DEVELOPMENT AND ACCEPTABILITY OF AN ELECTRONIC PROBLEM-BASED LEARNING MODULE INTEGRATING 5C's IN TEACHING MATHEMATICS OF INVESTMENT



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Development and Acceptability of an Electronic Problem-Based Learning Module Integrating 5C's in Teaching Mathematics of Investment

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Abstract

Digital tools and student-centered strategies like PBL are increasingly vital for developing problem-solving skills in complex mathematical subjects, such as Mathematics of Investment. This study developed and evaluated an electronic Problem-Based Learning module in teaching Mathematics of Investment among Grade 11 HUMSS students. Prior research supports the integration of multimedia elements such as text, illustrations, images, and infographics as effective tools for enhancing mathematical problem-solving skills. To address this instructional gap, the study employed a Research and Development (R&D) design guided by the ADDIE model, involving 50 students and nine experts in mathematics, media, and language. Diagnostics identified students struggle with annuities and interest calculations, prompting to design an ePBL module via Canva and Hyzine. This e-module embedded multimedia elements within the 5C framework (Connect, Comprehend, Collaborate, Create, Critique) to address learning gaps. Three mathematics education experts validated and rated the ePBL module highly in terms of content (M=3.71, SD=0.23) alignment with learning objectives, format (M=3.72, SD=0.29) for clarity, presentation and organization (M=3.67, SD=0.24) for logical flow, accuracy (M=4.00, SD=0.00) for conceptual correctness. In addition, three language experts evaluated the ePBL module's language use (M=4.67, SD=0.33) was clear and appropriate, while three media experts assessed the integration of multimedia elements (M=4.53, SD=0.24) effectively enhanced comprehension. Students rated the ePBL module positively: content (M= 3.75, SD=0.34) for fostering critical thinking, presentation and organization (M=3.82, SD=0.05) for clarity, multimedia elements (M=3.73, SD=0.10) effectively enhanced engagement and supported comprehension, making the module a well-structured and engaging learning tool. The findings highlight ePBL's role in connecting abstract concepts to practical financial literacy, equipping students with actionable skills.

Keywords: Electronic Problem-Based Learning Module, problem-solving skills, ADDIE model, 5C framework, Research and Development (R&D).

Introduction

The Fourth Industrial Revolution (4IR), characterized by digital technologies, artificial intelligence, and automation, has reshaped education systems globally, compelling a transformation in how learning is structured and delivered. Schwab (2017) describes this shift as Industry 4.0, which demands that educational systems evolve to prepare students for the complexities of a technology-driven world. However, despite this global push towards digital integration, many classrooms worldwide, especially in mathematics, still rely on traditional methods, such as rote memorization, which fail to meet the cognitive and engagement needs of today's learners (Kivunja, 2014). This gap between evolving educational demands and outdated teaching practices has resulted in a mismatch, limiting students' ability to develop essential skills like critical thinking and problem-solving that are crucial for success in the modern workforce.

Mathematics education, particularly in the Philippines, has struggled to align with global standards. The 2019 PISA results revealed that Filipino students perform significantly below the global average in mathematics proficiency, particularly in applying mathematical concepts to real-world problems (OECD, 2019). This highlights the need for more innovative teaching methods that cultivate problem-solving skills and foster deeper understanding. Specifically, topics such as simple interest, compound interest, and annuities in Grade 11 General Mathematics present challenges when taught using static resources such as textbooks and worksheets, further emphasizing the need for more dynamic, interactive instructional strategies. Research has shown that electronic multimedia-based learning tools can significantly enhance problem-solving skills and comprehension. Clark and Mayer (2016) noted that the integration of digital resources can improve students' understanding and retention by catering to diverse learning styles. However, despite the increasing emphasis on problem-solving skills in mathematics education, many digital tools continue to focus primarily on content delivery, often overlooking the integration of problem-based (PBL) strategies that actively engage students in solving real-world problems. Specifically, while numerous educational technologies are available, few incorporate PBL methodologies, particularly in more complex mathematical concepts such as compound interest, annuities, and other advanced topics.

Recent studies highlight this issue. For instance, Powell (2018) asserts that while digital tools are widely used in education, many still lack the electronic problem-solving features essential for fostering critical thinking in mathematics. Similarly, Azizah et al. (2021) observed that while educational technology is effective in basic skill development, its impact on higher-order problem-solving, particularly in mathematics, remains limited. Tampubolon (2022) further emphasizes that PBL approaches, especially when integrated into digital platforms, can significantly enhance students' ability to apply theoretical concepts to real-world problems. Yet, these strategies are still underutilized in platforms designed for advanced mathematical topics. This indicates that despite the widespread availability of digital learning resources, there remains a significant gap in incorporating PBL methodologies that promote active

problem-solving and critical thinking, especially for complex mathematical concepts like those found in financial mathematics.

To address these challenges, this study developed and evaluated an electronic Problem-Based Learning (ePBL) module for Grade 11 Mathematics of Investment, guided by the 5C framework: Connect, Comprehend, Collaborate, Create, and Critique. The module aimed to enhance problem-solving skills through the use of multimedia elements such as text, images, infographics, and illustrations, creating a more engaging and interactive learning experience using Canva and Hyzine. By aligning with the digital expectations of Generation 4.0 learners, the ePBL module provides a more dynamic and effective approach than traditional methods. Ultimately, this study assessed the usability and instructional effectiveness of the ePBL module, offering insights into how digital tools can transform mathematics education. The findings contribute to the development of more effective teaching strategies and add to the growing body of research on integrating technology into education, particularly in fostering problem-solving skills in senior high school mathematics.

Research Questions

The study aimed to analyse, design, develop, implement, and evaluate an ePBL module in teaching Mathematics of Investment among Grade 11 students under the Humanities and Social Sciences (HUMSS). It answered the following questions:

- 1. What are the least learned competencies by the Grade 11 students?
- 2. What appropriate multimedia elements can be used based on the literature to address the least learned competencies?
- 3. What is the level of acceptability of the ePBL module as evaluated by experts in terms of:
 - 3.1. content;
 - 3.2. format;
 - 3.3. presentation and organization;
 - 3.4. accuracy and up-to-datedness;
 - 3.5. language; and
 - 3.6. 3.6 multimedia elements?
- 4. What are the students-participants' perceptions of the ePBL module in terms of:
 - 4.1. content;
 - 4.2. presentation and organization; and
 - 4.3. multimedia elements?

Methodology

Research Design

This research employed a Research and Development (R&D) approach, as outlined by Gall et al. (2007), to design and evaluate an electronic Problem-Based Learning (ePBL) module for teaching Mathematics of Investment. The R&D process is a systematic method used to develop educational materials that can be validated for both effectiveness and reliability. According to Juliándo (2019), the R&D process includes a detailed characterization, comparison, evaluation, and analysis of existing data, which makes it particularly suitable for developing instructional materials that address specific educational needs. The primary objective of this study was development, with a focus on implementing e-modules that incorporate PBL strategies, such as real-world problem-solving and student collaboration, to enhance mathematical learning. These modules were specifically designed for Mathematics of Investment and structured to promote problem-solving skills. To ensure the quality of the ePBL module, the development process followed a series of stages: analysis of the least learned competencies of grade 11 HUMSS students, design and development of the ePBL module, expert validation, implementation, and student-participation.

In the Analysis stage, the researcher assessed the least learned competencies of Grade 11 HUMSS students in Mathematics of Investment through a 45-item multiple-choice exam derived from the DepEd Grade 11 General Mathematics module. The data gathered was subjected to item analysis to determine which areas students struggled with the most. The results from this analysis informed the formulation of learning objectives and the selection of content for the ePBL module, ensuring it addressed the identified gaps effectively.

In the Design stage, multimedia elements such as text, images, illustrations, and infographics were selected based on relevant literature. Furthermore, during the Development stage, the researcher utilized Canva to create the ePBL module and integrate the selected multimedia elements. The instructional design was guided by the 5C framework (Connect, Comprehend, Collaborate, Create, and Critique). This framework represented a learner-centered approach that promoted active participation and deeper understanding. Connect focused on linking new knowledge to students' prior experiences. Comprehend ensured essential concepts were clearly understood through structured content. Collaborating emphasizes peer interaction and knowledge-sharing. Create encouraged application of learning through meaningful tasks, while Critique fostered reflection and self-assessment for continuous learning. After its creation, the module was formatted and published in HYZINE, an interactive digital platform, to enhance accessibility and user engagement.

Subsequently, the module underwent expert evaluation by professionals in mathematics education, media, and language to assess its content, format, presentation and organization, multimedia integration, and clarity of language. Feedback was gathered through

validation tools, including questionnaires and comments, and was used to refine the module prior to implementation.

During the Implementation phase, the ePBL module was introduced to Grade 11 students. The teacher provided the module to guide lesson delivery and to ensure its integration into the mathematics instruction. Lastly, the Evaluation phase focused on collecting student feedback regarding their perceptions of the ePBL module.

Respondents

The study's respondents and serves as validators were nine experts, with three experts rated the ePBL module in each of the following areas: media, language, and mathematics education, to ensure the module's content was comprehensive and aligned with best practices in each field. Also, part of the study were 50 Senior High School students from Ramon Magsaysay Memorial Colleges-Marbel Inc. SHS program enrolled in Grade 11 HUMSS during the School Year 2024-2025, across two sections of the HUMSS strand. Convenience non-random sampling was employed in selecting the respondents.

This study prioritizes HUMSS students over ABM or STEM groups due to their limited applied mathematics exposure. By integrating problem-solving skills into Mathematics of Investment, it bridges their quantitative competency gap, equipping them with essential skills for fields like economics and public administration.

Instrument

This study utilized three (3) sets of research instruments. The first set consisted of a multiple-choice test adopted from the Department of Education's (DepEd) Grade 11 General Mathematics module. To determine the least learned competencies, the study also employed a Competency Mastery Level Scale adopted from the DepEd PPST: Module 11.

The second set of research instruments was an adopted survey checklist based on the work of Rapada and Servañez (2024), designed to assess the acceptability of the ePBL module. It utilized a 4-point Likert scale, with 1 indicating "Not Acceptable" and 4 indicating "Highly Acceptable." to evaluate aspects such as content, format, accuracy, presentation and organization by the experts. Additionally, language acceptability and multimedia elements were assessed using a 5-point Likert scale, with 1 indicating "Not Acceptable" and 5 indicating "Very Highly Acceptable."

Lastly, student feedback on the acceptability of the ePBL was collected using a survey checklist adopted from the work of Rapada and Servañez (2024), which assessed their perceptions of the module's content, presentation and organization, and multimedia elements. The checklist employed a 4-point Likert scale, ranging from 1 ("Not Acceptable") to 4 ("Highly Acceptable").

Procedure

The researcher first sought approval from the principal and obtained informed consent from the parents of participating Grade 11 HUMSS students. Two sections from Ramon Magsaysay Memorial Colleges–Marbel Inc. SHS program were purposively selected based on their availability. Once approved, a 45-item multiple-choice test adopted from the DepEd Grade 11 General Mathematics module was administered to two sections to identify the least learned competencies.

Based on the findings and relevant literature, appropriate multimedia elements were selected. The ePBL module was then designed using Canva, guided by the 5C framework (Connect, Comprehend, Collaborate, Create, Critique), and published via Hyzine. It was validated by experts in mathematics, media, and language, and revised based on their feedback. In addition, the expert also rated the ePBL module.

The validated module was introduced in Grade 11 students, integrated into classroom instruction. Data collection involved student feedback using Likert-scale checklists adopted from Rapada and Servañez (2024), assessing content, presentation and organization, and multimedia elements. Data was collected, encoded, and prepared for statistical analysis.

Data Analysis

For the first research question, the data collected from the multiple-choice test were analyzed using descriptive statistics, including frequencies and percentages. The results were also categorized using the Competency Mastery Level Scale, with scores below 60 classified as "Least Learned," 61–79 as "Moderately Learned," and 80–100 as "Most Learned," to identify the least learned competencies among Grade 11 students.

For the second research question, relevant literature on multimedia elements was reviewed to determine appropriate strategies to address the identified least learned competencies. This did not involve statistical analysis but guided the selection of multimedia elements for the ePBL module.

To evaluate the acceptability of the ePBL module, responses from the expert evaluations were analyzed using a 4-point Likert scale for content, format, presentation, and accuracy, and a 5-point scale for language and multimedia elements. Descriptive statistics, such as mean and standard deviation, were calculated to determine the experts' level of acceptance for each aspect of the module.

Lastly, the student feedback was analyzed using a 4-point Likert scale to assess their perceptions of the module's content, presentation, and multimedia elements. The mean and standard deviation for each category provided an overall evaluation of the module's

acceptability from the students' perspectives.

Ethical Considerations

Several ethical guidelines must be followed to ensure the rights and welfare of participants in this research on the creation and evaluation of ePBL module for Grade 11 Mathematics of Investment. First, a fundamental ethical prerequisite was informed permission. The study's goal, procedures, and purpose shall be disclosed to all participants, including teachers and students. It was completely voluntary for participants to participate, and they could stop at any time without facing any repercussions. Regarding student participants, parental or guardian consent was also requested to ensure they were informed about and approved of their child's participation.

Protecting the participants' privacy also requires maintaining anonymity and confidentiality. Test scores, discussion answers, and personal data were handled with the utmost confidentiality. Participant identities were anonymized to guarantee that no identifiable information was revealed in the final research report. Sensitive data were stored via secure protocols, and only the researcher working on the project had access to it.

In addition, the non-maleficence principle was followed to guarantee that participants suffered no bodily, psychological, or emotional harm. Simultaneously, the research upheld the idea of beneficence by striving to offer advantages to the participants, namely by augmenting students' learning outcomes by creating efficient instructional resources.

Lastly, there was honesty and integrity in the research process. There was no data manipulation or false reporting of the outcomes. The study process, results, and constraints were openly revealed to preserve openness and retain all stakeholders' confidence in the research process.

Results and Discussion

This section presents the results and discussion of the study based from the order of the research questions.

Analysis

In the analysis stage, the researcher analyzed and assessed the least learned competencies in Mathematics of Investment for grade 11 HUMSS students using an adopted 45-item multiple-choice exam on the DepEd module.

Table 1.	Least Learned	Compe	tencies by	the	Grade 11	Students
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Competency	Frequency	Percentage	Description
Find the present value and future value of general annuity.	43	43.0%	Least learned
Computes interest, maturity value, future value, and present value in compound interest.	91	45.5%	Least learned
Solve problems using compound interest.	124	49.6%	Least learned
Find the present value and future value of simple annuity.	57	57.0%	Least learned
Solve problems using simple interest.	150	60.0%	Least learned
Computes interest, maturity value, future value, and present value in simple interest.	200	80.0%	Most learned
Illustrates general annuity.	242	80.7%	Most learned
Illustrates compound interest	173	86.5%	Most learned
Distinguishes between simple and compound interest.	87	87.0%	Most learned
Illustrates simple interest	229	91.6%	Most learned
Illustrates simple interest	229	91.6%	Most learned

Legend: below 60 – Least learned, 61 – 79 – Moderately learned, 80 – 100 – Most learned

Table 1 presents the distribution of competencies in Mathematics of Investment, highlighting the students' performance based on the total correct answers, average score percentage, and corresponding description. The data show that several competencies were identified as least learned, particularly those involving computations and problem-solving.

These include finding the present and future value of general annuity (43.0%), computing interest, maturity value, future value, and present value in compound interest (45.5%), and solving problems using compound interest (49.6%). Additionally, the least mastered areas were finding the present and future value of simple annuity (57.0%) and solving problems using simple interest (60.0%). These results suggest that students may understand the basic concepts but struggle with applying them in computations and real-world scenarios.

On the other hand, the most learned competencies include illustrating simple annuity (92.0%), illustrating simple interest (91.6%), and illustrating general annuity (80.7%). This indicates that students can effectively grasp and demonstrate fundamental concepts but encounter difficulties when calculating and solving problems.

This supports the claim of Manibog (2023), who stated that many individuals struggle with understanding compound interest and annuities. Compound interest is a more complex financial concept than simple interest. Their study emphasized that while basic interest

calculations are more easily comprehended, compound interest poses significant challenges for learners.

Design

Appropriate multimedia elements were identified and selected during the design stage to address the least learned competencies. These elements were chosen based on their relevance and effectiveness, as supported by existing literature. Table 2 summarizes the selected multimedia elements along with their corresponding sources and description.

Multimedia	Source of literature	Description
Elements		
1. Text	Mayer, R. E. (2009). Multimedia Learning (2nd ed.). Cambridge University Press.	Text is used to present essential concepts, instructions, and explanations in a structured manner. According to Mayer's Cognitive Theory of Multimedia Learning, text plays a crucial role in verbal representation, aiding learners in processing information effectively. In the ePBL module, text is utilized to ensure clarity and coherence in conveying key ideas, particularly when introducing new concepts or summarizing information. The use of text allows for direct and explicit instruction, facilitating student comprehension of complex topics.
2. Illustration	Levin, J. R., & Mayer, R. E. (1993). Understanding illustrations in text: Guidelines for educators. Educational Psychologist, 28(1), 56-70.	Illustrations reinforce textual explanations by providing visual representations of abstract ideas. Levin and Mayer (1993) emphasize that illustrations enhance comprehension, particularly when they closely align with the accompanying text. In the ePBL module, illustrations simplify difficult concepts, support student understanding, and contribute to engagement. They are especially effective in breaking down complex processes into more manageable parts.
3. Images	Paivio, A. (2007). Mind and Brain: Neurocognitive Mechanisms of Language and Visual Imagery. Psychology Press.	Images are integrated into the module to support dual coding theory (Paivio, 2007), which posits that learners process information more effectively when both verbal and visual elements are used. The inclusion of images enhances recall, illustrates real-world applications, and makes abstract concepts more tangible. Images are particularly useful for presenting examples, diagrams, and step-by-step processes related to the least mastered competencies.
4. Infographics	Tufte, E. R. (2001). The Visual Display of Quantitative Information. Graphics Press.	Infographics are employed to present data, trends, and key takeaways in a visually structured format. Tufte (2001) highlights that well-designed infographics improve comprehension by reducing cognitive load and organizing information efficiently. In the ePBL module, infographics help summarize essential information, make comparisons, and emphasize key points in an engaging manner.

 Table 2. Multimedia Elements Used in Addressing the Least Learned Competencies

Table 2 presents the existing literature on the multimedia elements, such as text, images, illustration, and infographics used in the ePBL module to address the least learned competencies. According to Mayer's cognitive theory of multimedia learning, learners process verbal and visual information separately in distinct cognitive channels, and by integrating both, it is possible to reduce cognitive overload and improve understanding (Mayer, 2009). This dual-channel approach is particularly useful for addressing competencies that learners struggle with, as it allows for the reinforcement of concepts through different media formats, helping students grasp complex material more effectively.

Each multimedia element has specific strengths that contribute to the effectiveness of instructional design. Text provides clarity and structure, allowing learners to process information at their own pace. Images engage the visual system, helping learners connect abstract concepts to concrete representations (Mayer & Moreno, 2003). Infographics, which merge text and graphics, are particularly powerful for presenting data or summarizing key points in an easily digestible format, allowing for quick understanding and retention. Integrating these multimedia elements creates an immersive learning environment that caters to diverse learning styles, ultimately improving the mastery of challenging competencies.

Development

In the development phase, the researcher meticulously crafted and structured the ePBL module using the appropriate multimedia elements and integrated it into Canva and Hyzine. After the ePBL module was created, it underwent review by experts: media experts, language experts, and mathematics education experts. The table below shows the level of acceptability for the nine experts, which includes evaluations on content, format, presentation and organization, and accuracy and up-to-datedness of information.

Table 3. Level of Acceptability of ePBL Module as Evaluated by Experts in terms of Content

Criteria	Mean	SD	DI
1. Content is suitable to the student's level of development.	4.00	0.00	Highly Acceptable

2. Material contributes to the achievement of specific objectives of the subject area and	4.00	0.00	Highly Acceptable
grade/year level for which it is intended.	2.67	0.50	TT 11 4 . 11
3. Material provides for developing higher cognitive skills such as critical thinking,	3.67	0.58	Highly Acceptable
creativity, learning by doing, inquiry, and problem-solving.			
4. Material is free of ideological, cultural, religious, racial, and gender biases and	3.67	0.58	Highly Acceptable
prejudices.			
5. Material enhances the development of desirable values and traits.	3.33	0.58	Highly Acceptable
6. Material can potentially arouse the target reader's interest.	3.67	0.58	Highly Acceptable
7. Adequate symbols are provided in topics and activities.	3.67	0.58	Highly Acceptable
Overall	3.71	0.23	Highly Acceptable
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Legend for Descriptive Interpretation (DI): 1.00 – 1.74 Not Acceptable, 1.75 – 2.49 Slightly Acceptable, 2.50 – 3.24 Moderately Acceptable, 3.25 – 4.00 Highly Acceptable

The content acceptability of the ePBL module was assessed based on several key criteria, all of which received a "Highly acceptable" rating, as shown in Table 3 above. The suitability of the content to the students' level of development, along with its alignment with subject-specific objectives, both achieved the highest mean score of 4.00 with an SD of 0.00, indicating strong relevance and appropriateness. The module also supports the development of higher cognitive skills such as critical thinking, creativity, and problemsolving, earning a 3.67 rating.

Similarly, it was rated 3.67 for being free from ideological, cultural, religious, racial, and gender biases, ensuring inclusivity and fairness. The module also scored 3.67 for its ability to engage students and provide adequate symbols in topics and activities, reflecting its effectiveness in maintaining student interest and clarity.

Meanwhile, its contribution to developing desirable values and traits received a 3.33 rating, still within the "Highly acceptable" range. With an overall mean of 3.71, the findings affirm that the module is well-structured, engaging, and suitable for its intended learners, making it an effective tool for problem-based learning.

This aligns with Lorenzo's (2022) study, emphasizing that well-designed, problem-based learning modules enhance students' cognitive engagement and motivation. Additionally, Jonassen (2011) highlights that PBL materials should be developmentally appropriate and foster critical thinking, inquiry, and problem-solving. These qualities are reflected in this module's high acceptability ratings.

Table 4. Level of Acceptability of ePBL module as Evaluated by Experts in Terms of Format						
Text Format	Mean	SD	DI			
1. The size of the letters is appropriate to the intended user.	3.67	0.58	Highly Acceptable			
2. Spaces between letters and words facilitate reading.	3.67	0.58	Highly Acceptable			
3. The font is easy to read.	4.00	0.00	Highly Acceptable			
Illustrations Format						
4. Simple and easily recognizable.	4.00	0.00	Highly Acceptable			
5. Clarify and supplement the text.	3.67	0.58	Highly Acceptable			
6. Properly labeled or captioned (if applicable).	3.67	0.58	Highly Acceptable			
7. Realistic/appropriate colors.	3.67	0.58	Highly Acceptable			
8. Attractive and appealing.	3.67	0.58	Highly Acceptable			
9. Culturally relevant.	3.33	0.58	Highly Acceptable			
Design and Layout Format						
10. Attractive and pleasing to look at.	4.00	0.00	Highly Acceptable			
11. Simple (i.e., not distract the reader's attention).	4.00	0.00	Highly Acceptable			
12. Adequate illustration of the text.	3.67	0.58	Highly Acceptable			
13. Harmonious blending of elements (illustrations and text).	3.00	0.58	Highly Acceptable			
Overall	3.72	0.29	Highly Acceptable			

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Legend for Descriptive Interpretation (DI): 1.00 – 1.74 Not Acceptable, 1.75 – 2.49 Slightly Acceptable, 2.50 – 3.24 Moderately Acceptable, 3.25 – 4.00 Highly Acceptable

The format acceptability of the ePBL module was evaluated across three key areas: text format, illustrations format, and design and layout format, all of which received a "Highly acceptable" rating, as shown in Table 4 above. In terms of text format, the appropriateness of letter size and spacing, as well as readability of the font, were well-rated, with font readability receiving the highest score of 4.00, indicating clear and accessible text for users.

For illustration format, clarity, labeling, and realistic colors scored 3.67, demonstrating that the visuals effectively support the text. The highest rating of 4.00 was given to the simplicity and recognizability of illustrations, which show their effectiveness in enhancing understanding. Meanwhile, cultural relevance received a slightly lower score of 3.33, though it still falls within the "Highly acceptable" category.

The module's attractiveness and simplicity were rated highly acceptable in the design and layout format, scoring 4.00. This suggests the layout is visually appealing and does not overwhelm the reader. The adequacy of illustrations in supporting the text scored 3.67, while the harmonious blending of elements received 3.00, the lowest rating but still considered highly acceptable.

The results, with an overall mean of 3.72, affirm that the module's format is well-structured, visually appealing, and effectively

designed to enhance learning. This supports Mayer's (2009) Cognitive Theory of Multimedia Learning, emphasizing that clear text, appropriate visuals, and well-organized design improve comprehension and engagement in educational materials.

Criteria	Mean	SD	DI
1. The presentation is engaging, interesting, and understandable.	3.67	0.58	Highly Acceptable
2. There is a logical and smooth flow of ideas.	3.33	0.58	Highly Acceptable
3. Vocabulary level is adapted to target the reader's likely experience and level of	3.67	0.58	Highly Acceptable
understanding.			
4. The length of sentences is suited to the comprehension level of the target reader.	4.00	0.00	Highly Acceptable
5. Sentences and paragraph structures are varied and interesting to the target reader.	3.67	0.58	Highly Acceptable
Overall	3.67	0.24	Highly Acceptable
Legend for Descriptive Interpretation (DI): 1.00 – 1.74 Not Acceptable, 1.75 – 2.49 Slightly Acceptable , 2.50 – 3.24 Moder	Highly Acceptable		

 Table 5. Level of Acceptability of ePBL Module as Evaluated by Experts in Terms of Presentation and Organization

The acceptability of the ePBL module in terms of presentation and organization was rated as "Highly acceptable" across all criteria, with an overall mean of 3.67, as shown in Table 5 above. The module was engaging, interesting, and understandable, earning a 3.67 rating, indicating that it effectively captured students' attention. The logical and smooth flow of ideas received a slightly lower score of 3.33, though still within the "Highly acceptable" range, suggesting that the content is generally well-structured.

The vocabulary level was rated 3.67, confirming the language is appropriate for the intended learners. Sentence length received the highest rating of 4.00, showing that the text is well-suited to students' comprehension levels. Additionally, sentence and paragraph structures received a 3.67 rating, indicating that the writing style is engaging and varied. These results affirm that the module's presentation and organization effectively support student learning.

Table 6. Level of Acceptability of ePBL Module as Evaluated by Experts in terms of Accuracy and Up-to-Datedness

Criteria	Mean	SD	DI
1. Conceptual errors	4.00	0.00	Highly Acceptable
2. Factual errors	4.00	0.00	Highly Acceptable
3. Grammatical errors	4.00	0.00	Highly Acceptable
4. Computational errors	4.00	0.00	Highly Acceptable
5. Obsolete information	4.00	0.00	Highly Acceptable
6. Typographical and other minor errors (e.g., inappropriate or unclear	4.00	0.00	Highly Acceptable
illustrations, missing labels, wrong caption, etc.)			
Overall	4.00	0.00	Highly Acceptable
Legend for Descriptive Interpretation (DI): 1.00, 1.74 Not Acceptable 1.75, 2.49 Slightly Acceptable	2.50 3.24 Mod	arately Accents	able 3.25 4.00 Highly Acceptable

Legend for Descriptive Interpretation (DI): 1.00 – 1.74 Not Acceptable, 1.75 – 2.49 Slightly Acceptable, 2.50 – 3.24 Moderately Acceptable, 3.25 – 4.00 Highly Acceptable

The accuracy and up-to-datedness of the e-PBL module received an overall mean rating of 4.00, categorized as "Highly Acceptable" across all criteria, as shown in Table 6 above. The module was found to be free from conceptual, factual, grammatical, and computational errors, ensuring the reliability and correctness of its content. Additionally, it contained no obsolete information, affirming its relevance and up-to-date nature. The evaluation also confirmed the absence of typographical and minor errors, such as unclear illustrations or incorrect labels.

These results highlight the module's high standard of accuracy and clarity, making it a credible and effective learning resource. This aligns with the study of Eriyante et al. (2023), which emphasizes that error-free and up-to-date instructional materials enhance comprehension and learning efficiency, ensuring students receive accurate and relevant information.

 Table 7. Overall Level of Acceptability of ePBL Module

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Factors	Mean	SD	DI
1. Content	3.71	0.23	Highly Acceptable
2. Format	3.72	0.29	Highly Acceptable
3. Presentation and Organization	3.67	0.24	Highly Acceptable
4. Accuracy and up-to-datedness of information	4.00	0.00	Highly Acceptable
Overall	3.78	0.15	Highly Acceptable

 Legend for Descriptive Interpretation (DI):
 1.00 – 1.74 Not Acceptable,
 1.75 – 2.49 Slightly Acceptable,
 2.50 – 3.24 Moderately Acceptable,
 3.25 –

 4.00 Highly Acceptable
 4.00 Highly

Table 7 above shows the overall acceptability of the ePBL module. The evaluation yielded highly positive results, with all key factors rated "highly acceptable." The module's content received a mean rating of 3.71, reflecting its relevance and effectiveness in delivering learning materials. Its format scored 3.72, indicating a well-structured and user-friendly design.

The presentation and organization of information obtained a mean of 3.67, demonstrating clarity and coherence in its instructional flow. Notably, the accuracy and up-to-datedness of information received the highest rating of 4.00, highlighting the reliability and relevance of the content.

With an overall mean of 3.78, the results affirm the module's strong acceptability, making it a valuable tool for problem-based learning.

This means that the ePBL module passed all the criteria and was deemed valid. This supports the claim of Manibog (2023) that through validated instructional materials, the students' learning becomes meaningful.

Table 8. Level of	f Acceptability	of ePBL Module a	is Evaluated by Ex	perts in Terms of Language
			~	

	anguage		
Criteria	Mean	SD	DI
1. Instructions to students are clear, unambiguous, and easy to follow.	4.67	0.58	Very Highly Acceptable
2. The words, grammar, and mechanics are correct and accurate.	4.00	0.00	Highly Acceptable
3. The vocabulary used suits the reading and understanding level of students to whom the	4.67	0.58	Very Highly Acceptable
learning resource is intended.			
4. The vocabulary and grammar used in the learning resource are contextualized.	5.00	0.00	Very Highly Acceptable
5. The use of mathematical terms and jargon are appropriately retained in the learning	5.00	0.00	Very Highly Acceptable
resource.			
6. The learning resource uses a great and accurate command of language to the intended	4.67	0.58	Very Highly Acceptable
users.			
7. The language used in the learning resource truly reflects a conversational type of	4.67	0.58	Very Highly Acceptable
discussion.			
Overall	4.67	0.33	Very Highly Acceptable
Legend for Descriptive Interpretation (DI): 1.00 – 1.74 Not Acceptable, 1.75 – 2.49 Slightly Acceptable, 2.50 – 3.24 Moderately Acceptable	otable, 3.25 - 4.00	Highly A	cceptable

The language acceptability of the ePBL module was rated "Very Highly Acceptable" with an overall mean of 4.67, demonstrating its strong effectiveness in communication and clarity, as shown in Table 8 above. The highest ratings of 5.00 were given to contextualizing vocabulary and grammar and appropriately retaining mathematical terms and jargon, indicating that the module effectively maintains subject-specific accuracy while ensuring comprehension. Instructions for students, vocabulary suitability, language command, and conversational tone all received a 4.67 rating, highlighting the module's clarity and engagement. Additionally, the correctness of words, grammar, and mechanics was rated 4.00, showing that the module maintains linguistic accuracy.

These findings affirm that the ePBL module effectively uses clear, contextualized, and student-friendly language, making it highly accessible and engaging for learners. This supports the study of Imperial (2023) and Huang et al. (2024), which emphasizes that well-structured language in educational materials enhances comprehension, scaffolds learning, and facilitates deeper understanding.

Table 9. Level of Acceptability of ePBL Module as Evaluated by Experts in Terms of Multimedia Elements

Criteria	Mean	SD	DI
1. The text is clear, easy to read, and relevant to the learning objectives.	5.00	0.00	Very Highly Acceptable
2. The images are visually appealing and effectively support the learning content.	4.67	0.58	Very Highly Acceptable
3. The figures are clear and complement the text and visuals.	4.67	0.58	Very Highly Acceptable
4. The illustrations are engaging and enhance understanding of the topic.	4.33	0.58	Very Highly Acceptable
5. The infographics present information clearly and simplify complex concepts.	4.33	0.58	Very Highly Acceptable
6. The multimedia elements are appropriately integrated into the e-PBL module.	4.67	0.58	Very Highly Acceptable
7. The quality (resolution and visuals) of all multimedia elements is appropriate.	4.67	0.58	Very Highly Acceptable
8. The multimedia elements contribute to maintaining the students' attention.	4.33	0.58	Very Highly Acceptable
9. The multimedia elements are culturally and contextually appropriate.	4.33	0.58	Very Highly Acceptable
10. Overall, the multimedia elements effectively enhance the learning	4.33	0.58	Very Highly Acceptable
experience.			
Overall	4.53	0.24	Very Highly Acceptable
Legend for Descriptive Interpretation (DI): 1.00 - 1.74 Not Acceptable, 1.75 - 2.49 Slightly Acceptable, 2.50 - 3.24 Mode	Highly Acceptable		

Table 9 above shows the acceptability of Multimedia Elements in the ePBL module. The multimedia elements acceptability of the ePBL module received an overall mean rating of 4.53, categorized as "Very Highly Acceptable," demonstrating the effectiveness of its visual and multimedia components in enhancing learning. The text's clarity, readability, and relevance received the highest rating of 5.00, indicating that the textual content is well-structured and aligned with learning objectives.

The visual appeal and effectiveness of images and figures and the overall multimedia quality were consistently rated between 4.67 and 4.33, signifying that these elements successfully support comprehension and engagement. The integration of multimedia elements within the module was also rated highly (4.67), affirming their seamless incorporation into the learning experience. Additionally, infographics, engagement of illustrations, and cultural appropriateness all received a 4.33 rating, demonstrating their role in simplifying complex concepts while maintaining relevance.

These findings support Mayer's (2009) Cognitive Theory of Multimedia Learning, emphasizing that well-integrated text and visuals enhance comprehension, engagement, and knowledge retention. Similarly, a study by Huang et al. (2024) highlights that properly structured multimedia elements help tailor educational content to diverse learners, improving accessibility and learning outcomes. The high ratings across all criteria confirm that the ePBL module effectively utilizes multimedia to enrich the learning experience.

Evaluation

According to Sidek and Jamaluddin (2015), as cited by Abdelmohsen (2020), module development encompasses validation by experts

and students. The ePBL module was evaluated by experts, including one qualified language expert with appropriate expertise. After the module validation, it was implemented with grade 11 HUMSS students to assess their perception. Feedback from students was collected and analyzed to determine their perspective on the ePBL module.

 Table 10. Student Participants' Perception of the Content of the ePBL Module

Criteria	Mean	SD	DI
1. Content is suitable to the student's level of development.	3.96	0.20	Highly Acceptable
2. Material contributes to the achievement of specific objectives of the subject area and	3.94	0.24	Highly Acceptable
grade/year level for which it is intended.			
3. Material provides for developing higher cognitive skills such as critical thinking,	3.84	0.37	Highly Acceptable
creativity, learning by doing, inquiry, and problem-solving.			
4. Material is free of ideological, cultural, religious, racial, and gender biases and	3.80	0.40	Highly Acceptable
prejudices.			
5. Material enhances the development of desirable values and traits.	3.00	0.45	Moderately Acceptable
6. Material can potentially arouse the target reader's interest.	3.82	0.39	Highly Acceptable
7. Adequate symbols are provided in topics and activities.	3.88	0.33	Highly Acceptable
Overall	3.75	0.34	Highly Acceptable
Lagand for Descriptive Interpretation (D): 1.00 1.74 Not Accortable 1.75 2.40 Slightly Accortable 2.50 2.24 Moderately Acc	contable 2.25 4.0	0 Uighly Ac	aaptabla

The students' perception of the level of acceptability of the ePBL module in terms of the content was shown in Table 10, and they received an overall mean rating of 3.75, which is interpreted as "Highly Acceptable." This indicates that students found the module effective in delivering well-structured and meaningful content.

The highest ratings were given to the content's suitability to students' level (3.96) and its alignment with subject objectives (3.94), confirming that the material is appropriate and meets the intended learning outcomes. The module was rated highly for fostering higher cognitive skills (3.84) and maintaining fairness and inclusivity (3.80) by being free from ideological, cultural, religious, racial, and gender biases.

The module also scored well in arousing student interest (3.82) and providing adequate symbols in topics and activities (3.88), ensuring the learning experience remains engaging and visually supported. However, enhancing desirable values and traits received a slightly lower rating (3.00, Moderately acceptable), suggesting room for improvement in integrating value-based learning.

These findings align with those of Hmelo-Silver (2014), who emphasized that well-designed, problem-based learning materials contribute to deeper understanding, critical thinking, and student engagement. The module's positive reception further validates its effectiveness as a learning resource.

Table 11. Student Participants' Perception of the Presentation and Organization of the ePBL Module

	2		
Criteria	Mean	SD	DI
1. The presentation is engaging, interesting, and understandable.	3.82	0.39	Highly Acceptable
2. There is a logical and smooth flow of ideas.	3.78	0.42	Highly Acceptable
3. Vocabulary level is adapted to target the reader's likely experience and level of	3.84	0.37	Highly Acceptable
understanding.			
4. The length of sentences is suited to the comprehension level of the target reader.	3.90	0.30	Highly Acceptable
5. Sentences and paragraph structures are varied and interesting to the target reader.	3.78	0.42	Highly Acceptable
Overall	3.82	0.05	Highly Acceptable

Legend for Descriptive Interpretation (DI): 1.00 – 1.74 Not Acceptable, 1.75 – 2.49 Slightly Acceptable, 2.50 – 3.24 Moderately Acceptable, 3.25 – 4.00 Highly Acceptable

The students' perception of the level of acceptability of the ePBL module in terms of presentation and organization was shown in Table 11, and they received an overall mean rating of 3.82, which was interpreted as "Highly Acceptable." This indicates that the module is well-structured, engaging, and effectively organized for student learning.

Among the highest-rated aspects were sentence length suitability (3.90) and vocabulary adaptation to students' level (3.84), confirming that the text's language and complexity are appropriate for the target readers. Additionally, the logical flow of ideas (3.78) and variation in sentence and paragraph structures (3.78) received high ratings, highlighting the module's ability to present information smoothly and maintain student interest. The module's engagement, clarity, and understandability were also rated positively (3.82), reinforcing its effectiveness in delivering well-organized and accessible content. These results align with Lorenzo (2022), which emphasizes that clear and well-structured instructional materials improve comprehension and reduce cognitive overload, leading to better learning outcomes. The findings affirm that the ePBL module successfully facilitates student engagement and understanding through its presentation and organization.

Table 12. Student Participants' Perception of the Multimedia Elements

Criteria	Mean	SD	DI
1. Text	3.84	0.37	Highly Acceptable
2. Images	3.70	0.46	Highly Acceptable
3. Illustration	3.78	0.42	Highly Acceptable



4. Infographics	3.78	0.49	Highly Acceptable	of the ePBL Module
Overall Mean	3.73	0.10	Highly Acceptable	- 0

Table 12 presents the students' perceptions of the ePBL module's acceptability level regarding its multimedia elements. They received an overall mean rating of 3.73, categorized as "Highly Acceptable." This indicates that the module effectively integrates multimedia components to enhance student learning and engagement.

Among the different elements, text clarity and readability received the highest rating (3.84), affirming that the written content is wellpresented and easy to comprehend. Illustrations (3.78) and images (3.70) were also rated positively, highlighting their effectiveness in supporting the learning material. Infographics (3.60), while still rated as "Highly acceptable," had the lowest score, suggesting potential improvements in clarity or design for better comprehension.

These findings align with Mayer's Multimedia Learning Theory (2009), which emphasizes that combining text with well-designed visuals enhances understanding, retention, and engagement. The positive evaluation of multimedia elements confirms that the ePBL module successfully integrates various visual aids to support students' learning experiences.

Table 15. Summary of Students	Perceptions	on ePBI	_ Moaule
Factors	Mean	SD	DI
1. Content	3.75	0.34	Highly Acceptable
2. Presentation and Organization	3.82	0.05	Highly Acceptable
3. Multimedia Elements	3.73	0.10	Highly Acceptable
Overall	3.77	0.05	Highly Acceptable

Table 13. Summary of Students' Perceptions on ePBL Module

 Legend for Descriptive Interpretation (DI):
 1.00 – 1.74 Not Acceptable, 1.75 – 2.49 Slightly Acceptable, 2.50 – 3.24 Moderately

 Acceptable,
 3.25 – 4.00
 Highly Acceptable

The students' perception of the overall level of acceptability of the ePBL module exhibited in Table 13. revealed that the module passed the three factors: content, multimedia elements, presentation, and organization with mean of 3.75, 3.82, and 3.73 respectively. The students' overall perception of the developed module is 3.77 with an adjectival rating of Highly Acceptable. This implies that the module passed according to the student's perception.

These findings suggest that the ePBL module meets students' learning needs and expectations. This aligns with Manibog (2023), who emphasized that well-structured, problem-based learning materials enhance student engagement, comprehension, and motivation. The module's positive reception further supports its potential as a valuable learning resource in an interactive, student-centered environment.

Conclusions

Based from the findings of the study, the following conclusions are hereby formulated.

Grade 11 HUMSS students struggle the most with computations and problem-solving in Mathematics of Investment, particularly in topics like annuities, compound interest, and simple interest. While they grasp fundamental concepts, applying them to real-life scenarios remains a significant challenge.

Guided by literature, the integration of multimedia elements—such as text, illustrations, images, and infographics—within the electronic Problem-Based Learning (ePBL) module using the 5C framework proved effective in enhancing comprehension and problem-solving skills. These elements simplified complex computations and reinforced understanding through visual representation.

The ePBL module received highly favorable evaluations, indicating its effectiveness as an engaging and structured learning tool. It stood out for its content, format, presentation, accuracy, language, and multimedia integration. Students perceived it as an engaging and well-structured tool that significantly improved their problem-solving abilities.

Overall, the results highlight the success of the PBL approach in helping students apply mathematical concepts to real-world contexts. The strategic use of multimedia elements significantly supported their learning, making the ePBL module a valuable tool for developing practical problem-solving skills in mathematics.

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