



**ETCOR** Educational Research Center  
PHILIPPINES  
Sta. Ana, Pampanga, Philippines



**iJOINED ETCOR**  
P - ISSN 2984-7567  
E - ISSN 2945-3577



Website: <https://etcor.org>



**The Exigency**  
P - ISSN 2984-7842  
E - ISSN 1908-3181

## Interactive E-book: A Supplementary Innovative Material in Mathematics 10

Sharlyn Barbin Balgoa<sup>1\*</sup>, Dr. Prescila I. Marcelo<sup>2</sup>

<sup>1</sup>Urdaneta City National High School, Urdaneta City, Pangasinan, Philippines

<sup>2</sup>Urdaneta City University, Urdaneta City, Pangasinan, Philippines

\*Corresponding Author email: [sharlyn.balgoa@deped.gov.ph](mailto:sharlyn.balgoa@deped.gov.ph)

**Received:** 17 April 2023

**Revised:** 21 June 2023

**Accepted:** 26 June 2023

**Available Online:** 27 June 2023

**Volume II (2023), Issue 2, P-ISSN – 2984-7567; E-ISSN - 2945-3577**

### Abstract

**Aim:** This study aimed to develop and establish the level of acceptability of an interactive e-book as a supplementary innovative material in Mathematics 10 in the Schools Division Office of Urdaneta City, S.Y. 2022-2023.

**Methodology:** This study utilized documentary analysis and descriptive-developmental method of research given the nature of the research problems presented in this study. A total of thirty (30) Mathematics 10 teachers were included as the validators of the e-book. Data were obtained using a researcher-designed questionnaire checklist which was validated by experts in the field.

**Results:** The analysis of the diagnostic test results in Mathematics 10 revealed that students struggled the most in competencies related to determining geometric means, graphing geometric figures, understanding combination and permutation, and illustrating measures of position. To address these challenges, an interactive e-book was proposed as a supplementary material, featuring simplified discussions, guided practices, adopted video tutorials, and interactive assessments. Moreover, based on the evaluation of the Grade 10 mathematics teachers, the e-book received high acceptability ratings indicating its potential to enhance student engagement and understanding in Mathematics 10.

**Conclusion:** The proposed interactive e-book as a supplementary innovative material in Mathematics 10 has the potential to enhance learners' engagement and understanding of mathematical concepts particularly the identified least learned competencies and rated as highly acceptable by the Grade 10 mathematics teachers. The comprehensive nature of the material, which includes clear and easy-to-understand discussions, illustrative examples, and activities, also ensures that it is appropriate for students at various stages of development and instructional needs.

**Keywords:** e-book, adequacy, appropriateness, coherence, usefulness, illustrations, graphics and design

### INTRODUCTION

A digital native is a term used to describe the generation of learners at present. This emphasizes the importance and influence of technology in their lives nowadays (Halton, 2019). Unquestionably, Information and Communications Technology (ICT) has significantly impacted education in many nations worldwide in recent years (Carvajal & Sanchez, 2023; Muñoz & Sanchez, 2023; Salendab & Dapitan, 2021a). The progress in science, technology, and the internet has ushered in many opportunities for innovative teaching methods and techniques. As a result, the international education arena is continuously evolving, especially on learning resources to cater the needs of the learners in the 21<sup>st</sup> century learning environment.

Learning resources play an essential role in overcoming learning problems faced by learners. According to Wahyuningsih et al. (2021), learning resources are anything teachers can use separately or in combination for teaching and learning to increase the effectiveness of the educative process, thereby attaining the set learning objectives. Advances in technology have given birth to new learning sources. One of the distinguishing features of this new learning resource is its digital character.



**ETCOR** Educational Research Center  
PHILIPPINES  
Sta. Ana, Pampanga, Philippines



Website: <https://etcor.org>



**iJOINED ETCOR**  
P - ISSN 2984-7567  
E - ISSN 2945-3577



**The Exigency**  
P - ISSN 2984-7842  
E - ISSN 1908-3181

As Munir (2016) mentioned, several types of digital learning resources are developed by teachers, like computer software, interactive media, and online resources (e-books, websites, YouTube channels, and interactive videos). The wide availability of these types of technology-based learning resources in various formats offers the possibility to make a profound difference in education. Digital learning resources are not only used to transmit and access information but are seen as materials that provide vast opportunities for anyone, including teachers and learners, to create and express themselves (Salendab, 2021; Salendab & Laguda, 2023). Furthermore, interactivity skills, visualization, and feedback from digital learning sources positively impact the quality of learning related to motivation, retention, learning styles, and students' creativity (Yani & Siwi, 2020).

Among the digital resources, e-book is the most common learning tool used by students today. Towards the latter part of the twenty-first century's first decade, an increasing number of mobile reader devices were available, making it easier to read digital books (Sehn & Fragoso, 2015). Students can easily search for information because e-books have allowed traditional books to be converted to digital formats (Wang & Yang, 2014). According to Koh and Herring (2016) and Pal, Cuong and Nehru (2021), e-books have several advantages over published printed books. They are simple to use, require no library visits, allow for quick topic searches, are available everywhere and at any time, and have better, more affordable displays that conserve space. Likewise, Yachina, Valeeva, and Sirazeeva (2016) emphasized that one distinguishing characteristic of e-books over traditional books is providing information in text and audiovisuals, which helps students concentrate on learning and improves their ability to understand and retain information.

These innovations in the international education arena contributes to the response of learners in Mathematics. The idea of Hizon (2018) centers on the importance of digital learning materials in the effective academic performance of learners. The positive attitude of teachers and the proper utilization of these resources are necessary for the teaching and learning process. Thus, quality learning resources would boost the students' knowledge, skills, and competence in mastering the subject (Dizon & Sanchez, 2020; Salendab, 2023; Salendab & Akmad, 2023; Sanchez, 2022).

However, in the Philippine education system, mathematics education still needs to be improved by challenges with insufficient learning resources and teaching tools, be it in print or non-print materials, that align with the learning outcomes prescribed by the Department of Education (DepEd). Despite the approval of Republic Act 10533, otherwise known as the K to 12 Basic Education Program, which allows schools to localize, indigenize and enhance learning materials based on their respective educational and social contexts, still, the need for appropriate, adaptable, and evidence-based learning resources makes it challenging for teachers to teach some math ideas and principles. As a result, the struggling ranking of mathematics is still manifested in the result of various international examinations such as in 2018 Programmed for International Students Assessment (PISA) and the 2019 Trends in International Mathematics and Science Study (TIMSS), which revealed that Filipino learners are left behind when it comes to Science and Mathematics studies. Thus, learning materials are essential for school teaching and learning activities to increase teacher efficiency and improve students' learning performance (Olayanki, 2016).

In line with this, teachers are challenged to create appropriate instructional materials that can improve student learning and alleviate the problem of the lack of reference materials due to the concerns with the scarcity of learning materials in mathematics (Murcia, 2006). They are expected to do so much and are typically the focal person in any educational process. Teachers go beyond what is considered standard practice to provide learners with a quality education that is relevant to their lives. Therefore, it is evident that teachers are the strong links that can change the direction of mathematics education in the country. The elevation of the student's mathematical achievement levels lies in their hands.

Likewise, teachers need to be creative in finding alternative solutions to these problems. One best way to do this is by developing additional learning materials such as activity sheets, strategic intervention materials, worksheets, modules, workbooks, interactive e-books and manuals, and other resource materials. Using learning materials is one of the solutions that could make mathematics an exciting area of study for students.

In the context of the Schools Division Office of Urdaneta City, the Curriculum Implementation Division, through the Learning Resource Management Section, issued Division Memorandum No. 435, s. 2022 dated October 28, 2022, encouraged teachers to submit learning resource materials (print and non-print) for quality assurance to supplement the materials they use in the teaching and learning process. This is under the objectives of the 2022 Region 1 Learning Resource Agenda to develop quality and appropriate contextualized and localized learning resources for learners and the mandate of the R.A. 10533 to develop locally produced learning resources.

Based on the preceding insights, the researcher believes that the development of innovative learning material in Mathematics could help to facilitate more effective instruction in concretizing abstract concepts in the



**ETCOR** Educational Research Center  
PHILIPPINES  
Sta. Ana, Pampanga, Philippines



**iJOINED ETCOR**  
P - ISSN 2984-7567  
E - ISSN 2945-3577



Website: <https://etcor.org>



**The Exigency**  
P - ISSN 2984-7842  
E - ISSN 1908-3181

subject and maximize the learning experience despite the limited resources in public secondary schools. This innovation will address the urgent need for basic education. Thus, it is in this context that this study was conceptualized.

### Research Questions

This study aimed to develop and establish the level of acceptability of an interactive e-book as a supplementary innovative material in Mathematics 10 in the Schools Division Office of Urdaneta City for the S.Y. 2022-2023. Specifically, it sought to answer the following questions:

1. What are the least learned competencies in Mathematics for Grade 10?
2. What supplementary innovative material can be proposed to enhance students' performance in Mathematics 10?
3. What is the level of acceptability of the proposed supplementary material in Mathematics 10 in terms of:
  - a. adequacy;
  - b. appropriateness;
  - c. coherence;
  - d. usefulness;
  - e. graphics and design; and
  - f. illustration?

### METHODS

#### Research Design

The researchers adopted documentary analysis and descriptive-developmental methods, given the nature of the research problems presented in this study.

Documentary analysis is a type of qualitative research that systematically examines documentary evidence and responds to targeted research questions. The purpose of documentary analysis, like other methods of analysis in qualitative research, is to gain meaning and empirical understanding of the construct being investigated by repeatedly reviewing, examining, and interpreting the data (Gross, 2018). In this study, documentary analysis was employed to analyze and interpret the least learned competencies in Mathematics 10 as the bases for the development of e-learning material.

On the other hand, according to McCombes (2022), the descriptive method looks for the facts about a situation as it is. Furthermore, this approach aims to characterize a population, circumstance, or phenomenon precisely and methodically. Meanwhile, the term developmental method, as mentioned by Richey, Klein, and Nelson (2004), is directly related to the construction of instructional materials. Therefore, an output was created following the completion of this research. In other words, the descriptive developmental method is systematic research that carefully plans, creates, and assesses educational processes, products, and programs that must meet internal consistency and effectiveness standards. This research design is suitable in this study since it developed an interactive e-book to address the least learned competencies as well as facilitate an effective teaching and learning process in Mathematics.

#### Population and Sampling

In this study, the researchers adopted the census method to have maximum representation and consistency. The researchers considered the population itself to reduce the chance of sampling error. The respondents of the study were the Grade 10 Mathematics teachers in the public secondary schools in the Schools Division Office (SDO) Urdaneta City, Pangasinan.

The thirty (30) Grade 10 Mathematics teachers from the ten (10) clusters of the Schools Division Office of Urdaneta City were included as respondents. They were the validators and evaluators of the interactive e-book that was developed.

#### Instrument

Questionnaire checklist was used to collect the necessary data in this study. Said instrument was validated by experts in the field.



**ETCOR Educational Research Center PHILIPPINES**  
Sta. Ana, Pampanga, Philippines



**iJOINED ETCOR**  
P - ISSN 2984-7567  
E - ISSN 2945-3577  
**The Exigency**  
P - ISSN 2984-7842  
E - ISSN 1908-3181



Website: <https://etcor.org>



**Data Collection**

This study utilized a questionnaire checklist as the data collection instrument. It is a formalized list of questions used to gather information from the respondents. The questionnaire checklist was constructed after a comprehensive search of related literature and studies.

With the knowledge and information obtained from books, journals, periodicals, and other studies, the questionnaire was prepared and patterned on the study of Benavente (2010), as cited by Campilla et al. (2016), and the study of Rogayan and Dollete (2019) with some revisions to suit with the construct of the present study. It was used to determine the level of acceptability of the interactive e-book as a supplementary innovative material in Mathematics 10.

Also, the researchers used a 4-point Likert scale to treat the data gathered from the respondents. Likert scales which are commonly used, are 5-point and 7-point scales that have an odd number of points. On a 5- or 7-point Likert scale, a respondent might occasionally select the "Neutral" response. Researchers have started utilizing a 4-point scale known as a force Likert scale, in which there is no neutral choice, and the respondents are compelled to make a judgment, as stated in the study of Campilla and Castañaga (2021). The respondents were asked to respond precisely using a 4-point Likert scale.

The questionnaire checklist was evaluated, refined, and improved by experts in the field using the Survey/Interview Validation Rubric for Expert Panel by Simon and White (2016), cited in Campilla and Castañaga (2021). The validation process aimed to achieve several objectives, primarily focusing on ensuring clarity and relevance of each question within the respondents' experiences. The ultimate goal was to guarantee that respondents would not encounter difficulties while answering the questionnaire, while also ensuring the collected data would be valid and reliable.

Before administering the questionnaire to assess the acceptability of the interactive e-book as a supplementary material in Mathematics 10, the researcher embarked on the development of the interactive e-book. The development process consisted of stages such as planning, analysing, designing, developing, validating, and integrating, which were sequentially followed to ensure the creation of an effective supplementary resource for Mathematics 10.

Following the development process, the researcher obtained permission from the Schools Division Superintendent of Urdaneta City Division to gather data from the respondents. Validated questionnaires were personally distributed to the respondents, along with the proposed interactive e-book, to evaluate its adequacy, appropriateness, coherence, usefulness, graphics, design, and illustrations.

The researcher carefully analyzed the data from the evaluations to gain a comprehensive understanding of the teachers' perspectives. This analysis helped in determining specific areas that required revision or enhancement to better meet the needs and expectations of Grade 10 Mathematics teachers. By incorporating the teachers' valuable feedback, the researcher aimed to refine the e-book and make it a valuable supplementary resource for Mathematics instruction.

**Treatment of Data**

The data collected were sorted out, tallied, organized, and tabulated into the Excel Spreadsheet and subjected to treatment using the appropriate statistical tools.

To answer problem number 1 on the least learned competencies in Mathematics 10, documentary analysis was used based on the result of the diagnostic test administered to all Grade 10 students on September 12-13, 2022 in the Schools Division Office of Urdaneta City. The data collected from the diagnostic test served as a valuable source of information for determining the least learned competencies.

To answer problem number 2 on what supplementary innovative material can be proposed to address the least learned competencies, the researcher developed and validated an interactive e-book in Mathematics 10 with the following features: simplified discussion of mathematical concepts, guided and independent practices, adopted video tutorials, and interactive assessment.

To answer problem number 3 on the level of acceptability of the proposed interactive e-book as an innovative supplementary material in Mathematics 10 along adequacy, appropriateness, coherence, usefulness, graphics and design, and illustration, the weighted mean was utilized further described as follows:

Mean Scale Range	Descriptive Equivalent	Transmuted Rating
3.50-4.00	Strongly Agree	Highly Acceptable
2.50-3.49	Agree	Acceptable
1.50-2.49	Disagree	Slightly Acceptable



**ETCOR** Educational Research Center  
PHILIPPINES  
Sta. Ana, Pampanga, Philippines



**iJOINED ETCOR**  
P - ISSN 2984-7567  
E - ISSN 2945-3577  
**The Exigency**  
P - ISSN 2984-7842  
E - ISSN 1908-3181



Website: <https://etcor.org>



1.00- 1.49

Strongly Disagree

Not Acceptable

### Ethical Considerations

Ethical considerations were carefully taken into account to maintain the integrity and confidentiality of the data gathered. This involved obtaining consent from participants, ensuring anonymity and confidentiality, and following ethical guidelines for data collection, analysis, and reporting.

### RESULTS and DISCUSSION

#### Least Learned Competencies

Least learned competencies refer to the specific skills or concepts in a particular subject area that students need help understanding or performing. These competencies are identified based on assessments, evaluations, and feedback from teachers.

Identifying the least learned competencies in Mathematics 10 was crucial in developing the proposed interactive e-book as a supplementary innovative material. The goal was to create a supplementary material that targets the areas where the students struggled the most, thereby supporting them and improving their performance in the subject.

To identify these areas, a diagnostic test was administered to the students at the beginning of the school year, specifically on September 12-13, 2022. The diagnostic test assessed the student's understanding of various mathematical concepts covered in Mathematics 10.

The analysis revealed that the students struggled the most in four specific competencies, which were: (1) determining geometric means,  $n$ th term of a geometric sequence, (2) graphing and solving problems involving circles and other geometric figures on the coordinate plane, (3) illustrating the combination of objects and differentiating permutation from the combination, and (4) illustrating the following measures of position: quartiles, deciles, and percentiles. These competencies were found to be the least learned by the students from quarters 1 to 4.

Identifying such least learned competencies in Mathematics 10 as the basis for developing the proposed interactive e-book as a supplementary innovative material is an important step in ensuring that students have the necessary knowledge and skills to succeed in their academic endeavors.

#### The Proposed Interactive E-book as a Supplementary Innovative Material in Mathematics 10

Mathematics is a fundamental subject that is essential to people. However, not all students find mathematical concepts easy to grasp, which can make it difficult for them to succeed in this subject. To address this challenge, the researcher proposed an interactive e-book as a supplementary innovative material for Mathematics 10 in the form of an interactive e-book that incorporates simplified discussions of mathematical concepts, guided and independent practices, adopted video lessons, and interactive assessments which were anchored on the least learned competencies on the diagnostic test.

**Simplified discussion of mathematical concepts:** The proposed supplementary material included simplified discussions of mathematical concepts tailored to the student's level of understanding. These discussions were presented clearly and concisely, using simple language and examples that are relevant to their daily lives. These discussions aim to help students understand mathematical concepts better and to enable them to apply these concepts to real-life situations. This feature is supported by research, which shows that the use of plain language and examples can enhance learners' understanding of mathematical concepts (National Council of Teachers of Mathematics, 2014).

**Guided and independent practices:** The material also included guided and independent practices to help students reinforce their learning. The guided practices were designed to help students apply the concepts they have learned in class. In contrast, the independent practices will allow them to independently test their understanding of the concepts. The exercises were designed to challenge students at different levels and will be accompanied by clear explanations and examples. The use of practice exercises is supported by research, which shows that regular practice can improve learners' retention and understanding of mathematical concepts (Karpicke & Roediger III, 2007).

**Adopted video tutorials:** In addition to the discussions and practices, the material also included adopted video tutorials. These videos were curated from reliable sources and will be designed to complement the discussions and practices. This will also provide additional explanations and examples tailored to the student's needs. Research shows that the use of multimedia, including videos, can enhance learners' understanding and retention of mathematical concepts (Fathima & Leema Rose, 2018).



**ETCOR** Educational Research Center  
PHILIPPINES  
Sta. Ana, Pampanga, Philippines



Website: <https://etcor.org>



**iJOINED ETCOR**  
P - ISSN 2984-7567  
E - ISSN 2945-3577



**The Exigency**  
P - ISSN 2984-7842  
E - ISSN 1908-3181

**Interactive assessment:** Finally, the material included interactive assessments that allow students to test their understanding of the concepts they have learned. The assessments were designed to be engaging and included multiple-choice questions, problem-solving, and short-answer questions. The assessments provided immediate feedback, allowing students to identify areas where they need to improve and take corrective action. The use of interactive assessments is supported by research, which shows that regular testing can improve learners' understanding and retention of mathematical concepts (Roediger & Butler, 2011).

In conclusion, the proposed interactive e-book as an innovative supplementary material for Mathematics 10 will provide students with a comprehensive and engaging learning experience in the subject, thereby addressing the least learned competencies. By incorporating simplified discussions, guided and independent practices, adopted video lessons and interactive assessments, the material will help students to understand mathematical concepts better, reinforce their learning, and develop the skills they need to succeed in this subject.

### **Level of Acceptability of the Proposed Interactive E-Book: A Supplementary Innovative Material in Mathematics 10**

Innovative teaching materials have the potential to enhance the quality of education and improve learning outcomes (Amihan & Sanchez, 2023; Salendab & Dapitan, 2020; Sanchez, 2023a). However, the acceptability of such materials largely depends on their effectiveness and usability (Salendab & Cogo, 2022; Sanchez, 2023b). The proposed interactive e-book as a supplementary innovative material for Mathematics 10, which incorporates simplified discussions of mathematical concepts, guided and independent practices, adopted tutorials, and interactive assessment, can potentially improve students' understanding of mathematics and ability to apply mathematical concepts in real-life situations. In this context, it is important to examine the level of acceptability of the proposed material along with adequacy, appropriateness, coherence, usefulness, graphics and design, and illustration. By evaluating the level of acceptability of the proposed material, areas for improvement can be identified, and it can ensure that the material meets the needs and expectations of its intended user.

This section presents the data and the interpretation that answers problem number 3. It presents the level of acceptability of the proposed interactive e-book as an innovative supplementary material in Mathematics 10, along with adequacy, appropriateness, coherence, usefulness, graphics, and design, and illustration. Such data were presented in Tables 1 to 6 on the succeeding pages.

Table 1 presents the level of acceptability of the proposed interactive e-book as an innovative supplementary material in Mathematics 10, along with adequacy.

Adequacy refers to the degree to which instructional materials meet the needs and expectations of their intended users and are consistent with the existing curriculum and teaching methods. It involves ensuring that the materials are relevant, accurate, appropriate, and accessible to the intended users (Davidson, 2019).

It can be gleaned from the table that based on the evaluation of the Grade 10 mathematics teachers, the level of acceptability of the proposed interactive e-book as an innovative supplementary material in Mathematics 10 along with adequacy obtained an overall weighted mean is 3.70, described as "Highly Acceptable." All ten (10) indicators were rated "Highly Acceptable," with weighted means ranging from 3.60 to 3.83.

The finding suggests that the teachers' ratings were generally positive and that the proposed innovative material received high acceptance from the teachers. This result also implies that the proposed innovative material met the requirements needed in the Mathematics 10 curriculum.

This result could be attributed to the fact that the material was developed in response to the identified needs and difficulties of the students in Mathematics 10 and was designed to address these concerns in an innovative and effective way.

Upon further analysis of the table, it is evident that item no. 1, "there are enough objectives in each lesson which clearly manifest the intended purpose to be measured," and item no. 4, "the illustrations/samples are enough to facilitate understanding of the topics presented," garnered the highest weighted mean of 3.83. This high score suggests that these aspects were highly regarded by the Grade 10 mathematics teachers and deemed crucial for the effectiveness of the material.

The favorable transmuted rating of "Highly Acceptable" reinforces the conclusion that the objectives in each lesson were well-defined and explicitly demonstrated the intended purpose to be measured. This indicates that the material effectively guided learners toward achieving the desired outcomes.

Furthermore, the presence of ample illustrations and samples proved to be instrumental in facilitating an understanding of the presented topics. The high weighted mean for this item implies that the visuals provided were clear and relevant and aided learners in effectively comprehending and internalizing the subject matter.



**ETCOR** Educational Research Center  
PHILIPPINES  
Sta. Ana, Pampanga, Philippines



**iJOINED ETCOR**  
P - ISSN 2984-7567  
E - ISSN 2945-3577  
**The Exigency**  
P - ISSN 2984-7842  
E - ISSN 1908-3181

On the other hand, item no. 10, "the interactive e-book, in general, can enhance the skills of the users," obtained the lowest mean rating of 3.60, although described as "Highly Acceptable." This indicates that the proposed interactive e-book still considerably impacts skill development, although to a lesser degree, according to the Grade 10 mathematics teachers' perspectives.

Table 1. Level of acceptability of the proposed interactive e-book as an innovative supplementary material in Mathematics 10, along with adequacy

Indicators	Weighted Mean	Transmuted Rating
1. There are enough objectives in each lesson which clearly manifest the intended purpose to be measured.	3.83	HA
2. The discussions per topic are enough to fully realize the objectives of the lesson.	3.77	HA
3. The presentation is enough to manifest cohesiveness and unity of thoughts.	3.70	HA
4. The illustrations/samples are enough to facilitate understanding of the topics presented.	3.83	HA
5. There is enough variety of sample problems to gain mastery of the lesson.	3.63	HA
6. The instruction corresponds with the activities of the lesson.	3.57	HA
7. There are sufficient independent learning activities to develop the skills of the students and meet the objectives of the lesson.	3.70	HA
8. The scope is sufficient to cover the competencies.	3.67	HA
9. The assessment is enough to enhance the skills of the users	3.70	HA
10. The interactive e-book, in general, can enhance the skills of the users.	3.60	HA
<b>Overall Weighted Mean</b>	<b>3.70</b>	<b>HA</b>

Legend:

Mean Score Range	Descriptive Equivalent	Transmuted Rating
3.50-4.00	Strongly Agree	Highly Acceptable (HA)
2.50-3.49	Agree	Acceptable (A)
1.50-2.49	Disagree	Slightly Acceptable (SA)
1.00- 1.49	Strongly Disagree	Not Acceptable (NA)

Generally, the assessment of the level of acceptability in terms of adequacy of the proposed interactive e-book as a supplementary innovative material in Mathematics 10 provides valuable insights into the sufficiency of the discussions, activities, examples, and assessment of the material to address the least learned competencies in the subject.

Materials that include opportunities for active learning, such as discussions, exercises, and activities, have been found to promote deeper processing of information and increase students' achievement outcomes (Wang & Turner, 2018; Salendab & Dapitan, 2021b; Sanchez, 2020a). Wang and Turner (2018) further suggests that when students are actively engaged in learning through materials incorporating interactive elements, they are more likely to remember and apply the information learned. Therefore, the sufficiency of discussion, exercises, and activities in a learning resource is essential for promoting student engagement, retention, and learning outcomes (Salendab & Sanchez, 2023; Sanchez, 2020b; Sanchez & Sarmiento, 2020).

Table 2 reflects the level of acceptability of the proposed interactive e-book as an innovative supplementary material in Mathematics 10, along with appropriateness.

Appropriateness refers to the degree to which the materials are suitable for the intended learners in terms of their age, maturity level, cultural background, and language proficiency. Appropriateness also involves ensuring that the materials are free from bias and stereotypes and promoting inclusivity and diversity (Bates, 2019).

As shown in the table, based on the evaluation of the Grade 10 mathematics teachers, the level of acceptability of the proposed interactive e-book as an innovative supplementary material in Mathematics 10, along



**ETCOR** Educational Research Center  
PHILIPPINES  
Sta. Ana, Pampanga, Philippines



**iJOINED ETCOR**  
P - ISSN 2984-7567  
E - ISSN 2945-3577  
**The Exigency**  
P - ISSN 2984-7842  
E - ISSN 1908-3181



Website: <https://etcor.org>



with appropriateness, obtained an overall weighted mean of 3.70, described as "Highly Acceptable." All ten (10) indicators were rated as "Highly Acceptable," with weighted means ranging from 3.60 to 3.77. This result means that the e-book as a supplementary innovative material in Mathematics 10 is suitable to the needs and interests of the intended learners.

Of the ten (10) indicators, item no. 3 "The topics are suitably arranged and logically sequenced," item no. 8, "the interactive e-book caters to immediate needs of the learners," and item no. 9, "the interactive e-book provides varied activities to sustain the interest of the learners" obtained the highest mean rating of 3.77 described as "Highly Acceptable." It can be deduced that the proposed interactive e-book as a supplementary material in Mathematics 10 demonstrates strong qualities in terms of logical sequencing, catering to immediate needs, and providing varied activities.

Table 2. Level of acceptability of the proposed interactive e-book as an innovative supplementary material in Mathematics 10, along with appropriateness

Indicators	Weighted Mean	Transmuted Rating
1. The organization and structure of the interactive e-book suits the most essential learning competencies prescribed in the Mathematics curriculum.	3.73	HA
2. There is consistency between the learning competency and the activities made in the interactive e-book.	3.63	HA
3. The topics are suitably arranged and logically sequenced.	3.77	HA
4. The words used are simply worded for a better understanding of the topic.	3.70	HA
5. There is the suitability of the presentations made based on the kind of discipline it manifests.	3.70	HA
6. The illustrations and diagrams are suitable for the understanding of the topics.	3.70	HA
7. The evaluation exercises are arranged to suit the objectives of each topic.	3.63	HA
8. The interactive e-book caters immediate needs of the learners.	3.77	HA
9. The interactive e-book provides varied activities to sustain the interest of the learners	3.77	HA
10. In general, the interactive e-book material suits to the intended learners.	3.60	HA
<b>Overall Weighted Mean</b>	<b>3.70</b>	<b>HA</b>

Legend:

Mean Score Range	Descriptive Equivalent	Transmuted Rating
3.50-4.00	Strongly Agree	Highly Acceptable (HA)
2.50-3.49	Agree	Acceptable (A)
1.50-2.49	Disagree	Slightly Acceptable (SA)
1.00- 1.49	Strongly Disagree	Not Acceptable (NA)

On the other hand, item no. 10, "the interactive e-book material suits to the intended learners," obtained the lowest mean rating of 3.60, although described as "Highly Acceptable." This suggests that despite the low rating, the Grade 10 mathematics teachers still found the alignment between the e-book and the needs of the learners.

Generally, the high level of acceptability in terms of appropriateness of the interactive e-book is a strong indicator of the quality of the material as a supplementary learning resource. It also implies that the e-book is well-designed and effective in supporting learners' needs, interests, and goals and is likely to positively impact their learning outcomes.

This could be associated with the findings that incorporating appropriate discussion, exercises, and activities into learning resources such as worktext, workbooks, e-books, etc., can positively impact learning outcomes, particularly for learners with diverse needs (Pituch & Lee, 2016). The authors also noted that such activities provide





**ETCOR** Educational Research Center  
PHILIPPINES  
Sta. Ana, Pampanga, Philippines



**iJOINED ETCOR**  
P - ISSN 2984-7567  
E - ISSN 2945-3577



Website: <https://etcor.org>



**The Exigency**  
P - ISSN 2984-7842  
E - ISSN 1908-3181

opportunities for students to apply and practice their skills in meaningful contexts, receive immediate feedback, and engage in social interactions with peers and teachers.

Table 3 indicates the level of acceptability of the proposed interactive e-book as an innovative supplementary material in Mathematics 10, along with coherence.

Coherence refers to the degree to which the materials are logically structured and organized and the content is presented clearly and concisely. Coherence also involves ensuring that the materials are aligned with the learning objectives and outcomes and that the content is connected and builds upon previous knowledge and skills (Bates, 2019).

Table 3. Level of acceptability of the proposed interactive e-book as an innovative supplementary material in Mathematics 10, along with coherence

Indicator	Weighted Mean	Transmuted Rating
1. The objectives aptly support the prescribed standards in the Mathematics curriculum.	3.60	HA
2. The objectives fittingly promote the development of the student's critical thinking and problem-solving skills.	3.60	HA
3. The concepts and procedures which are clearly and accurately presented are useful to equip the students to become well-informed.	3.67	HA
4. The illustrations/samples are aligned to the instructional content.	3.60	HA
5. The instructional content and the designed learning experiences are appropriate to students' stages of development and instructional needs.	3.53	HA
6. The activities in the interactive e-book provide practical work to the learners.	3.57	HA
7. The activities included in the interactive e-book develop creativity and resourcefulness	3.73	HA
8. The interactive e-book provides relevant information and relevant activities for better understanding of the topic.	3.67	HA
9. The activities of the material conform with the concepts discussed.	3.63	HA
10. The presentation is enough to manifest cohesiveness and unity of thoughts.	3.60	HA
<b>Overall Weighted Mean</b>	<b>3.62</b>	<b>HA</b>

Legend:

Mean Score Range	Descriptive Equivalent	Transmuted Rating
3.50-4.00	Strongly Agree	Highly Acceptable (HA)
2.50-3.49	Agree	Acceptable (A)
1.50-2.49	Disagree	Slightly Acceptable (SA)
1.00- 1.49	Strongly Disagree	Not Acceptable (NA)

As reflected in the table, the level of acceptability of the proposed interactive e-book as an innovative supplementary material in Mathematics 10, along with coherence based on the evaluation of the Grade 10 mathematics teachers, obtained an overall weighted mean of 3.62, described as "Highly Acceptable." This means that the interactive e-book adheres to the requirements prescribed in the curriculum for Mathematics 10 concerning the discussion, activities, exercises, and assessments.

Moreover, it can be gleaned that all ten (10) indicators were rated as "Highly Acceptable," with weighted means ranging from 3.53 to 3.73. Among the indicators, item no. 8, "provides relevant information and relevant activities for better understanding," obtained the highest weighted mean of 3.73, described as "Highly Acceptable." This means that teachers perceived that the proposed material seeks to provide students with opportunities to think critically, apply knowledge in new ways, and develop practical skills that are relevant to real-world situations. The activities included in the interactive e-book involved problem-solving tasks, brainstorming exercises, design



**ETCOR** Educational Research Center  
PHILIPPINES  
Sta. Ana, Pampanga, Philippines



**iJOINED ETCOR**  
P - ISSN 2984-7567  
E - ISSN 2945-3577  
**The Exigency**  
P - ISSN 2984-7842  
E - ISSN 1908-3181



Website: <https://etcor.org>



challenges, or other activities that required students to think creatively and use available resources in innovative ways.

On the other hand, item no. 5, "the instructional content and the designed learning experiences are appropriate to students' stages of development and instructional needs," obtained the lowest mean rating of 3.53, although rated as "Highly Acceptable." This means that the material considers the cognitive, social, emotional, and physical development of students in Mathematics 10 and is designed to meet their instructional needs, including specific learning goals, skill development, and reinforcement of concepts, particularly the least learned competencies.

According to Wang, Guo, and Chen (2018), coherent instructional materials that align with the learning competencies and students' prior knowledge and experience can enhance students' learning outcomes, increase their motivation, and improve students' understanding and retention of new information.

Table 4 presents the level of acceptability of the proposed interactive e-book as an innovative supplementary material in Mathematics 10, along with its usefulness.

Usefulness refers to the degree to which the materials are practical and applicable to the learners' needs and interests. Useful instructional materials are relevant and valuable to the learners and help them to achieve their learning objectives and goals (UNESCO, 2013).

Table 4. Level of acceptability of the proposed interactive e-book as an innovative supplementary material in Mathematics 10 along with usefulness

Indicators	Weighted Mean	Transmuted Rating
1. The interactive e-book offers a more engaging and dynamic learning experience, allowing learners to interact with the content in a way that traditional materials cannot.	3.77	HA
2. The interactive e-book provides a range of multimedia options, including videos, audio recordings, and interactive graphics, which can enhance learning and retention.	3.73	HA
3. The interactive e-book can be customized to meet the needs of individual learners, offering a personalized learning experience.	3.70	HA
4. The interactive e-book can be updated and revised easily, ensuring that the content remains current and accurate.	3.67	HA
5. The interactive e-book can be accessed from anywhere, at any time, making learning more convenient and flexible.	3.73	HA
6. The interactive e-book is cost-effective, reducing the need for physical textbooks and other instructional materials.	3.63	HA
7. The interactive e-book can be used to teach a variety of mathematical skills	3.67	HA
8. The interactive e-book provides immediate feedback to learners, helping them identify improvement areas and adjust their learning strategies accordingly.	3.57	HA
9. The interactive e-book is easy to navigate and use.	3.60	HA
10. The interactive e-book fosters a sense of community and collaboration, with interactive features allowing learners to interact and share ideas.	3.70	HA
<b>Overall Weighted Mean</b>	<b>3.68</b>	<b>HA</b>

Legend:

Mean Score Range	Descriptive Equivalent	Transmuted Rating
3.50-4.00	Strongly Agree	Highly Acceptable (HA)
2.50-3.49	Agree	Acceptable (A)
1.50-2.49	Disagree	Slightly Acceptable (SA)
1.00- 1.49	Strongly Disagree	Not Acceptable (NA)

It can be observed from the table that based on the evaluation of Grade 10 mathematics teachers on the level of acceptability of the proposed interactive e-book as an innovative supplementary material in Mathematics 10



**ETCOR Educational Research Center PHILIPPINES**  
Sta. Ana, Pampanga, Philippines



**iJOINED ETCOR**  
P - ISSN 2984-7567  
E - ISSN 2945-3577  
**The Exigency**  
P - ISSN 2984-7842  
E - ISSN 1908-3181



Website: <https://etcor.org>



along with usefulness obtained an overall weighted mean of 3.68 described as "Highly Acceptable." This means that the Grade 10 mathematics teachers found the e-book to be useful in enhancing students' learning of Mathematics 10, particularly in addressing the least learned competencies.

In a specific manner, the table reveals that item no. 1, "the interactive e-book offers a more engaging and dynamic learning experience, allowing learners to interact with the content in a way that traditional materials cannot," obtained the highest weighted mean of 3.77, described as "Highly Acceptable." It could be interpreted to mean that the Grade 10 mathematics teachers highly appreciate the interactive and engaging nature of the e-book that will allow learners to interact with the content in ways that are not possible with traditional materials. This also suggests that this particular feature of the interactive e-book has a high level of acceptability and adds value to the learning experience.

On the other hand, item no. 8, "the interactive e-book provides immediate feedback to learners, helping them to identify areas for improvement and adjust their learning strategies accordingly," obtained the lowest mean rating of 3.57 though rated as "Highly Acceptable." This means that providing immediate feedback to learners is considered an important and helpful feature of interactive e-books, even if it did not receive the highest rating in the survey or evaluation.

This finding could be associated with the study of Bhatti and Ashraf (2019) and Sanchez, Sanchez and Sanchez (2023), which revealed that the use of e-learning materials was a significant predictor of students' satisfaction with the learning experience.

Table 5 presents the level of acceptability of the proposed interactive e-book as an innovative supplementary material in Mathematics 10, along with graphics and design.

Graphics and design refer to the visual elements and layout of the materials, which can enhance the learners' engagement and understanding of the content. Graphics and design can include images, diagrams, charts, and typography, as well as the layout, color scheme, and overall aesthetic of the materials (Clark & Lyons, 2011).

Table 5. Level of acceptability of the proposed interactive e-book as an innovative supplementary material in Mathematics 10, along with graphics and design

Indicators	Weighted Mean	Transmuted Rating
1. Media elements are of sufficiently high quality.	3.53	HA
2. There is complete synchronization of audio with the visuals.	3.50	HA
3. Music and sound effects are appropriate and effective for instructional purposes.	3.53	HA
4. Screen displays (text) are uncluttered, easy to read, and aesthetically pleasing.	3.57	HA
5. Visual presentations (non-text) are clear and easy to understand.	3.70	HA
6. Visuals sustain interest and do not distract the user's attention.	3.67	HA
7. Visuals provide an accurate representation of the concept discussed.	3.60	HA
8. The design allows the target user to navigate freely through the interactive e-book.	3.63	HA
9. It uses graphics, sound, and color to augment the content	3.67	HA
10. The interactive e-book can easily and independently be used.	3.70	HA
<b>Overall Weighted Mean</b>	<b>3.61</b>	<b>HA</b>

Legend:

Mean Score Range	Descriptive Equivalent	Transmuted Rating
3.50-4.00	Strongly Agree	Highly Acceptable (HA)
2.50-3.49	Agree	Acceptable (A)
1.50-2.49	Disagree	Slightly Acceptable (SA)
1.00- 1.49	Strongly Disagree	Not Acceptable (NA)

As revealed in the table, the level of acceptability of the proposed interactive e-book as an innovative supplementary material in Mathematics 10, along with graphics and design as evaluated by the Grade 10 mathematics teachers, obtained an overall weighted mean of 3.61, described as "Highly Acceptable." This could be interpreted to mean that the graphics and design of the interactive e-book as a supplementary innovative material



**ETCOR** Educational Research Center  
PHILIPPINES  
Sta. Ana, Pampanga, Philippines



**iJOINED ETCOR**  
P - ISSN 2984-7567  
E - ISSN 2945-3577  
**The Exigency**  
P - ISSN 2984-7842  
E - ISSN 1908-3181



Website: <https://etcor.org>



were viewed favorably by the teachers who evaluated it. This rating also could mean that the material was visually appealing, well-organized, and effectively presented.

By looking closely at the table, it is indicated that item no. 5, "visual presentations (non-text) are clear and easy to understand," and item no. 9, "the interactive e-book can easily and independently be used," obtained the highest mean rating of 3.70, described as "Highly Acceptable". This means that the visuals or graphics included in the e-book are presented in a way that is easily understandable by the learners. Likewise, it is designed in such a way that it is user-friendly and can be used by learners without the need for significant external guidance or assistance from the teachers.

On the other hand, item no. 2, "there is complete synchronization of audio with the visuals, if any," obtained the lowest mean rating of 3.50, although described as "Highly Acceptable." This means that the audio embedded in the e-book (spoken words, music, sound effects, etc.) is properly matched with the visuals (images, animations, videos, etc.) in a way that creates a seamless and coherent learning experience.

Generally, the interactive e-book uses high-quality graphics and designs, which help to create a visually appealing and engaging instructional resource, which in turn increases learners' interest and motivation toward the subject matter. As indicated by Christou et al. (2018) in their study that learners who were exposed to e-books with a visually appealing design reported higher levels of engagement and motivation compared to those who were exposed to e-books with a plain design.

Table 6 presents the level of acceptability of the proposed interactive e-book as a supplementary innovative material in Mathematics 10, along with illustrations.

Illustrations refer to visual representations, such as drawings, photographs, or diagrams, used to enhance and support the understanding of the content (Clark & Lyons, 2011). Illustrations can provide a clear and concise representation of the content, making it easier for learners to comprehend complex ideas and concepts.

Table 6. Level of acceptability of the proposed interactive e-book as a supplementary innovative material in Mathematics 10, along with illustrations

Indicators	Weighted Mean	Transmuted Rating
1. Simple and easily recognizable.	3.73	HA
2. Clear and supplement the text.	3.83	HA
3. Properly labeled or captioned.	3.70	HA
4. Realistic / appropriate colors.	3.63	HA
5. Attractive and appealing.	3.70	HA
6. Culturally sensitive and inclusive, reflecting diverse perspectives and experiences.	3.77	HA
7. Creative and imaginative, sparking the reader's curiosity and encouraging them to explore the content further.	3.57	HA
8. Aesthetically pleasing and engages the reader with its vivid colors and attractive design.	3.77	HA
9. Free from any social content violations.	3.67	HA
10. Relevant to different learning styles, catering to visual learners and providing an effective way to present information.	3.77	HA
<b>Overall Weighted Mean</b>	<b>3.71</b>	<b>HA</b>

Legend:

Mean Score Range	Descriptive Equivalent	Transmuted Rating
3.50-4.00	Strongly Agree	Highly Acceptable (HA)
2.50-3.49	Agree	Acceptable (A)
1.50-2.49	Disagree	Slightly Acceptable (SA)
1.00- 1.49	Strongly Disagree	Not Acceptable (NA)

As indicated in the table, the level of acceptability of the proposed supplementary material in Mathematics 10, along with illustrations as evaluated by the Grade 10 mathematics teachers, obtained an overall weighted mean



**ETCOR** Educational Research Center  
PHILIPPINES  
Sta. Ana, Pampanga, Philippines

INTERNATIONAL  
MULTIDISCIPLINARY  
RESEARCH CONFERENCE



Website: <https://etcor.org>



**iJOINED ETCOR**  
P - ISSN 2984-7567  
E - ISSN 2945-3577



**The Exigency**  
P - ISSN 2984-7842  
E - ISSN 1908-3181

of 3.71, described as "Highly Acceptable." This means that the illustrations in the e-book are clear and concise and support learners' comprehension of mathematical concepts. They are effective in conveying complex information in a simplified and easy-to-understand manner.

All ten (10) indicators were rated "Highly Acceptable," with item no. 2, "clear and supplement the text," being the highest, with a weighted mean of 3.83. This means that the e-book provides illustrations that support and enhance the understanding of the text, making it easier for students to comprehend the material.

On the other hand, item no. 7 "creative and imaginative, sparking the reader's curiosity and encouraging them to explore the content further." obtained the lowest weighted mean of 3.57 although described as "Highly Acceptable." This means that creativity and imagination are considered important features in the illustrations of an interactive e-book, as they can help to engage and encourage readers to explore the content more deeply. Even though it did not receive the highest rating, this feature is still considered highly acceptable and adds value to the overall learning experience.

In general, the high level of acceptability of the proposed interactive e-book as a supplementary innovative material in Mathematics 10, along with illustrations, signifies that the e-book embedded illustrations appropriate with the context of the subject matter to support students' needs, particularly on the least learned competencies.

As indicated by Hashim and Vongkulluskn (2016) and Sanchez, et al. (2022), illustrations positively impact learning as they can improve the understanding and retention of the material.

### Summary, Conclusions, and Recommendations

The analysis of diagnostic test results in Mathematics 10 identified the competencies where students struggled the most, including determining geometric means, graphing geometric figures, understanding combination and permutation, and illustrating measures of position. To address these challenges, an interactive e-book was proposed as a supplementary material, which received high acceptability ratings from Grade 10 mathematics teachers, indicating its potential to enhance student engagement and understanding. The comprehensive nature of the e-book, with clear explanations and interactive elements, ensures its suitability for students at different levels.

The findings emphasize the need for innovative intervention materials in Mathematics 10. The proposed interactive e-book presents a solution to address the least learned competencies, promoting student performance and understanding. The positive evaluation by teachers supports its potential effectiveness.

It is recommended to adopt the proposed interactive e-book as an instructional material in Mathematics 10. Likewise, further research should be conducted to evaluate its effectiveness through pilot testing, involving IT experts and English teachers to ensure comprehensive evaluation of its multimedia elements and language clarity. This evaluation will provide insights into the e-book's impact on student learning outcomes and guide potential improvements.

### Acknowledgement

We express our sincere appreciation to the Schools Division Office of Urdaneta City as a place to carry out this study. We are grateful to our family for their unwavering support, love, care, understanding, and prayers throughout this endeavor. We would also like to extend our thanks to all those who have made significant contributions to the successful completion of this research. Above all, we acknowledge the Almighty God, the ultimate source of knowledge and wisdom, for His continuous guidance, protection, and strength that enabled us to undertake and accomplish this endeavor.

### REFERENCES

- Amihan, S. R., & Sanchez, R. D. (2023). Connecting Workplace Literacy Gaps through Innovative Academe-Industry Collaboration. *International Journal of Open-access, Interdisciplinary and New Educational Discoveries of ETCOR Educational Research Center (iJOINED ETCOR)*, 2(2), 515-528.
- Bates, T. (2016). Teaching in a Digital Age: guidelines for designing teaching and learning. [https://teachonline.ca/sites/default/files/pdfs/teaching-in-a-digital-age\\_2016.pdf](https://teachonline.ca/sites/default/files/pdfs/teaching-in-a-digital-age_2016.pdf)
- Bates, A. W. (2019). Teaching in a digital age: Guidelines for designing teaching and learning. Tony Bates Associates Ltd.



**ETCOR** Educational Research Center  
PHILIPPINES  
Sta. Ana, Pampanga, Philippines



Website: <https://etcor.org>



**iJOINED ETCOR**  
P - ISSN 2984-7567  
E - ISSN 2945-3577



**The Exigency**  
P - ISSN 2984-7842  
E - ISSN 1908-3181

- Bhatti, R. A., & Ashraf, M. (2019). Assessment of the usefulness of e-learning materials in higher education: Evidence from Pakistan. *Journal of Education and Practice*, 10(1), 24-31.
- Campilla, J., Cabuslay, R., Cabanlig, R., Obedoza, E., Pascua, J., Aben, K. (2016). Proposed Workbook in History of Mathematics. Unpublished Research. Urdaneta City University. Urdaneta City, Pangasinan, Philippines.
- Campilla, J., & Castañaga, V. A. (2021). Teaching Strategies Utilized by Mathematics Teachers in the 21st-Century. *International Journal of Sciences: Basic and Applied Research (IJSBAR)*, 59(2), 140-160. Retrieved from <https://www.gssrr.org/index.php/JournalOfBasicAndApplied/article/view/12854>
- Carvajal, A. L. P., & Sanchez, R. D. (2023). Strategic Considerations, Challenges, and Opportunities in Establishing the International Journal of Open-access, Interdisciplinary, and New Educational Discoveries (iJOINED). *International Journal of Open-access, Interdisciplinary and New Educational Discoveries of ETCOR Educational Research Center (iJOINED ETCOR)*, 2(2), 539-546.
- Christou, C., Hadjicharalambous, C., & Soteriou, A. (2018). The impact of visual design on student engagement in an e-book learning environment. *Computers in Human Behavior*, 80, 45-54.
- Clark, R. C., & Lyons, C. (2011). Graphics for learning: Proven guidelines for planning, designing, and evaluating visuals in training materials. John Wiley & Sons.
- Davidson, A. (2019). Adequacy and acceptability of educational resources: A review of the literature. *Educational Research Review*, 27, 36-43. doi: 10.1016/j.edurev.2019.04.001
- Division Memorandum No. 435, s. 2022. (October 28, 2022). Call for Submission of Learning Resource Materials for Quality Assurance. Department of Education, Schools Division Office of Urdaneta City.
- Dizon, E. C., & Sanchez, R. D. (2020). Improving select grade 7 Filipino students' reading performance using the eclectic model. *Journal of World Englishes and Educational Practices*, 2(2), 216-221.
- Fathima, S. A., & Leema Rose, T. (2018). A review on the use of multimedia in teaching mathematics. *International Journal of Engineering & Technology*, 7(2.7), 54-58.
- Gross, J. (2018). Document analysis. In B. Frey (Ed.), *The SAGE encyclopedia of educational research, measurement, and evaluation* (pp. 545-548). SAGE Publications, Inc., <https://dx.doi.org/10.4135/9781506326139.n209>
- Halton, C. (2019). Digital Native. <https://www.investopedia.com/terms/d/digitalnative.asp>
- Hashim, H. A., & Vongkulluskn, V. (2016). The role of illustrations in enhancing learning: A review. *Education in Medicine Journal*, 8(3), 51-60.
- Hizon, I. R. (2018, October 13). The Importance of Instructional Materials. Press Reader. <https://www.pressreader.com/philippines/sunstar-pampanga/20181013/281681140839189>
- Karpicke, J. D., & Roediger III, H. L. (2007). Expanding retrieval practice promotes short-term retention, but equally spaced retrieval enhances long-term retention. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 33(4), 704-719.
- Koh, H. and Herring, S.C. (2016), "Historical insights for e-book design", Library Hi Tech, Vol. 34 No. 4, pp. 764-786. <https://doi.org/10.1108/LHT-06-2016-0075>
- McCombes, S. (2022). *Descriptive Research | Definition, Types, Methods & Examples*. Scribbr. Retrieved November 25, 2022, from <https://www.scribbr.com/methodology/descriptive-research/>



**ETCOR** Educational Research Center  
PHILIPPINES  
Sta. Ana, Pampanga, Philippines



**iJOINED ETCOR**  
P - ISSN 2984-7567  
E - ISSN 2945-3577  
**The Exigency**  
P - ISSN 2984-7842  
E - ISSN 1908-3181

- Munir, M. (2016). Digital Learning. CV Alfabeta.
- Muñoz, M. C., & Sanchez, R. D. (2023). Exploring Fernandino Teens TV as a supplementary learning delivery modality: Opportunities and challenges from the lens of select learners. *International Journal of Open-access, Interdisciplinary and New Educational Discoveries of ETCOR Educational Research Center (iJOINED ETCOR)*, 2(1), 358-374.
- Murcia, M. (2006). Teaching English as a Second or Foreign Language. Singapore: Thomson Learning Asia.
- National Council of Teachers of Mathematics. (2014). Principles to Actions: Ensuring Mathematical Success for All. Reston, VA: Author.
- Olayanki, A. R. B. (2016). Effects of Instructional Materials on Secondary Schools Students' Academic Achievement in Social Studies in Ekiti State, Nigeria. *World Journal of Education*, 6(1), 32-39. <https://doi.org/10.5430/wje.v6n1p32>
- Pal, S., Cuong, T. Nehru, R. (2021). Digital Education Pedagogy: Principles and Paradigms. Apple Academic Press, Inc. [https://books.google.com.ph/books?hl=en&lr=&id=bLICEAAAQBAJ&oi=fnd&pg=PA133&dq=use+of+kotobee&ots=mFbzt2yBv1&sig=8uxTTOjJxbMuKJzk6ADwQbl6fpo&redir\\_esc=y#v=onepage&q=use%20of%20kotobee&f=false](https://books.google.com.ph/books?hl=en&lr=&id=bLICEAAAQBAJ&oi=fnd&pg=PA133&dq=use+of+kotobee&ots=mFbzt2yBv1&sig=8uxTTOjJxbMuKJzk6ADwQbl6fpo&redir_esc=y#v=onepage&q=use%20of%20kotobee&f=false)
- Pituch, K. A., & Lee, Y.-J. (2016). The impact of worktext features on student learning outcomes: A synthesis of research. *Educational Research Review*, 19, 68-85.
- Radovic, S.; Radojicic, M.; Veljkovic, K.; Maric, M. (2020) Examining the effects of Geogebra applets on mathematics learning using interactive mathematics textbook, *Interactive Learning Environments*, 28:1, 32-
- Republic Act 10533. (May 15, 2013). An act enhancing the Philippine basic education system by strengthening its curriculum and increasing the number of years for basic education, appropriating funds therefor and for other purposes. <https://www.officialgazette.gov.ph/2013/05/15/republic-act-no-10533/>
- Roediger III, H. L., & Butler, A. C. (2011). The critical role of retrieval practice in long-term retention. *Trends in Cognitive Sciences*, 15(1), 20-27.
- Rogayan, D., Dollete, L. (2019). Development and Validation of Physical Science Workbook in Senior High School. *Science Education International*, (4), 284-290. <https://doi.org/10.33828/sei.v30.i4.5>
- Salendab, F. A. (2021). Effectiveness of Performance-Based Assessment Tools (PBATs) and the Students' Academic Performance. *Turkish Journal of Computer and Mathematics Education (TURCOMAT)*, 12(10), 6919-6928.
- Salendab, F. A. (2023). Proposed Instructional Scheme in the New Normal Education: Basis for Pedagogical Strategies/Practices. *Psychology and Education: A Multidisciplinary Journal*, 6(8), 712-719. <https://doi.org/10.5281/zenodo.7502764>
- Salendab, F. A., & Akmad, S. P. (2023). A Personal Narrative Experience of Teachers Teaching Purposive Communication During the New Normal Education. *International Journal of Multidisciplinary: Applied Business and Education Research*, 4(5), 1590-1601. <https://doi.org/10.11594/ijmaber.04.05.20>
- Salendab, F. A., & Cogo, D. A. (2022). Implementation of Alternative Learning System: Basis for Policy Review and Recommendation. *Journal of Positive School Psychology*, 5457-5467.
- Salendab, F. A., & Dapitan, Y. C. (2020). Accuracy of Use of Alternative Language Assessment (ALA) Tools and the Students' Performance. *Psychology And Education*, 57(9), 6679-6688.



**ETCOR** Educational Research Center  
PHILIPPINES  
Sta. Ana, Pampanga, Philippines



Website: <https://etcor.org>



**iJOINED ETCOR**  
P - ISSN 2984-7567  
E - ISSN 2945-3577



**The Exigency**  
P - ISSN 2984-7842  
E - ISSN 1908-3181

- Salendab, F. A., & Dapitan, Y. C. (2021). School Heads' Administrative Supervision: Its Relation to the Program Accreditation of Private Higher Education Institutions (PHEIs) in Region XII. *Turkish Journal of Computer and Mathematics Education*, 12(13), 194-202.
- Salendab, F. A., & Dapitan, Y. C. (2021). Performance of Private Higher Education Institutions and the School Heads' Supervision in South Central Mindanao. *Psychology and Education*, 58(3), 3980-3997.
- Salendab, F. A., & Laguda, J. L. (2023). Learning Purposive Communication: A Personal Narrative Experience of Non-Teacher Education Students. *International Journal of Multidisciplinary: Applied Business and Education Research*, 4(5), 1682-1696.
- Salendab, F. A., & Sanchez, R. D. (2023). Graduates Tracer Study: The Employability Status of Bachelor of Elementary Education (BEED) of Sultan Kudarat State University – Kalamansig Campus. *International Journal of Open-access, Interdisciplinary and New Educational Discoveries of ETCOR Educational Research Center (iJOINED ETCOR)*, 2(2), 642-655
- Sanchez, A. M. P. (2022). HR practitioners' perceptions on boosting employees' loyalty and commitment: Inputs for a 21st century-responsive human resource system. *International Journal of Open-access, Interdisciplinary and New Educational Discoveries of ETCOR Educational Research Center (iJOINED ETCOR)*, 1(4), 89-102.
- Sanchez, R. (2023). Utilization of the daily lesson logs: An evaluation employing the CIPP model. *International Journal of Open-access, Interdisciplinary and New Educational Discoveries of ETCOR Educational Research Center (iJOINED ETCOR)*, 2(1), 199-215.
- Sanchez, R. D. (2023). Unveiling the moral-theological foundations of the nullity of marriage due to psychological incapacity. *International Journal of Open-access, Interdisciplinary and New Educational Discoveries of ETCOR Educational Research Center (iJOINED ETCOR)*, 2(1), 397-404.
- Sanchez, R. D. (2020, December 28). Parent-Teacher Collaboration in the Time of Pandemic. SunStar Pampanga. Retrieved from <https://www.pressreader.com/philippines/sunstar-pampanga/20201228/281608128046465>
- Sanchez, R. D. (2020, December 29). Three Qualities of a Successful Leader. SunStar Pampanga. Retrieved from <https://www.pressreader.com/philippines/sunstar-pampanga/20201229>
- Sanchez, R., & Sarmiento, P. J. (2020). Learning together hand-in-hand: An assessment of students' immersion program in a schools division. *International Journal of Research Studies in Education*, 9(1), 85-97.
- Sanchez, R., Sarmiento, P. J., Pangilinan, A., Guinto, N., Sanchez, A. M., & Sanchez, J. J. (2022). In the name of authentic public service: A descriptive phenomenological study on the lives of Filipino teachers in select coastal villages. *International Journal of Open-access, Interdisciplinary and New Educational Discoveries of ETCOR Educational Research Center (iJOINED ETCOR)*, 1(1), 35-44.
- Sanchez, R. D., Sanchez, A. M. P., & Sanchez, J. J. D. (2023). Delving into the Integration of Research Subjects in the Junior High School Curriculum from the Learners' Point of View. *International Journal of Open-access, Interdisciplinary and New Educational Discoveries of ETCOR Educational Research Center (iJOINED ETCOR)*, 2(1), 432-442.
- Sehn, T. M., & Frago, S. (2015). The synergy between e-books and printed books in Brazil. *Online Information Review*, 39(3), 401-415.
- UNESCO. (2013). Guidelines for the Preparation of All-Language Teaching and Learning Materials. Retrieved from <https://unesdoc.unesco.org/ark:/48223/pf0000223149>





**ETCOR** Educational Research Center  
PHILIPPINES  
Sta. Ana, Pampanga, Philippines

INTERNATIONAL  
MULTIDISCIPLINARY  
RESEARCH CONFERENCE



Website: <https://etcor.org>



ISSN



**iJOINED ETCOR**  
P - ISSN 2984-7567  
E - ISSN 2945-3577



**The Exigency**  
P - ISSN 2984-7842  
E - ISSN 1908-3181

UNESCO. (2013). Guidelines for the development of open educational resources policies. Paris: UNESCO.

Wahyuningsih, D., Wahyono, S. B., Nugroho, A. A. (2021). Teachers' Difficulties in Developing Learning Resources. The 2nd International on Meaningful Education (2nd ICMEd), KnE Social Sciences, pages 665–679. DOI 10.18502/kss.v6i2.10024

Wang, M. T., & Turner, J. C. (2018). Active learning through worktexts: Examining the impact of worktext features on achievement outcomes. *Journal of Educational Psychology*, 110(7), 1031-1046.

Wang, S. H., Guo, J. C., & Chen, S. M. (2018). Effectiveness of cooperative learning and concept mapping intervention in a health informatics course. *Nurse Education Today*, 63, 44-49.

Yani, S., & Siwi, M. (2020). Analysis of the Use of Social Media and Digital Learning Resources in Learning for Digital Native Students at SMAN 2 Painan. *Journal of Economic Education*, 13(1), 1–7. <https://doi.org/10.17977/um014v13i12020p001>