee Thorndike.

In Antipolo National High School (ANHS), the learning modalities offered are Online and Modular Distance Learning according to the gathered responses on a survey conducted before the school year 2020 – 2021 started. These choices were reflected based on what parents and students believed that they are safe and suitable for their needs and capabilities.

Teachers were highly aware of the presence and consequences caused by the COVID-19 pandemic (Lapada et al., 2020). The desire of catering to the needs of the 12,441 students of ANHS who enrolled this school year held to be one of the biggest considerations. There are 811 parents who preferred online distance learning for their children and 11,630 chose modular distance learning because of lack of gadgets. It also put to test the roles of the parents as the first teachers of their children as More Knowledgeable Others (MKO). The results of the study of Garcia, Caldito, & Siena (2020) about the struggles of parents in online and modular distance

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learning states that it is difficult for parents to help their children in their studies specially in Mathematics and Science because of the medium of instruction which is English and some text in the Module were in small font sizes. Lastly, according to them, it was not taught when they were still attending school and they also having a hard time learning the lessons for the subjects.

Similarly, in the study of Dangle & Sumaoang, (2020), all the lessons or activities of self-learning modules must be appropriate to the learners' needs. Both parents and students' feedback pinpoint to exercises' instructions that must be clear enough for the students to understand. Topics could have been simplified and should have provided more examples that are relevant to the topics. Furthermore, all printed images in the modules should be legible.

Module motivates and allows learners to enjoy answering it is likely to have a significant impact on the learners' performance as stated by Javier (2021). The importance of content, format, accuracy, presentation, and organization in module design cannot be overstated (Madrazo & Dio, 2020).

Dewey, as cited in Nardo (2017), the development of self-learning modules and other resources for modular instruction tends to address the desire for educational opportunity for students from all walks of life, regardless of aptitude, IQ, or past achievement, as well as moral, emotional, or personality attributes. Individualized instruction aims to provide the best possible learning environment for each student and situation.

Learning module is an instructional material used to facilitate, encourage, improve, and promote teaching and learning activities to improve and enhance effective instructional processes (Matarazzo, Durik, & Delaney, 2010; Fradd, Lee, Sutman, & Saxton, 2001). It also provides new approaches and educational opportunities that improve the knowledge of the students and assist them in achieving the learning competencies (Gordon & Nicholas, 2013). Furthermore, it is user-friendly where students engage in an independent learning. Self-learning modules improve students' abilities and affect their learning motivation (Saifiyah, Ferdianto, & Setiyani, 2017) and develop mathematical skills (Setyani, Putri, Ferdianto, & Fauji, 2020).

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Mathematics is a language which requires scientific disciplines to convey series of meaningful statements. A mathematics module must be developed based on metacognitive strategy improved problem-solving skills of a student. There were indicators to determine the effectiveness namely: students' learning mastery; students' activity achieved an ideal percentage of time to accomplished; good teachers' management of learning; and 85% positive response on the activities and learning components. (Telaumbanua, Sinaga, Mukhtar, & Surya , 2017).

In addition, according to Rochsun & Agustin (2020) that in this time of pandemic, a contextualized mathematics learning module helps students to connect and construct abstract concepts to the experiences before, during, or after learning.

Mathematics, as the queen of all sciences, requires precision, accuracy, and correctness in deriving solutions to every mathematical problem. It is a subject that encompasses life at any age and in any place, according to the May 2018 K to 12 Mathematics Curriculum Guide.

On the study of Reyes, Pagalunan, Matos, & Tabuena (2020) cited McMaster (2006), that in every instructional strategy, it's important to keep track of students' progress and see whether they're making any significant development. In teaching Mathematics, the results of progress assessment that show a student is not progressing, the instructor should modify the activities or try alternative differentiated instructions that meet the student's unique needs. Given the recent situation, Math teachers must take an extra mile of effort to help their students in attaining the competencies.

The importance of Mathematics extends beyond the classroom and university, where in as a student, subject must be studied thoroughly and in detail in any modes of distance learning they choose (Reyes et al., 2020). Teaching Mathematics in a New Normal way has been a challenge. Many educators have viewed the process of teaching and studying mathematics as one of the most challenging they have faced throughout the years by Saritas & Akdemir as cited by Abirin & Obra (2019).

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In the study of Cutamora (2020) that cited Cabahug (2013), Mathematics is thought to be the subject with the highest number of failures at the University of the Philippines. Almost one for every three students had to repeat math course. As per their findings, the faculty of the University of the Philippines Cebu Natural Sciences and to their research, Mathematics Division observed a decline in students' basic mathematics proficiency.

As quarterly assessment is no longer to be part of the grading system in the New Normal setup of education in school year 2020-2021 according to the DepEd order No. 31, s. 2020. Summative assessments in form of written works are the ones to be used to evaluate students' learning in every quarter.

The results of the summative tests every quarter, with the following Means Percentage Scores (MPS) 53.07, 48.78, 47.28, and 57.38 from first to fourth quarter respectively, appeared that Third quarter garnered the lowest MPS in SY 2020-2021.

In the first quarter and second quarter of the school year in Region IV-A CALABARZON, PIVOT 4A Module, a contextualized self-learning module, were given and used by the students, while in the third quarter and fourth quarter, only Learner's Packet (LeaP) from the regional office were given as the learning materials.

The skills for Mathematics 10 are incorporated in the PIVOT 4A Module and Learner's Packet that are aligned to the sequence of learning in the Most Essential Learning Competencies (MELC). Hence, there are the needs to develop another instructional material in the form of a self-learning module for the third and fourth quarter in grade 10 mathematics. The researcher opts to develop a module for the third quarter, as it is having a lower MPS between the quarters without self-learning module for the New Normal in Mathematics 10.

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Statement of the Problems

The study aimed to develop and evaluate self-learning module in Mathematics for the grade 10 students of Antipolo National High School, District I of the City Schools Division Office of Antipolo for the third quarter of the school year 2021 – 2022.

Specifically, it sought answers to the following questions:

1. What were the five least mastered skills based on the third quarter summative test?

2. What was the evaluation of the mathematics experts and grade 10 Mathematics teacher-respondents on the developed Self-Learning Module in terms of the following criteria:

a. Content

1) Format;
2) Objectives and Content;
3) Example, and
4) Self-Assessment?

b. Pedagogy

1) Clarity;
2) Technical Quality;
3) Appropriateness; and
4) Usefulness?

3. Was there a significant difference between the evaluation of the mathematics experts and grade 10 Mathematics teacher-respondents on the developed self-learning module?

4. What were the comments and suggestions of the two groups of respondents on the developed self-learning module?

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Conceptual Model of the Study

The conceptual models which guided the researcher in conducting this study are shown in Figures 1 and 2. There are three (3) frames for each figure, namely: the input, the process and the output.

Figure 1 illustrates the conceptual model in identifying the of topics in Combinatorics and Probability included in developing the self-learning module.

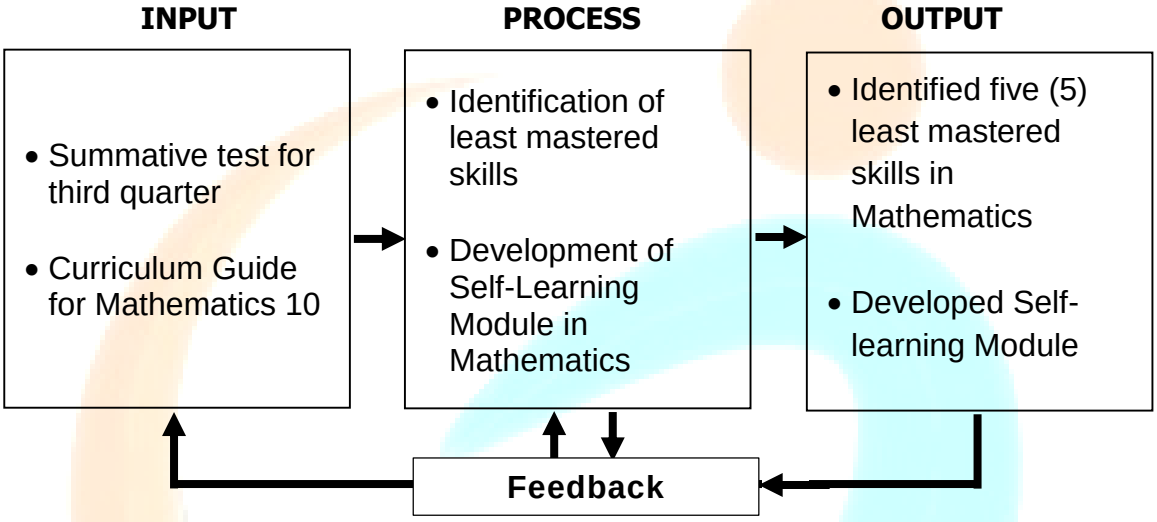

Figure 1. Conceptual Model for Development ¬f Self-Learning Module

The first frame is the input which includes the summative test for the third quarter and the curriculum guide for Mathematics 10. The second frame is the process which includes the identification of the least mastered skills and the development of the Self-learning Module in Mathematics 10. The last frame is output which includes the identified five (5) least mastered skills in Mathematics and the developed Self-learning Module in Mathematics 10.

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Figure 2 shows the conceptual model for evaluation of the developed Self-Learning Module in Combinatorics and Probability.

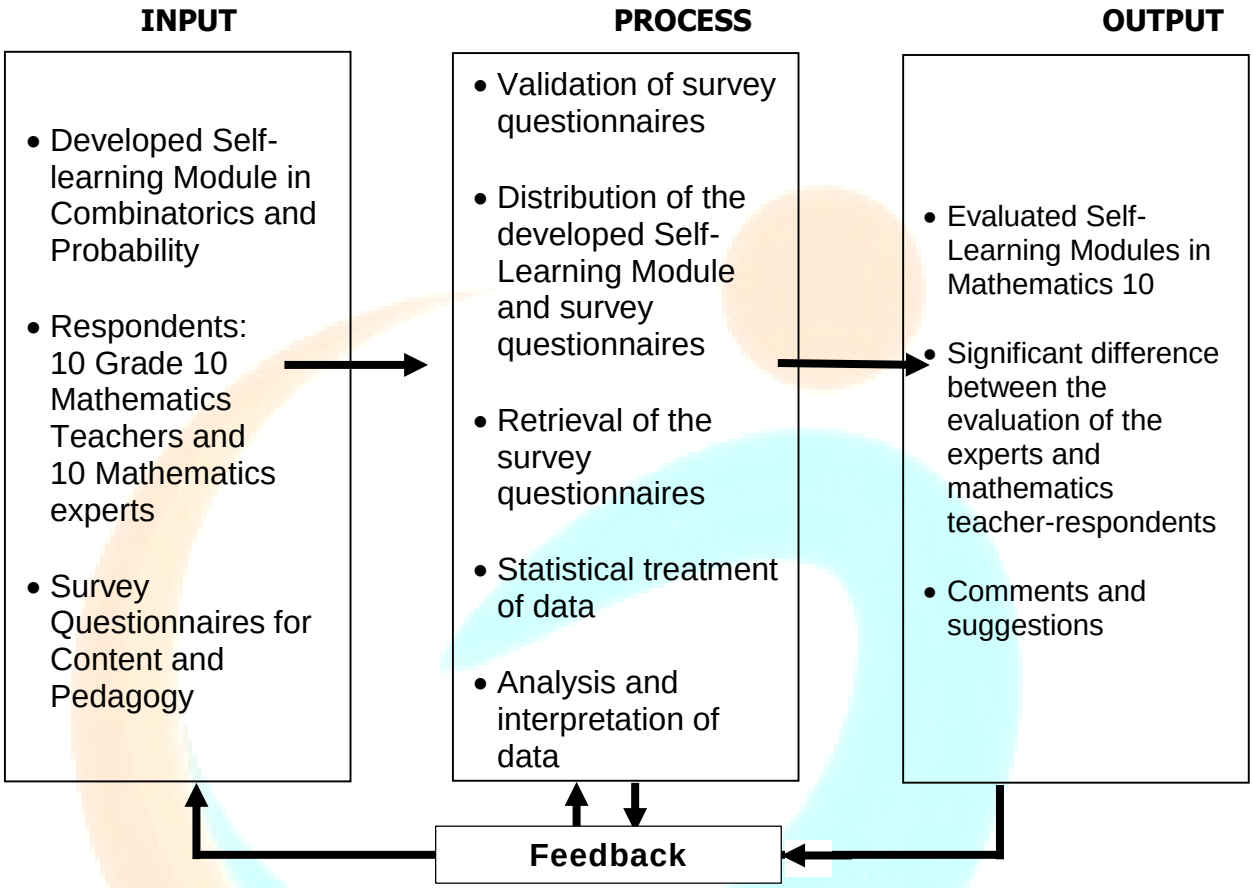

Figure 2. Conceptual Model for the Evaluation of Self-learning Module

The first frame is the input which consists of the developed Self-learning Module in Combinatorics and Probability; respondents consisting of the ten (10) Mathematics Grade 10 teachers and ten (10) Mathematics experts; and survey questionnaires for content and pedagogy.

The second frame is the process which consists of validation of survey questionnaires; distribution of the developed Self-Learning Module and survey questionnaires; retrieval of the survey questionnaires; statistical treatment of data; and analysis and interpretation of data.

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The last frame is the output which consists of evaluated Self-Learning Module in Mathematics 10; significant difference between the evaluation of the experts and mathematics teacher-respondents; and comments and suggestions on the developed Self-Learning Module.

MATERIALS AND METHODS

This study used the descriptive research design. This is used because the main concern of the research is to describe and evaluate the developed Self-Learning Module in Mathematics 10.

Descriptive research is a purposive process of gathering, analyzing, classifying, and tabulating data about prevailing conditions, practices, beliefs, processes, trends, and cause-effect relationships and then making adequate and accurate interpretation about such data with or without the aid of statistical methods. (Calderon & Gonzales, 2012). It describes what already exists and may be able to assist in the development of newer facts and meanings. As de Belen (2015) states "Descriptive Method research seeks to determine the present condition of a phenomenon or events". It aims to describe the current state of a variable, offer systematic information about the topic, and observe subjects without interfering.

This study conducted a survey on the evaluation of the self-learning Module. The survey questionnaire was used to determine the evaluations of the two groups of respondents, Mathematics teachers and experts on the developed modules for Grade 10 students based on the Most Essential Learning Competencies (MELC).

The respondents were chosen based on purposive sampling. Purposive sampling involves respondents that were selected as they have particular characteristics needed by the researcher (Cohen, Manion, & Morrison, 2011). There are 12 Grade 10 Mathematics teachers including the researcher and one Master Teachers in Antipolo National High School.

The respondents of the study were ten (10) Grade 10 Mathematics teachers of Antipolo National high School and ten (10) Mathematics experts from District I of City Schools Division

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Office of Antipolo with master's degree and Department Head/Chairman who have been in the service. They were the ones who were given the questionnaire survey to carefully review and evaluate the developed module in order to produce more comprehensive quality instructional learning materials.

The main data gathering instrument use in this study was survey questionnaire as were needed to answer the specific research questions. The purpose of the questionnaire was to elicit information about the developed Self-Learning Module. The survey questionnaire was distributed to the intended respondent through the use of Google Forms for health and safety of the respondents and researcher.

The development and evaluation of Self-Leaning Module in Mathematics 10 for the third quarter covering the topics for Combinatorics and Probability were based on the results of the summative test that contained the Most Essentials Learning Competencies (MELC) for Grade 10 Mathematics.

The survey questionnaire used was adapted from Cutamora (2020). The content and pedagogy evaluation of the teachers and expert respondents on Self-Learning Module in Mathematics 10 based on the criteria, namely: format, objectives and content, examples, and self-assessment; and clarity, technical quality, appropriateness, and usefulness. Each statement in the criteria was rated using 1 to 5 rating scales with the corresponding descriptions: (5 = Fully Agree), (4 = Strongly Agree), (3 = Moderately Agree), (2 = Strongly Disagree) and (1 = Fully Disagree).

The initial phase of the research involved determining least mastered skills based on the third quarter summative test for Grade 10 Mathematics based on the Most Essential Learning Competencies as the basis for development of Self-learning Module.

The developed Self-Learning Module was submitted to the adviser for comments and suggestions to improve the learning materials. Learning competencies, content, examples, and activities were included in the SLM. The competencies were aligned to the MELC of Grade 10

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Mathematics. The content was leading in the achievement of the learning objectives. The topics on Combinatorics and Probability were presented in the content as Firm Up activities where definitions and formulas were introduced. Examples and problems were based on the learners' daily experiences in the locality. Problems were shown on the checkpoint and enrichment activities as the self-assessment part of the developed learning materials.

The researcher sought permission through a formal letter to Schools Division Superintendent thru the research unit of the City Schools Division Office of Antipolo to conduct a research study in Antipolo National High District I-A. Also, a letter of same content was sent to the principal of the school where survey questionnaires were administered that are intended for the respondents of the study. Before the study began, R.A.10173 – Data Privacy Act of 2012 imposed various criteria in the letter's content to avoid future difficulties and to preserve human privacy.

The permit to conduct research was given, respondents were chosen. The researcher distributed the developed Self-learning Module and the survey questionnaires to the teacher respondents thru Google Forms. The form includes the data privacy consent, the Self-Learning Module, and survey questionnaires. The link of the Google Forms was personally sent by the researcher to the respondents. Likewise, the researcher monitored the responses on the Google Forms to ensure a 100% of the instrument result.

The data of the two groups of respondents were tallied and tabulated to undergo statistical treatment. The data were examined, orderly presented, compared, analyzed, and interpreted if there is a significant difference in the evaluation of the two groups of respondents.

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Statistical Treatment of Data

The data gathered was treated using the following statistical measures:

Percentage. This was used to find out the level of performance of the students in the third quarter summative tests.

Rank. This was utilized to determine the least mastered skills/ competencies in Mathematics.

Weighted Mean. This was applied to verify the respondents' evaluation of the developed third quarter SLM for grade 10 Mathematics as regards content and pedagogy. To interpret the evaluations of the respondents, the following scale values were used:

Table 1
Range, Scale and Verbal Interpretation of the Content and Pedagogy Evaluation

Range	Scale	Verbal Interpretations
4.50 – 5.00	5	Fully Agree (FA) – Very Highly Acceptable
3.50 – 4.49	4	Strongly Agree (SA) – Highly Acceptable
2.50 – 3.49	3	Moderately Agree (MA) – Moderately Acceptable
1.50 – 2.49	2	Strongly Disagree (SD) – Less Unacceptable
1.00 – 1.49	1	Fully Disagree (FD) – Least Unacceptable

***t* Test for Two Independent-Samples.** It was used to find out if there is a significant difference between the evaluations of the two groups of respondents on the content and pedagogy of the developed SLM. The computed t value was explained at 0.05 level of significance.

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RESULTS AND DISCUSSION

Least Mastered Competencies of the Third Quarter Summative Test in Mathematics 10 of School Year 2020 – 2021

Table 2 shows the top ten (10) least mastered skills/ competencies that can be developed in Combinatorics and Probability Self-learning Module for Mathematics 10 as the result of the Third quarter Summative Test of school year 2020 – 2021.

Based on Table 2, the competency on 'solves problems involving probability' got the lowest percentage with only 43.29% of the students to have mastered the skill. Second in rank was on 'illustrates probability of a union of two events' with 46.34%. The competency on 'solves problems involving permutations and combinations' ranked third with 47.48%. The fourth in rank was on 'finds the probability of (A U B)' with 48.34% and the fifth to the lowest in rank was on 'solves problems involving permutations', while placing the sixth, seventh, eight, nineth, and tenth are the following topics respectively: illustrates mutually exclusive event; illustrates events and union and intersection of events; illustrates the permutation of objects; differentiates permutation from combination of *n* objects taken *r* at a time; and illustrates combination of objects.

Table 2
Competencies of the Third Quarter Summative Test in Mathematics 10 of School Year 2020 – 2021

Skills/ Competencies	Percentage	Rank
1. Illustrates the permutation of objects.	62.70	8
2. Solves problems involving permutations.	48.81	5
3. Illustrates the combination of objects.	69.08	10
4. Differentiates permutation and combination differentiates objects taken at a time.	65.54	9
5. Solves problems involving permutations and combinations.	47.48	3

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6. Illustrates events, and union and intersection of events.	55.47	7
7. Illustrates the probability of a union of two events.	46.34	2
8. Finds the probability of (A U B).	48.34	4
9. Illustrates mutually exclusive events.	52.95	6
10. Solves problems involving probability.	43.29	1

This implies that the aforementioned first five competencies for the Third Quarter in Mathematics 10 based on Most Essential Competencies were determined to be the least mastered skills. These topics must be prioritized, and be given emphasis in the distance learning modality through the use of Self-Learning Module in order for the learners to not just learn the concepts but to apply significant contexts interactively in their lives.

Evaluations of Mathematics Teachers and Mathematics Experts on the Developed Self-Learning Module in Mathematics 10 on Content

The developed Self-Learning Module in Mathematics 10, Combinatorics and Probability, for the Third Quarter was evaluated by the grade 10 Mathematics teachers of Antipolo National High School and Mathematics experts for the content. The evaluations of the two groups of respondents on the developed Self-Learning Module in terms of format, objectives and content, examples, and self-assessment are presented in Tables 3 to 6 and summarized in Table 7.

Format. Table 3 presents the two groups of respondents' evaluations on the developed SLM on content in terms of format.

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Table 3

Respondents' Evaluations on the Developed Self-Learning Module in Mathematics 10 on Content in Terms of Format

Indicators	Respondents			
	Teachers		Experts	
	WM	VI	WM	VI
1. The titles and sub-titles are clearly distinguished.	4.80	FA	5.00	FA
2. The layout of the pages is attractive.	4.70	FA	4.90	FA
3. The type size used for the text is easy to read.	4.60	FA	4.90	FA
4. The graphics are well laid out and easy to understand.	4.70	FA	4.90	FA
5. Key concepts are well highlighted to attract attention.	4.70	FA	4.90	FA
Overall Weighted Mean	**4.70**	**FA**	**4.92**	**FA**
Standard Deviation	**0.38**		**0.19**	

Note: WM - Weighted Mean VI - Verbal Interpretation FA - Fully Agree

As presented in Table 3, teachers and experts evaluated the Self-Learning Module in Mathematics 10 as **Fully Agreed** as regards to its format that are evidenced by the overall weighted means of 4.70 with 0.38 standard deviation, and mean score of 4.92 and standard deviation of 0.19, respectively.

Torrefranca (2017) stated that the font size, font style, mathematical symbols, titles, and subtitles used in the module must be readable and clearly defined. Also, the instructions and captions should be well-emphasized and properly laid out. Thus, the developed SLM on content in terms of format is suitable for Grade 10 learners based on the criteria for instructional materials.

Objectives and Content. Table 4 presents the two groups of respondents' evaluations on the developed SLM on content in terms of objectives and content.

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As seen in Table 4, grade 10 Mathematics teachers and experts evaluated the SLM regarding the objectives and content as **Fully Agreed** as evidenced by the overall weighted mean of 4.84 with 0.32 standard deviation, and mean score of 4.82 and standard deviation of 0.35, respectively.

Instructional modules are prepared for the purpose of attaining defined learning objectives through the content of activities (Torrefranca, 2017). The level of difficulty of contents and topics of learning module is appropriate for the age, needs, interests, and level of the learners to attain the objectives (Madrazo & Dio, 2020). These results implies that the developed SLM in terms of objectives and content were suited to the grade 10 learners' needs to help improve their mastery of the least mastered skills.

Table 4
Respondents' Evaluations on the Developed Self-Learning Module in Mathematics 10 on Content in Terms of Objectives and Content

Indicators	Respondents			
	Teachers		Experts	
	WM	VI	WM	VI
1. The instructional objectives are simple and attainable.	4.90	FA	4.90	FA
2. The instructional objectives state what should I do after answering of the module.	4.90	FA	4.70	FA
3. The explanations of the lessons are written in simple language.	4.80	FA	4.90	FA
4. The contents provide learning opportunity and experiences to improve the knowledge, understanding and skill through activities.	4.80	FA	4.80	FA
5. The contents are parallel to the objectives.	4.80	FA	4.80	FA

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Overall Weighted Mean	**4.84**	**FA**	**4.82**	**FA**
Standard Deviation	**0.32**		**0.35**	

Examples. Table 5 presents the two groups of respondents' evaluations on the developed SLM on content in terms of examples.

Table 5
Respondents' Evaluations on the Developed Self-Learning Module in Mathematics 10 on Content in Terms of Examples

Indicators	Respondents			
	Teachers		Experts	
	WM	VI	WM	VI
1. The illustrative examples appropriately apply the concepts presented.	4.70	FA	4.90	FA
2. Illustrative examples have been included in all necessary parts of the module.	4.80	FA	4.90	FA
3. The illustrative examples are sufficient for attaining mastery of the subject matter.	4.40	FA	4.70	FA
4. The illustrative examples are very useful in explaining and understanding the concepts.	4.80	FA	4.80	FA
5. The illustrative examples are practical.	4.80	FA	4.90	FA
Overall Weighted Mean	**4.70**	**FA**	**4.84**	**FA**
Standard Deviation	**0.44**		**0.30**	

In Table 5, both teachers and experts **Fully Agreed** that the developed SLM on content regarding the examples as evidenced by the overall weighted mean of 4.70 and 4.84 with 0.44 and 0.30 standard deviations, respectively.

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Examples that are part of every lesson are appropriate to the learners, sufficient for achieving the mastery of the learning competencies, useful and practical in presenting and explaining the concepts as stated in the study of Cutamora (2020). This implies that the examples presented in the SLM are suitable, adequate, and helpful in attaining the Most Essential Learning Competencies for grade 10 Mathematics.

Self-Assessment. Table 6 presents the two groups of respondents' evaluations on the developed SLM on content in terms of self-assessment.

Shown in Table 6 that both teachers and expert-respondents, **Fully Agreed** in all indicators for content in terms of the self-assessment as evidenced by the overall weighted mean of 4.72 and 4.76 and standard deviation of 0.42 and 0.41, respectively.

According to Agripa (2018), assessment is tailored to the learning objectives, which make it easy to assess and monitor the learning of the students. Self-assessment questions measure the knowledge and skills which also stimulate and encourage the higher-order thinking skills (Vergara, 2017).

This implies that the self-assessment on the developed SLM is useful, relevant and relatable to the learning experiences and real-life situation of the learners which is written in a way that they can easily understand what is given, presented, and offered to them to apply the knowledge and skills.

Table 6

Respondents' Evaluations on the Developed Self-Learning Module in Mathematics 10 on Content in Terms of Self-Assessment

Indicators	Respondents			
	Teachers		Experts	
	WM	VI	WM	VI
1. The questions enable me to learn by myself.	4.70	FA	4.80	FA

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2. The questions are relevant to the lessons that ought to be mastered.	4.70	FA	4.80	FA
3. The questions guide me to know whether I have attained the objectives of the module.	4.80	FA	4.70	FA
4. The problems are very useful in attaining mastery of the lesson.	4.60	FA	4.80	FA
5. The self-assessment questions motivate me in studying the lessons actively.	4.80	FA	4.70	FA
Overall Weighted Mean	**4.72**	**FA**	**4.76**	**FA**
Standard Deviation	**0.42**		**0.41**	

Table 7 shows the summary of evaluations between the Grade 10 Mathematics teachers and Mathematics experts on the developed Self-Learning Module in Mathematics 10 on content.

As reflected in Table 7, that both teachers and expert-respondents **Fully Agreed** on all the criteria for content with grand weighted mean of 4.74 and 4.84, respectively.

Content of the instructional materials helps the learners to easily grasp the concept presented (Vergara, 2017). As cited by Ambayon (2020) that a Self-Learning Module is acceptable and relevant on contents when independent learning is fostered.

Table 7

Summary of Respondents' Evaluations on the Developed Self-Learning Module in Mathematics 10 on Content

Criteria	Respondents			
	Teachers		Experts	
	OWM	VI	OWM	VI
A. Format	4.70	FA	4.92	FA
B. Objectives and Content	4.84	FA	4.82	FA
C. Examples	4.70	FA	4.84	FA

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D. Self-Assessment	4.72	FA	4.76	FA
Grand Weighted Mean	**4.74**	**FA**	**4.84**	**FA**

Note: OWM - Overall Weighted Mean VI - Verbal Interpretation FA - Fully Agree

Therefore, the developed Self-Learning Module in Mathematics 10 for the third quarter is very highly acceptable to Grade 10 Mathematics teachers and Mathematics experts' respondents in teaching Combinatorics and Probability. This only shows that SLM is very highly acceptable in terms of content which comprised of format, objectives and content, examples, and self-assessment.

Significant Difference between the Evaluations of Two Groups of Respondents on the Developed Self-Learning Module in Mathematics 10 on Content

The computed results of the significant difference with the evaluations between the Grade 10 Mathematics teachers and Mathematics experts on the developed Self-Learning Module in Mathematics10 are shown in Tables 8 to 11. Hence, the summary of the significant difference test of the two groups of respondents' evaluation of the developed Self-Learning Module in Mathematics 10 is presented in Table 12.

Format. Table 8 contains the independent-samples *t* test of respondents' evaluations on the developed SLM on content in terms of format.

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Table 8

Test of Difference between the Evaluations of the Two Groups of Respondents on the Developed Self-Learning Module in Mathematics 10 on Content as to Format

Respondents	OWM	S	Computed *t* Value	Critical t Value (α=5%, df=18)	Decision	Interpretation
Teachers	4.70	0.38	1.63	2.10	Fail to Reject the H_o	Not Significant
Experts	4.92	0.19				

Legend: WM – Weighted Mean s – Standard Deviation H_o – Null Hypothesis

Based on Table 8, at 5% level of significance with 18 degrees of freedom, the computed *t* value is 1.63 and the critical *t* value is 2.10. Since the computed *t* value is less than the critical value, the statistical decision is not to reject the null hypothesis. Thus, there is no significant difference between the evaluation of mathematics teachers and experts on the developed self-learning module in Mathematics 10 on content in terms of format.

This concludes that the two groups of respondents fully agreed that the format of the Self-Learning Module is very highly acceptable.

Objectives and Content. Table 9 presents the two groups of respondents' evaluations on the developed SLM on content in terms of objectives and content. As revealed in Table 9, the critical *t* value with 18 degrees of freedom is 2.10 and the computed *t* value 0.13. As the computed *t* value is less than the critical *t* value, at 5% level of significance, the statistical decision is to fail to reject the null hypothesis. Thus, there is no significant difference between the evaluation of mathematics teachers and experts on the developed Self-Learning Module in Mathematics 10 on content in terms of objectives and content.

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Table 9
Test of Difference between the Evaluations of the Two Groups of Respondents on the Developed Self-Learning Module in Mathematics 10 on Content as to Objectives and Content

Respondents	OWM	S	Computed *t* Value	Critical t Value (α=5%, df=18)	Decision	Interpretation
Teachers	4.84	0.32	0.13	2.10	Fail to Reject the H_o	Not Significant
Experts	4.82	0.35				

This means that the two groups of respondents fully agreed that the developed self-learning module on content is with very high acceptability in terms of objectives and content.

Examples. Table 10 presents the two groups of respondents' evaluations on the developed SLM on content in terms of examples.

Table 10
Test of Difference between the Evaluations of the Two Groups of Respondents on the Developed Self-Learning Module in Mathematics 10 on Content as to Examples

Respondents	OWM	S	Computed *t* Value	Critical t Value (α=5%, df=18)	Decision	Interpretation
Teachers	4.70	0.44	0.83	2.10	Fail to Reject the H_o	Not Significant
Experts	4.84	0.30				

As depicted in Table 10, the computed *t* value of 0.83 is less than the critical *t* value of 2.10. At 5% level of significance, this leads that the null hypothesis cannot be rejected. This indicates that there is no significant difference between the evaluation of mathematics teachers

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and experts on the developed self-learning module in Mathematics 10 on content in terms of examples.

This suggests that examples presented on the developed self-learning module are with very high acceptability as evaluated by the two groups of respondents.

Self-Assessment. Table 11 presents the two groups of respondents' evaluations on the developed SLM on content in terms of self-assessment.

Table 11
Test of Difference between the Evaluations of the Two Groups of Respondents on the Developed Self-Learning Module in Mathematics 10 on Content as to Self-Assessment

Respondents	OWM	S	Computed *t* Value	Critical t Value (α=5%, df=18)	Decision	Interpretation
Teachers	4.72	0.42	0.21	2.10	Fail to Reject the H_o	Not Significant
Experts	4.76	0.41				

At 5% level of significance, the computed *t* value of 0.21 is lower than the critical *t* value of 2.10 as viewed in Table 11. So, the statistical decision is to not reject the null hypothesis. This concludes that there is no significant difference between the evaluations of the two groups of respondents on the developed self-learning module in Mathematics 10 on content in terms of self-assessment. This implies that the two groups of respondents fully agreed that the assessment of the developed SLM is indeed very highly acceptable on content in terms of self-assessment.

Table 12 shows the summary of test significant difference with the evaluation of the two groups of respondents on the developed Self-Learning Module in Mathematics10.

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Table 12

Summary of Test of Difference between the Evaluations of the Two Groups of Respondents on the Developed Self-Learning Module in Mathematics 10 on Content

Content	Teachers		Experts		$t_{computed}$ Value	Decision	Interpretation
	OWM	S	OWM	S			
a. Format	4.70	0.38	4.92	0.19	1.63	Fail to Reject the H_0	Not Significant
b. Objectives and Content	4.84	0.32	4.82	0.35	0.13	Fail to Reject the H_0	Not Significant
c. Examples	4.70	0.44	4.84	0.30	0.83	Fail to Reject the H_0	Not Significant
d. Self-Assessment	4.72	0.42	4.76	0.41	0.21	Fail to Reject the H_0	Not Significant

Note: a = 5% Critical t Value = 2.10

As evidently shown in Table 12, the evaluations of the two groups of respondents on the developed Self-Learning Module in Mathematics 10 on Content pertaining to format, objectives and content, examples, and self-assessment do not show significant differences with the respective computed t values which are below the critical t value.

This implies that the respondents' evaluations on the developed SLM on content are the same and very highly acceptable. This supported the present study in asserting that such developed Self-learning Module can be effective learning materials in teaching Mathematics.

Evaluations of Mathematics Teachers and Mathematics Experts on the Developed Self-Learning Module in Mathematics 10 on Pedagogy

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The pedagogy part of the developed Self-Learning Module in Mathematics 10, Combinatorics and Probability, for the Third Quarter was evaluated by the grade 10 Mathematics teachers and Mathematics experts of Antipolo National High School. The evaluations of the two groups of respondents on the developed Self-Learning Module with respect to clarity, technical quality, appropriateness, and usefulness are presented in Tables 13 to 16 and summarized in Table 17.

Clarity. Table 13 presents the two groups of respondents' evaluations on the developed SLM on pedagogy in terms of clarity.

Table 13
Respondents' Evaluations on the Developed Self-Learning Module in Mathematics 10 on Pedagogy in Terms of Clarity

Indicators	Respondents			
	Teachers		Experts	
	WM	VI	WM	VI
1. The procedures are clear and understandable of the basic concepts and principles.	4.70	FA	4.90	FA
2. The guide questions are clearly stated.	4.80	FA	4.90	FA
3. The presentation used is simple, direct to the point and understandable.	4.60	FA	4.70	FA
4. The illustrative examples and images are distinguishable and can easily attract students' attention.	4.70	FA	4.80	FA
5. The structures and styles have descriptions to clarify what it means.	4.70	FA	4.80	FA
Overall Weighted Mean	**4.70**	**FA**	**4.82**	**FA**
Standard Deviation	**0.41**		**0.30**	

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It can be gleaned on Table 13 that the teachers and expert respondents' evaluation on the developed Self-Learning Module in Mathematic 10 on pedagogy regarding the clarity as evidenced by the overall weighted means of 4.70 and 4.82, with standard deviations of 0.41 and 0.30, respectively.

Mabbayad (2018) cited that in terms of clarity of the learning module the procedures are clearly stated and easy to comprehend. The developed learning materials clarifies the concepts, language used is simple, direct, and comprehensible, (Cruzpero, 2021). In additional, according to Tan-Espinar and Ballado (2016), clarity involves logically arranged activities, clear and simple contents that are appropriate to the level of the learners as the users of the Self-Learning Module.

This implies that the SLM have a clear and basic procedure that are easy to follow, more examples, structure and style promote independent learning among the learners. Thus, the two groups of respondents **Fully Agreed** with the difference indicators, that the module is manifesting the clarity.

Technical Quality. Table 14 presents the two groups of respondents' evaluations on the developed SLM on pedagogy in terms of suitability.

As seen in Table 14, teachers and expert respondents' **Fully Agreed** on the developed Self-Learning Module regarding its technical quality as evinced by the overall weighted means of 4.70 and 4.74 with standard deviations of 0.48 and 0.38, respectively.

Table 14
Respondents' Evaluations on the Developed Self-Learning Module in Mathematics 10 on Pedagogy in Terms of Technical Quality

Indicators	Respondents			
	Teachers		Experts	
	WM	VI	WM	VI
1. The instructional material accurately gives feedback which makes the learner build self-confidence.	4.70	FA	4.70	FA

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2. The instructional material presents high quality graphics.	4.70	FA	4.70	FA
3. The instructional material allows the learners to improve visual literacy.	4.70	FA	4.80	FA
4. The instructional material allows the students with flexibility.	4.70	FA	4.70	FA
5. The instructional material appears accurate and aligned with the learning competency.	4.70	FA	4.80	FA
Overall Weighted Mean	**4.70**	**FA**	**4.74**	**FA**
Standard Deviation	**0.48**		**0.38**	

A technical quality of a learning materials on pedagogy is understandable and comprehensible to the learners (Cutamora, 2020). Therefore, two groups of respondents **Fully Agreed** that the technical quality of the developed SLM provided feedbacks to the learners, used a high-quality graphics that allows flexibility and develop visual literacy that are aligned with the MELC.

Appropriateness. Table 15 presents the two groups of respondents' evaluations on the developed SLM on pedagogy in terms of appropriateness.

Table 15
Respondents' Evaluations on the Developed Self-Learning Module in Mathematics 10 on Pedagogy in Terms of Appropriateness

Indicators	Respondents			
	Teachers		Experts	
	WM	VI	WM	VI
1. The activities match the level of students understanding.	4.70	FA	4.90	FA
2. The activities are consistent to the needs and interests of the students.	4.80	FA	4.70	FA
3. The illustrations show accuracy, support the text and enhance student understanding.	4.80	FA	4.70	FA

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4. The key terms are both familiar and challenging words to enhance understanding.	4.60	FA	4.80	FA
5. The activities incorporate individual, pair, and group work.	4.80	FA	4.70	FA
Overall Weighted Mean	**4.74**	**FA**	**4.76**	**FA**
Standard Deviation	**0.46**		**0.37**	

Table 15 shows that the appropriateness of the developed SLM has an overall weighted mean of 4.74 with standard deviation of 0.46, and 4.76 weighted mean and 0.37 standard deviation for teachers and experts' respondents, respectively. The two groups of respondents **Fully Agreed** that the SLM are related to the topics and well-matched to the ability of the students (Corpez, 2019).

These results concluded that the developed SLM is fitted to the learners to easily follows instructions and understand examples that are aligned with the lesson objectives and to answer the parallel activity that develops and enhance critical thinking.

Usefulness. Table 16 presents the two groups of respondents' evaluations on the developed SLM on pedagogy in terms of usefulness

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Table 16
Respondents' Evaluations on the Developed Self-Learning Module in Mathematics 10 on Pedagogy in Terms of Usefulness

Indicators	Respondents			
	Teachers		Experts	
	WM	VI	WM	VI
1. The activities provide opportunities for students to develop interests.	4.70	FA	4.90	FA
2. The activities are acceptable and customizable to makes learning easy and exciting.	4.80	FA	4.80	FA

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3. The activities presented are relevant to real world experience that encourages the students' engagement to learning and develops students critical thinking.	4.80	FA	4.80	FA
4. The activities encourage appreciation of the social and cultural values of society.	4.70	FA	4.60	FA
5. The activities provide assessment type questions to measure the level of students' learning.	4.80	FA	4.80	FA
Overall Weighted Mean	**4.76**	**FA**	**4.78**	**FA**
Standard Deviation	**0.36**		**0.37**	

As presented in Table 16, teachers and experts **Fully Agreed** on the usefulness of the developed Self-Learning Module, as evidenced by the overall weighted mean of 4.76 and 4.78 with standard deviation of 0.36 and 0.37, respectively.

Learning materials allow students to apply and integrate the learned concepts and skills using available resources (Corpez, 2019); and as well as, gain a better understanding of the society social and cultural values (Cruzpero. 2021). This implies that the module developed is useful in the students' daily life because of its activities that are relevant and relatable. It also provides opportunities to develop interests, love for their culture, and think critically and creatively about how to use the available local resources to apply their new acquire knowledge and skills.

Table 17 shows the summary of evaluations between the Grade 10 Mathematics teachers and Mathematics experts on the developed Self-Learning Module in Mathematics 10 on pedagogy.

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Table 17
Summary of Respondents' Evaluations on the Developed Self-Learning Module in Mathematics 10 on Pedagogy

Criteria	Respondents			
	Teachers		Experts	
	OWM	VI	OWM	VI
a. Clarity	4.72	FA	4.80	FA
b. Technical Quality	4.70	FA	4.74	FA
c. Appropriateness	4.74	FA	4.76	FA
d. Usefulness	4.78	FA	4.76	FA
Grand Weighted Mean	**4.74**	**FA**	**4.77**	**FA**

Note: OWM – Overall Weighted Mean VI – Verbal Interpretation

As reflected in Table 17, both teachers and experts' respondents **Fully Agreed** on all the criteria for pedagogy with grand weighted mean of 4.74 and 4.77, respectively. Real-life situations that are useful and appropriate that integrated in the module while promoting independent learning among students (Madrazo &Dio, 2020), by giving immediate, clear, and accurate feedback which significantly improve the academic performance (Vergara, 2017).

Therefore, the developed Self-Learning Module in Mathematics 10 for the third quarter are very highly acceptable on pedagogy in terms of clarity, technical quality, appropriateness, and usefulness in teaching Combinatorics and Probability. The SLM is with very high acceptability on Pedagogy as it promotes self-paced learning without compromising the learning objectives that are based on the Most Essential Learning Competencies by assigning task that are directly related to daily life of the learners.

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Significant Difference between the Evaluations of Two Groups of Respondents on the Developed Self-Learning Module in Mathematics 10 on Pedagogy

The results of computation for the significant difference in the evaluation of the grade 10 mathematics teachers and mathematics experts on the developed self-learning module in Mathematics10 on pedagogy are shown from Tables 18 to 21 and the summary is presented in Table 22.

Clarity. Table 18 contains the independent-samples t test of respondents' evaluations on the developed SLM on pedagogy in terms of its clarity.

Table 18
Test of Difference between the Evaluations of the Two Group of Respondents on the Developed Self-Learning Module in Mathematics 10 on Pedagogy in Terms of Clarity

Respondents	OWM	S	Computed *t* Value	Critical t Value (α=5%, df=18)	Decision	Interpretation
Teachers	4.70	0.41	0.74	2.10	Fail to Reject the H_o	Not Significant
Experts	4.82	0.30				

Table 18 reflected that the computed *t* value of 0.74 is smaller than the critical *t* value of 2.10 with 18 degrees of freedom. This means that the null hypothesis cannot be rejected. This shows that there is no significant difference between the evaluations of the two groups of respondents on the developed self-learning module in Mathematics 10 on pedagogy regarding clarity.

This implies that the teachers and expert respondents fully agreed that the self-learning module contains clarity. Thus, the procedure is clearly stated and easily understand by the learners. The illustration highly motivates them to learn independently.

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Technical Quality. Table 19 presents the two groups of respondents' evaluations on developed SLM on pedagogy in terms of its technical quality.

Table 19
est of Difference between the Evaluations of the Two Group of Respondents on the Developed Self-Learning Module in Mathematics 10 on Pedagogy in Terms of Technical Quality

Respondents	OWM	S	Computed *t* Value	Critical t Value (α=5%, df=18)	Decision	Interpretation
Teachers	4.70	0.48	0.21	2.10	Fail to Reject the H_o	Not Significant
Experts	4.74	0.38				

It can be gleaned on Table 19 with 18 degrees of freedom at 5% level of significance, the critical *t* value is 2.10 and the computed *t* value is 0.21. Since, the computed *t* value is less than the critical *t* value, the statistical decision is to not reject the null hypothesis. Therefore, there is no significant difference between the evaluation of mathematics teachers and experts on the developed self-learning module in Mathematics 10 on pedagogy in terms of technical quality.

This implies that the two groups of respondents fully agreed that the technical quality on pedagogy of the developed self-learning module is suited and very highly acceptable.

Appropriateness. Table 20 presents the two groups of respondents' evaluations on the developed SLM on pedagogy in terms of its appropriateness.

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Table 20
Test of Difference between the Evaluations of the Two Group of Respondents on the Developed Self-Learning Module in Mathematics 10 on Pedagogy in Terms of Appropriateness

Respondents	OWM	S	Computed *t* Value	Critical t Value (α=5%, df=18)	Decision	Interpretation
Teachers	4.74	0.46	0.11	2.10	Fail to Reject the H_o	Not Significant
Experts	4.76	0.37				

As shown on Table 20 with 18 degrees of freedom at 5% level of significance, the critical *t* value is 2.10 and the computed *t* value is 0.11. Since, the computed *t* value is less than the critical *t* value, the statistical decision is to not reject the null hypothesis. Therefore, there is no significant difference between the evaluation of mathematics teachers and experts on the developed self-learning module in Mathematics 10 on pedagogy in terms of appropriateness.

This infers that the two groups of respondents fully agreed that the developed self-learning module is appropriate to the grade 10 learners and with very high acceptability.

Usefulness. Table 21 presents the two groups of respondents' evaluations on the developed SLM on pedagogy in terms of its usefulness.

Table 21
Test of Difference between the Evaluations of the Two Group of Respondents on the Developed Self-Learning Module in Mathematics 10 on Pedagogy in Terms of Usefulness

Respondents	OWM	s	Computed *t* Value	Critical t Value (α=5%, df=18)	Decision	Interpretation
Teachers	4.76	0.36	0.12	2.10		Not Significant

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Experts	4.78	0.37			Fail to Reject the H_o	

As revealed in Table 21, at 5% level of significance with 18 degrees of freedom, the computed *t* value is 0.12 and the critical *t* value is 2.10. The statistical decision is to not reject the null hypothesis. Thus, there is no significant difference between the evaluation of mathematics teachers and experts on the developed self-learning module in Mathematics 10 on pedagogy in terms of usefulness.

This concludes that the developed self-learning module in Mathematics 10 for third quarter is useful to the grade 10 learners and very highly acceptable as perceive by the mathematics teachers and experts. Table 22 shows the summary of test significant difference with the evaluations between the Grade 10 Mathematics teachers and Mathematics experts on the developed Self-Learning Module in Mathematics10 on pedagogy.

As described in Table 22, at 5 % level of significant, 18 degree of freedom and the computed t values for pedagogy in terms of clarity, technical quality, appropriateness, and usefulness are less than the critical t value. The two groups of respondents **Fully Agreed** that the developed SLM in Mathematics 10 on pedagogy are clear, with technical quality, appropriate, and very useful.

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Table 22

Summary of Test of Difference between the Evaluations of the Two Groups of Respondents on the Developed Self-Learning Module in Mathematics 10 on Pedagogy

Pedagogy	Teachers		Experts		$t_{computed}$ Value	Decision	Interpretation
	OWM	S	OWM	S			
a. Clarity	4.70	0.41	4.82	0.30	0.74	Fail to Reject the H_0	Not Significant
b. Technical Quality	4.70	0.48	4.74	0.38	0.21	Fail to Reject the H_0	Not Significant
c. Appropriateness	4.74	0.46	4.76	0.37	0.11	Fail to Reject the H_0	Not Significant
d. Usefulness	4.76	0.36	4.78	0.37	0.12	Fail to Reject the H_0	Not Significant

Note: a = 5% Critical t Value = 2.10

This implies that the developed Self-Learning Module in Mathematics 10 for Combinatorics and Probability of the third quarter is very highly acceptable on pedagogy. This supported the present study in asserting that such developed Self-Learning Module can be effective learning materials in teaching Mathematics.

Respondents' Comments and Suggestions to Improve the Developed Self-Learning Module in Mathematics 10 on Content and Pedagogy

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These are the comments and suggestions to the developed Self-Learning Module in Mathematics 10, Combinatorics and Probability, for the Third Quarter by the Grade 10 Mathematics teachers and Mathematics experts.

Comments

(a) The layout of the Self-Learning Module is pleasing; (b)the Self-Learning Module is well-detailed; (c) it's good that there are pictures and practical applications to make the module interesting and engaging; (d) the Self-Learning Module in terms of objectives and content is impressive; (e)the Self-Learning Module is clear and easy to understand); (f) the Self-Learning Module is appropriate for Grade 10 students; (g) the Self-Learning Module encourage the students to study their lessons alone or by themselves; (h) the descriptions and examples are well presented; (i) there are enough examples so that the students can understand the lessons; and (j) the module developed by the teacher is excellent from the designs to content.

Suggestions

(a) The steps on how to get the solution aside from definition of terms and formula have to be included; (b) activities with three categories: easy, average, and difficult, if possible, have to be cited; (c) the word "learners' instead of "students" may be used instead; and (d) declarative sentence may be used on the reflection part instead of questions.

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Conclusion

Based on the findings, the following conclusions are drawn:

1. The evaluations of the Mathematics teachers and the expert respondents on the developed self-learning module in Mathematics 10 do not vary significantly in terms of content and pedagogy.

2. The developed Self-Learning Module in Mathematics 10 is highly acceptable to the respondents – Math experts and Math teachers; and useful instructional materials for teaching in distance learning modality (printed and digitized) as it is highly appreciated by those with expertise in the preparation of instructional materials like this.

Recommendations

The following are recommended based on the conclusions:

1. The developed self-learning module in Mathematics 10 may be subjected to validation process to make it more scholarly instructional material.

2. Future researchers may consider the developed Self-Learning Module for validation to determine the level of acceptability among learners.

3. Print out of the developed instructional material for a wider utilizationmay be produced.

4. Future researchers may consider the fourth quarter topics in Grade 10 Mathematics in developing the other modularized instruction in distance learning modality.

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5. A parallel research may be conducted by future researchers not only in Mathematics 10 but also in other levels of Mathematics.

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