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Development of innovative materials in teaching problem solving to business mathematics students

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Abstract

This study developed an innovative material in teaching problem solving to Business Mathematics students in Pili National High School of the academic year 2024-2025. This study is developmental research utilizing quantitative and qualitative research design in collecting and analyzing data. The topics covered in this study are solving problems involving percents, kinds of proportion, single trade discount and discount series, break even analysis, and types of commissions. The developed learning materials presented four key features which are: contextualized, collaborative, developmental learning tasks and problem-solving approach.

Results showed that the developed innovative materials based on the jurors' evaluation demonstrated a strong endorsement that the features are present in the learning materials, with highest frequencies of 'Evident' and minimal instances of 'Not Evident' from the 10 jurors which are Accountancy, Business, and Management teachers, suggesting that the materials are well-designed and effective in achieving the educational objectives. Areas for improvement were identified, particularly in ensuring that the materials include activities that are attainable by the students.

The acceptability levels of the learning materials as perceived by the 10 Business Mathematics teachers and students showed that the learning materials together with its features were 'Extremely Acceptable' demonstrating the potential to effectively support the teaching and learning process in teaching problem solving to Business Mathematics students.

Keywords: Innovative Material; Business Mathematics; Problem Solving; Developmental Research; Accountancy, Business and Management

1. Introduction

Problem solving has always been a necessary skill not only in mathematics but in everyday living. It is a process that involved the students starting from the moment they were faced with the problem until the end when the problem is solved. However, many students struggled to accomplish mathematics, especially in problem solving. Problem solving is not just a topic, but it is a process that underlies the whole of mathematics, which contextually helped concepts and skills to be learned.

Business Mathematics is a branch of Mathematics that aims to educate people about money and provide them with the resources they need to make wise financial decisions. Problem-solving skills are essential in learning Business Mathematics since it is not just simply analyzing a problem, but it involves mathematical skills. Developing problem-solving skills is one of the keys to succeeding in this quickly changing business environment. Especially in the subject of Business Mathematics, where complicated problems are being encountered.

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The development of innovative learning materials is very important as a strategy in improving student performance that can be used in the teaching and learning activities. Innovation in the teaching and learning interaction is needed to motivate the students to learn in the subject area. Innovation in education has also been proven to be effective in facilitating the development of student's concepts and in providing an enjoyable learning environment.

Furthermore, mathematics teachers should innovate instructional strategies that are developmentally appropriate for learners who require significant support. This equips students with the necessary skills, knowledge, and attitudes to excel in a dynamic environment. It can help improve the problem-solving skills of the students. It can also positively influence students learning experiences by creating and providing resources that can improve their problem-solving abilities in school and beyond.

1.1. Statement of the Problem

This study developed innovative materials in teaching problem solving to Business Mathematics students. Specifically, it answered the following questions:

- What is the current status of the learning materials in teaching Business Mathematics?
- What are the features of the developed innovative learning materials?
- What are the jurors' evaluation on the developed innovative materials along:
  - contextualized;
  - collaborative;
  - developmental learning tasks;
  - problem solving approach?
- What is the level of acceptability of the developed materials as perceived by the teachers and students along the features?
- What enhancements in the developed innovative materials may be proposed?

1.2. Assumption of the study

The researcher was guided by the following assumptions:

- There are teaching and learning materials in Business Mathematics.
- The developed innovative learning materials has different features along the learning competencies.
- The jurors evaluation of the developed innovative materials varies.
- The level of acceptability of the developed materials along the features as perceived by the teachers and students differs.
- The developed innovative learning materials are enhanced.

1.3. Scope and Delimitation

This study focused on the developed innovative materials to enhance the problem-solving skills of Business Mathematics students. It focused on learning competencies that required problem-solving skills that can be found in the curriculum guide in Business Mathematics of DepEd Order No. 021, s. 2019 as the Policy Guidelines on the K to 12 Basic Education Program. The developed innovative materials were on the following topics in Business Mathematics: solving problems involving percent, kinds of proportion, single trade discounts and discount series, break-even analysis, and types of commissions. The content of the innovative materials that were developed is based on the content and performance standards of Business Mathematics subject in the K to 12 Curriculum. Other topics in Business Mathematics are not included, and students in Grade 12 are not part of this research.

2. Material and methods

2.1. Research Method

This study utilized the developmental research method, since the researcher developed innovative materials in teaching problem solving to Business Mathematics students. This study utilized an evaluation rating sheet in evaluating the developed innovative materials in Business Mathematics along the features: contextualized, collaborative, developmental learning tasks, and problem-solving approach to ensure that the features are present in the materials that were developed. The level of acceptability of the innovative materials was also evaluated to determine if the developed innovative materials were acceptable to the teachers and students.

2.2. Subjects of the Study

The subjects of this study consisted of ten (10) Business Mathematics teachers and ten (10) Business Mathematics students. The students were the Grade 11 taking up the Business Mathematics subject from Pili National High School. The teachers determined the current status and level of acceptability of the developed innovative learning materials. San Jose National High School had two (2) business mathematics teachers, Pili National High School had three (3), Cabasan National High School had three (3), and Sto. Domingo National High School had two (2). There were also 10 Accountancy, Business and Management teachers from Tabaco National High School and Daraga National High School who served as jurors of the developed innovative materials.

2.3. Research Instrument

The researcher utilized a checklist to identify the current status of the learning materials in teaching business mathematics. An evaluation rating sheet was also developed for the critiquing of the developed innovative learning materials and measuring the level of acceptability. The Evaluation Rating Sheet is a tool used to assess the quality and effectiveness of educational materials such as textbooks, workbooks, or other instructional resources. This instrument was used to determine whether the developed innovative learning materials complied with the learning competencies, content, and performance standards stipulated in the K to 12 Curriculum Guide and, most importantly, the presence of its features: contextualized, collaborative, developmental learning tasks, and a problem-solving approach. Another evaluation rating sheet was made and utilized by the teachers and students to measure the level of acceptability of the developed innovative learning materials. The respondents were guided by a five-point Likert scale. The research instruments developed by the researcher were checked and evaluated for usage and validity by some chosen experts.

2.4. Validation of the Research Instrument

The validation of the research instrument was an essential part of the research process. The instrument that was used in any purpose must be validated to ensure its alignment with the users and its objectives. The checklist for the current status of the learning materials in teaching Business Mathematics, evaluation sheet for determining the presence of the features and the level of acceptability of the developed innovative materials were validated by three (3) master teachers were two (2) from Pili National High School and one (1) from Bonga National High School. The validators assessed the materials using a checklist with scaled responses. A five-point Likert scale was adopted, with 5 representing excellent and 1 representing very poor.

3. Results and discussion

3.1. The Current Status of the Learning Materials in teaching Business Mathematics

Learning materials may aid a student in concretizing a learning experience so as to make learning more exciting, interesting and interactive. Nadinegwe (2000) as cited in Baan (2021)[1], noted that instructional materials highly influence the teaching and learning process and so as the academic performance of the learners.

Table 1 The Current Status of the Learning Materials in teaching Business Mathematics

Learning Materials	Frequency $n = 10$	Percentage (%)
Teacher's Manual	8	80
Self-Learning Modules	10	100
Business Mathematics Books	10	100
Learning Activity Sheets	8	80
Teaching Guide	4	40

There are 10 Business Mathematics teachers who responded. The data reveal that self-learning modules (SLMs) recorded a 100% utilization rate with a frequency of 10. This indicates that these materials play in the teaching process because they are readily available and considered indispensable by all. SLM's learning components such as "What I Need to Know," "What I Can Do," and "Assessment," ensures both students and teachers are well-supported in the teaching-learning process. The inclusion of the references and answer keys is a reliable tool for independent learning. Business

Mathematics Books also achieved a 100% utilization rate, implying the importance as a main resource in the subject. The books include parts such as introduction, objectives, lesson, and assessment. Meanwhile, it also reveals that 80% of respondents reported utilizing the teacher's manual, with a frequency of 8. This indicates that while the teacher's manual is a widely used resource it will not guarantee its availability to be utilized by all teachers. These manuals include parts such as lesson overviews and objectives, motivation, presentation of content, processing, remediation, enrichment, and reflection that are essential for effective instruction.

On the other hand, the learning activity sheets showed an equal usage rate of the teacher's manual, with 80% of respondents using them and with a frequency of 8. This indicates that while these learning activity sheets are widely adopted, there are room for improvement in ensuring their accessibility across all of the teachers. These learning activity sheets provide components such as introductions, objectives, discussions, activities, assessments, reflections, reference and answer key capable for independent learning. While, teacher's guides had the lowest utilization rate of 40%. These guides provide essential instructional components including introduction, motivation, instruction, practice and evaluation.

The result discloses that there is available learning materials used in teaching Business Mathematics. These findings are similar to those of the study by Aquino (2014)[2], where it was found that faculty were using textbooks, PowerPoint presentations, workbooks, manuals and modules. Mang'uu (2021)[3] also recommended that there was need for school principal to avail enough teaching and learning resources and balance teacher's workload and work closely with the teachers to ensure there is enough provision of teaching materials as well as e-resources for use by both the teachers and the students. This imply that there are learning materials available ready for used by the teachers during the teaching and learning process. It is very important that teaching resources must be widely available and ensuring that teachers have the necessary support and tools to effectively use them. The results served as a basis for understanding the strengths and gaps on the current materials, guiding future innovations and enhancements to meet the needs of teachers and learners.

3.2. The Features of the Developed Innovative Learning Materials

The features of developed innovative learning materials are essential for effective teaching and learning processes. These features ensure that the materials are impactful, engaging and aligned with educational standards. To start the process of developing the innovative learning materials, the researcher began by defining the learning objectives that need problem solving skills. The developed worksheets have different parts namely: Review, Warm Up, Level 1, Target, Level 2, Mastery Check, and Challenge. The topics covered in this study are solving problems involving percents, kinds of proportion, single trade discount and discount series, break even analysis, and types of commissions. The developed learning materials presented four key features: contextualized, collaborative, developmental learning tasks and problem solving approach.

Table 2 Features of the Developed Innovative Learning Materials

Features	Lessons									
	Solving Problems Involving Percents		Kinds of Proportion		Single Trade Discount and Discount Series		Break-even Analysis		Types of Commissions	
	f	%	f	%	f	%	f	%	f	%
Contextualized	10	100	10	100	10	100	10	100	10	100
Collaborative	10	100	10	100	10	100	10	100	10	100
Developmental Learning Tasks	10	100	10	100	10	100	10	100	10	100
Problem Solving Approach	10	100	10	100	10	100	10	100	10	100

This research developed an innovative learning materials in Business Mathematics that need problem solving skills. The results, as summarized in Table 2 reveal that 10 out of 10 respondents find that all the features: contextualized, collaborative, developmental learning tasks, and problem-solving approach are 100% successfully implemented across the five distinct lessons. Each developed innovative learning materials highlight the application of each features. All

learning materials that are developed in this study involves problem-solving. The learning materials focus on developing learner's ability to analyze, reason, and find solutions to real-life situations. These materials engage students by presenting problems that require critical thinking and logical reasoning to solve. The problem-solving approach feature was highlight almost in each part of the learning materials except in the "Warm Up" which is the motivation part in the lesson plans since it doesn't indicate any problem-solving, it only pointed out an analysis.

3.3. The Juror's Evaluation on the Developed Innovative Learning Materials

The evaluation of learning materials by the jurors can be a meticulous process that involves a deep understanding on the key features: contextualized, collaborative, developmental learning tasks, and problem solving approach. The following tables presents a juror's evaluation of the developed innovative learning materials, focusing on its effectiveness across various indicators of the innovative learning materials. The indicators are categorized into four key features: Contextualized, Collaborative, Developmental Learning Tasks, Problem Solving Approach. Each features is further divided into specific criteria that assess the developed innovative learning materials ability to facilitate learning and understanding. There are 10 jurors specifically Accountancy, Business, and Management teachers who evaluated the developed innovative learning materials.

Table 3a Jurors Evaluation on the Developed Innovative Learning Materials Along Contextualized Feature

Indicators	Learning Materials No.	Evident $n = 10$	Percentage (%)
It provides real-life applications of the topic.	1	5	50
	2	6	60
	3	10	100
	4	10	100
	5	10	100
It relates learning content to local information or situations and experiences of the learners.	1	10	100
	2	10	100
	3	6	60
	4	10	100
	5	10	100
It stimulates interest and appreciation of Albay Businesses.	1	6	60
	2	10	100
	3	10	100
	4	10	100
	5	10	100
The process and outputs can be used to improve their knowledge on Business Mathematics and apply in their daily lives.	1	10	100
	2	10	100
	3	10	100
	4	8	80
	5	10	100

Table 3a presents the juror's evaluation on each developed innovative learning materials based on their contextualized features. For the first indicator, which evaluates if it provides real-life applications of the topic in the learning materials, received unanimous agreement from the 10 jurors rated 'Evident' or 100 percent for Learning Materials numbered 3, 4, and 5. This indicates that these materials successfully contextualized mathematical concepts. For Learning Material number 2, there are 6 out of 10 jurors found this feature 'Evident', or 60 percent suggesting a further enhancement to incorporate much more relatable real-life context. While, Learning Material number 1 demonstrated a weaker alignment, with only 5 out of 10 jurors rated this indicator as 'Evident' or 50 percent, indicating that this material should improve integration of practical application. For second indicator, which assesses if it relates learning content to local information or situations and experiences of the learners, Learning Materials numbered 1, 2, 4, and 5 received undivided agreement from all 10 jurors or 100 percent shows that this indicator is 'Evident'. Contextualized teaching and learning fosters active learning by enabling students to construct meaning from the information they receive from what they encountered and experienced. However, Learning Material number 3 received slightly lower ratings, with 6 out of 10 jurors affirming that the indicator is 'Evident' or 60 percent, suggesting to add connection to local contexts in this material. In the third indicator, that examines if the materials stimulate interest and appreciation of Albay Businesses,

was unanimously 'Evident' or 100 percent in Learning Materials numbered 2, 3, 4, and 5. This shows the material's effectiveness in promoting and appreciating local enterprises. However, Learning Material 1, received evaluations that only 6 out of 10 jurors or 60 percent affirming this indicator as 'Evident', indicating that it needs to revise activity that will emphasize more local businesses. For fourth indicator, which evaluates whether the process and outputs can be used to improve their knowledge on Business Mathematics and apply in their daily lives, Learning Materials numbered 1, 2, 3, and 5 also received unanimous rating from the 10 jurors or 100 percent showing that the fourth indicator is 'Evident'. While, Learning Material 4 showed slightly lower rating, with 8 out of 10 jurors or 80 percent affirming this indicator.

The juror's evaluation on the developed innovative learning materials along contextualized features indicates a positive impact across various indicators. It shows that it generally excels in providing contextualized learning activities especially in integrating the real-life situations, local contexts, and stimulating interest in Albay businesses. The concepts of the lessons were clearly established, and the learning strategies employed were largely effective in helping learners achieve the desired skills and understanding. It emphasized that the process and outputs can be used to improve their knowledge in daily lives. This suggests that the materials were successful in engaging learners in a contextualized manner. This finding resonates with research of De Vera (2016)[4] highlighting that teachers may include other features like contextual learning to maximize the advantage of instructional material and other features that will make the use of material more productive and effective. From personal experience, adapting contextualized activities has proven in developing student engagement and understanding. However, Learning Materials numbered 1 and 3 demonstrated areas for improvement, especially adding content that are more closely with real-life local situations.

Table 3b Jurors Evaluation on the Developed Innovative Learning Materials Along Collaborative Feature

Indicators	**Learning Materials No.**	**Evident** $n = 10$	**Percentage (%)**
It requires students to achieve common goals fostering a sense of teamwork.	1	10	100
	2	10	100
	3	8	80
	4	6	60
	5	6	60
It provides opportunities for a student to develop communication and leadership.	1	10	100
	2	10	100
	3	6	60
	4	7	70
	5	10	100
It facilitates interactions among students promoting active participations and effective collaboration.	1	10	100
	2	10	100
	3	5	50
	4	6	60
	5	10	100
It provides opportunity for students to work within a small group.	1	10	100
	2	10	100
	3	10	100
	4	10	100
	5	10	100

Table 3b presents the juror's evaluation in each developed innovative learning materials based on their collaborative features. First indicator assesses if the innovative learning materials requires students to achieve common goals fostering a sense of teamwork, 100 percent or 10 out of 10 jurors unanimously agreed that this indicator is 'Evident' in Learning Materials 1 and 2, showing that these materials are highly effective in fostering teamwork. For Learning Material 3, there are 8 out of 10 or 80 percent jurors found this indicator 'Evident'. Meanwhile, Learning Materials numbered 4 and 5 received a low rate, with 6 out of 10 or 60 percent jurors acknowledging the presence of this feature. These results revealed that while teamwork is strongly emphasized in some materials, the Learning Materials 4 and 5 may require additional scenarios that promote collaborative settings. The second indicator assures if the learning materials provides opportunities for a student to develop communication and leadership. For this indicator, Learning Materials numbered 1, 2, and 5 demonstrate that all the 10 or 100 percent of the jurors agreeing that these materials

provide opportunities for students to develop communication and leadership skills. More so, Learning Material number 4 received slightly lower ratings, with 7 out of 10 jurors or 70 percent affirming the presence of this indicator in the learning material. Learning Material 3 was rated less favorably, with only 6 out of 10 jurors or 60 percent acknowledging this indicator as 'Evident'. These implies that it needs to enhance the collaborative activities in Learning Materials 3 and 4 that will develop communication and leadership skills. For the third indicator which assesses if innovative learning materials facilitates interactions among students promoting active participations and effective collaboration. Learning Materials 1, 2, and 5 received 100 percent rating from jurors which is 'Evident', demonstrating strong alignment of promoting student participations and collaboration. However, Learning Material 4 showed that 6 out of 10 jurors or 60 percent rated 'Evident' in this indicator. More so, Learning Material 3 had the lowest ratings, with only half of the jurors (5 out of 10 or 50 percent) implying that the presence of this indicator needs to be refined. The last indicator which provides opportunity for students to work within a small group. All 10 jurors or 100 percent agreed that this indicator is evident across all the learning materials (1, 2, 3, 4, and 5). This demonstrate that small-group collaboration is well-integrated along all the innovative learning materials.

The findings indicates that the developed innovative learning materials effectively incorporate collaborative features, particularly in fostering teamwork and small-group collaboration. The provided collaborative learning activities will enhance students problem-solving abilities in mathematics. However, some improvements are necessary for Learning Materials 3 and 4 to better support communication and interaction among the students. The result also implies that the collaborative activities provided can also improve students' camaraderie while learning the expected outcome. The overall results align emphasizing the value of collaborative learning environments in enhancing student engagement and interpersonal skills. This is consistent with literature pointing out collaborative learning shows a significant effect on students' social interaction skills. Students believe that collaborative learning encourages everyone to work best with others and enhances socialization among members (Ghavifekr, 2020).[5] Based on observation, when students work together on solving problems, they want to engage in higher-order thinking and refine their reasoning through group discussions.

Table 3c Jurors Evaluation on the Developed Innovative Learning Materials Along Developmental Learning Tasks Feature

Indicators	**Learning Materials No.**	**Evident** $n = 10$	**Percentage (%)**
The activities provided is in easy, average to difficult level.	1	10	100
	2	10	100
	3	10	100
	4	10	100
	5	10	100
The activities are attainable by the students.	1	7	70
	2	10	100
	3	6	60
	4	10	100
	5	10	100
Activities encourage analysis, evaluation, and synthesis of information.	1	10	100
	2	6	60
	3	10	100
	4	10	100
	5	10	100
Activities promote deep understanding rather than rote memorization.	1	10	100
	2	10	100
	3	10	100
	4	5	50
	5	7	70

The table 3.c presents the jurors evaluations of the developmental learning task features in the innovative learning materials based on each specific indicator. In the first indicator which assesses if the activities provided in the innovative learning materials is in easy, average to difficult level. All the 10 jurors or 100 percent unanimously agreed that this indicator is evident across all five learning materials. These implies the material's effective scaffolding of tasks to cater

to varying student levels of skills. The second indicator assesses if the activities are attainable by the students. For this indicator, Learning Materials numbered 2, 4, and 5 were also unanimously rated by all jurors as 'Evident' or 100 percent, demonstrating alignment with the learner's capabilities. However, Learning Material 1 received moderate ratings, with 7 out of 10 or 70 percent jurors rated as 'Evident', implying that some activities may be perceived as too challenging or unclear. Similarly, Learning Material 3 received a lower rate, with only 6 out of 10 jurors or 60 percent finding the tasks attainable or 'Evident'. These implies that some materials require adjustments to ensure tasks are achievable for all the students. For the third indicator it evaluates if activities encourage analysis, evaluation, and synthesis of information. Learning Materials numbered 1, 3, 4, and 5 received a rating 'Evident' from 10 jurors or 100 percent, implying that the activities effectively promote higher-order thinking skills. This alignment supports Bloom's Taxonomy, which recognized framework in the field of education, used to classify educational learning objectives according to levels of complexity and specificity (Ajayi, 2024).[6] Conversely, Learning Material number 2 received an evaluation that 6 out of 10 or 60 percent of the jurors agreeing that this indicator is 'Evident', with minimal adjustment. The fourth indicator assesses if activities promote deep understanding rather than rote memorization. Learning Materials 1, 2, and 3 were perfectly rated as 'Evident' in this indicator, highlighting that the materials build meaningful learning and also incorporate inquiry-based tasks that engage students in exploring concepts deeply. However, Learning Material 5 received moderate agreement, with 7 out of 10 jurors or 70 percent affirming the indicator. Conversely, Learning Material number 4 received an equal rating, with only 5 out of 10 jurors or 50 percent finding the indicator 'Evident' suggesting significant room for improvement.

The evaluation indicates that most innovative learning materials demonstrate features that support developmental learning tasks. The developmental learning tasks in the materials generally demonstrate pedagogical principles of critical thinking and deep understanding. It has learning activities provided that present mathematical processes which require a step-by-step procedure. However, Learning Material number 4 reveal areas where tasks could be refined to ensure they are attainable and promote deeper understanding. Activities that have level of difficulty can help the students learned the concepts slowly but surely. This implies that the learning tasks are from simpler to more complex tasks parallel to the set learning objectives. This aligns with literature that developmental activities will helps teachers understand the varying levels of knowledge exhibited by individual students, it allows them to better meet the learning needs of all children (Clements & Sarama, 2020).[7] In practice, developmental tasks can influence students problem-solving abilities at different levels of difficulty, from basic operations to complex problem-solving tasks.

Table 3d Jurors Evaluation on the Developed Innovative Learning Materials Along Problem Solving Approach Feature

Indicators	**Learning Materials No.**	**Evident** $n = 10$	**Percentage (%)**
Use logical, analytical, and systematic thinking to approach the problem.	1	10	100
	2	10	100
	3	10	100
	4	10	100
	5	10	100
Problems incorporate the content objectives.	1	10	100
	2	10	100
	3	6	60
	4	10	100
	5	10	100
Framed within a specific real-world scenario or context that provides the background for the mathematical question.	1	10	100
	2	7	70
	3	10	100
	4	10	100
	5	10	100
Require applying a sequence of logical steps to move from the given data to the desired solution.	1	10	100
	2	10	100
	3	10	100
	4	10	100
	5	6	60

Table 3d shows the jurors evaluations on the developed innovative learning materials along problem-solving approach features. The first indicator assesses if the innovative learning materials uses logical, analytical, and systematic thinking to approach the problem. All the 10 out of 10 or 100 percent of the jurors unanimously agreed that this indicator is 'Evident' in all learning materials. This consistent result implies that the materials effectively guide students in adopting a logical and systematic approach to problem-solving. This finding resonates with research highlighting that PBL (Problem Based Learning) materials is an important matter to be considered in an effort to maximize student mathematics learning achievement (Siagian, 2019).[8] For the second indicator which evaluates if the problems incorporate the content objectives. Learning Materials numbered 1, 2, 4, and 5 received favorably agreement from 10 jurors or 100 percent that the indicator is 'Evident', implying that the problems in these materials are well-aligned with the intended content objectives. However, Learning Material 3 showed a slightly lower rating, with only 6 out of 10 jurors or 60 percent agreeing that this indicator is 'Evident'. This suggests that Learning Material 3 can offer some adjustment to better integrate its problem sets with the instructional goals. The third indicator evaluate if it framed within a specific real-world scenario or context that provides the background for the mathematical question. Jurors unanimously agreed or 100 percent of the jurors said that this indicator is 'Evident' in Learning Materials 1, 3, 4, and 5, implying that these materials successfully use real-world scenarios to contextualize mathematical problems. Likewise, Learning Material 2 received moderate ratings, with 7 out of 10 jurors or 70 percent highlighting the presence of this indicator. The lower rating for Learning Material 2 suggests some adjustment that its problem sets could benefit from incorporating more practical and relatable contexts. For the last indicator that evaluates if the innovative learning materials require applying a sequence of logical steps to move from the given data to the desired solution. Learning Materials 1, 2, 3, and 4 were unanimously rated or 100 percent of the jurors said that these materials meet this indicator. These implies that the indicator is 'Evident', demonstrating the effectiveness in guiding the students through logical sequences to reach solutions. More so, Learning Material 5, however, received with only 6 out of 10 jurors finding this indicator 'Evident'.

This result implies that Learning Material 5 may lack of clarity in its problem-solving tasks and need some improvement. Problem-solving approach must be essential in teaching mathematics. Overall, the problem-solving approach embedded in the developed innovative learning materials which is well-aligned with educational standards and promotes logical thinking and systematic sequence. This incorporate with the literature highlighting that teaching mathematical problem-solving is an efficient way to develop 21st-century skills and to give cross-curricular experiences with real-world meaning to learners. By including in the learning process and practicing specific methods for solving mathematical problems, students could learn a way of thinking to approach and solve problems successfully in a broader context in life (Szabo et al., 2020).[9] In practice, an activity that incorporate problem solving helps the students become more effective problem solvers because they think critically and refining strategies as they work through the mathematical problems. Specifically, those topics that requires logical and critical thinking skills. However, Learning Materials 3, 2, and 5 show room for improvement in certain indicators. The jurors suggest to incorporate more practical examples and providing clearer step-by-step guidance in the word problems.

Table 3e Summary Table on Jurors Evaluation on the Developed Innovative Learning Material

Features	Learning Materials No.	Evident $n = 10$	Percentage (%)
Contextualized	1	8	80
	2	9	90
	3	9	90
	4	10	100
	5	10	100
Collaborative	1	10	100
	2	10	100
	3	7	70
	4	7	70
	5	9	90
Developmental Learning Tasks	1	9	90
	2	9	90
	3	9	90
	4	9	90
	5	9	90
Problem Solving Approach	1	10	100
	2	9	90
	3	9	90

	4	10	100
	5	9	90

Table 3e summarizes on jurors' evaluation of the developed innovative learning materials across four key features: contextualized, collaborative, developmental learning tasks, and problem-solving approaches. The contextualized feature was universally 'Evident' in Learning Materials 4 and 5, as affirmed by all the 10 jurors. This indicates that 100 percent of the jurors said that these materials effectively integrate real-world scenarios relevant to learner's contexts. For Learning Materials 2 and 3, 9 out of 10 jurors found this feature 'Evident' or 90 percent. In contrast, Learning Material 1 had 8 out of 10 jurors agree or 80 percent.

For the collaborative features it is unanimously 'Evident' or 100 percent jurors said that in Learning Materials 1 and 2 showcased the effectiveness in fostering teamwork and interaction among students. Learning Material 5 also received high ratings with 9 out of 10 jurors or 90 percent affirming its collaborative feature while 1 juror disagreed. However, Learning Materials 3 and 4 showed slightly lower rating with 7 out of 10 jurors rated as 'Evident' or 70 percent. This result suggests that while collaboration is present, improvements could focus on creating more dynamic group activities.

For the developmental learning tasks feature, 9 out of 10 jurors or 90 percent agreed that this was 'Evident' in all learning materials. This consistency implies that the material's ability to provide a progression of activities that will cater to different learning levels. However, the minimal disagreement indicates the need for minor adjustments to ensure inclusivity.

The problem-solving approach feature was unanimously evident in Learning Materials 1 and 4 highlighting their ability to promote logical, analytical, and systematic thinking. For Learning Materials 2, 3, and 5, there are 9 out of 10 jurors or 90 percent affirmed this feature. This result demonstrates alignment with pedagogical principles promoting critical thinking but suggests slight refinements to strengthen their problem-solving approach.

Overall, the innovative learning materials were evaluated positively, particularly in their contextualized and problem-solving features. However, slight discrepancies in collaborative and developmental tasks suggest areas for improvement. This is consistent with literature emphasizing the importance of instructional materials in the effective academic performance of the learners. The positive attitude of teachers and the proper utilization of these resources are indeed necessary in the teaching and learning process (Hizon, 2018).[10] The remarks accompanying each innovative learning materials would provide valuable insights into how these areas might be enhanced to better support the learning process and achieve the desired educational outcomes. The juror's evaluation of the developed innovative learning materials implies that while most of indicators were effectively evident in the materials, there are still areas for improvement. The instances of 'Not Evident' in the evaluation of the developed innovative learning materials likely point out to some specific parts in the learning materials and mastery of learning competencies that did not fully meet the juror's expectations. The remarks of the jurors will provide insights into how the materials will be enhanced to achieve the desired learning outcomes or objectives. Enhancing some of these areas will ensure that these materials will provide high-quality, engaging, and inclusive learning experiences aligned with modern educational frameworks in this generation. All the comments and suggestions of the jurors were incorporated to all the learning materials before it was distributed to the respondents for measuring the learning materials level of acceptability.

3.4. Level of Acceptability of the Developed Innovative Learning Materials

The level of acceptability of the developed innovative learning materials is an essential steps that reflects the effectiveness and suitability of these developed innovative learning materials for teaching Business Mathematics. It encompasses various dimensions such as content quality, clarity, appeal, and originality that are essential for ensuring that the materials meet the needs and expectations of both teachers and learners. The acceptability level is often described using a range of descriptors from 'extremely acceptable' to 'not acceptable' with aimed of identifying the areas for enhancement. In this study it utilized the five-point likert scale. The mean ranges are provided to categorize the level of acceptability based on the calculated weighted mean scores for both teachers and students. These ranges are accompanied by adjectival descriptions: extremely acceptable, highly acceptable, moderately acceptable, slightly acceptable, and not acceptable. This provides a clear interpretation of the level of acceptability of the following materials.

Table 4 Summary Table on Level of Acceptability of the Developed Innovative Learning Materials as perceived by the Teachers and Students

Features	LMs NO.	Teachers		Students		Average	
		WM	AD	WM	AD	WM	AD
Contextualized	1	3.83	HA	4.25	EA	4.04	HA
	2	4.13	HA	4.53	EA	4.33	EA
	3	4.53	EA	4.35	EA	4.44	EA
	4	4.60	EA	4.53	EA	4.57	EA
	5	4.65	EA	4.38	EA	4.52	EA
Collaborative	1	3.80	HA	4.55	EA	4.18	HA
	2	4.20	EA	4.48	EA	4.34	EA
	3	4.38	EA	4.40	EA	4.39	EA
	4	4.63	EA	4.25	EA	4.44	EA
	5	4.63	EA	4.40	EA	4.52	EA
Developmental Learning Tasks	1	4.05	HA	4.00	HA	4.03	HA
	2	3.90	HA	4.35	EA	4.13	HA
	3	4.40	EA	4.23	EA	4.32	EA
	4	4.63	EA	4.18	HA	4.41	EA
	5	4.65	EA	4.43	EA	4.54	EA
Problem Solving Approach	1	3.98	HA	4.28	EA	4.13	HA
	2	3.90	HA	4.25	EA	4.08	HA
	3	4.13	HA	4.40	EA	4.27	EA
	4	4.28	EA	4.00	HA	4.14	HA
	5	4.23	EA	4.25	EA	4.24	EA

Legend: WM-Weighted Mean, AD-Adjectival Description, LMs-Learning Materials, EA-Extremely Acceptable, HA-Highly Acceptable, MA-Moderately Acceptable, SA-Slightly Acceptable, NA-Not Acceptable

The table shows the summary on the level of acceptability of the developed innovative learning materials as perceived by the teachers and students reveals insights regarding the effectiveness of various features across the five developed learning materials. In the Contextualized Feature, the ratings were generally high. Learning Material 1 was rated 'Highly Acceptable' by teachers with a weighted mean of 3.83 and 'Extremely Acceptable' by students with a weighted mean of 4.25. Learning Material 2 received a slightly higher rating from both groups, with teachers rating it 'Highly Acceptable' with a weighted mean of 4.13 and students rating it 'Extremely Acceptable' with a weighted mean of 4.53. Learning Material 3 received 'Extremely Acceptable' ratings from both teachers and students with a weighted mean of 4.53 and 4.35, while Learning Material 4 was rated 'Extremely Acceptable' by teachers and students having a weighted mean of 4.60 and 4.53. Learning Material 5 also received 'Extremely Acceptable' ratings from both groups, with teachers giving it a weighted mean of 4.65 and students giving it a weighted mean of 4.38. In the average mean Learning Materials 2, 3, 4, and 5 received higher scores, with Materials 4 and 5 achieving 4.57 and 4.52, respectively, both rated as 'Extremely Acceptable'. While, Learning Material 1 received an average weighted mean of 4.04, described as 'Highly Acceptable'. This implies that most of the materials were highly acceptable, with Learning Material 4 being particularly well-accepted. The ratings show that the learning materials are well-received by both students and teachers, indicating that it is successful in creating developing innovative materials that are engaging and relevant. In general experience as a Business Mathematics teacher, it is rewarding to see that students are not only able to learn the material but also find it meaningful and engaging, which leads to better learning outcomes.

The Collaborative Feature saw a similar trend, with Learning Material 1 receiving 'Highly Acceptable' ratings from teachers with a weighted mean of 3.80 and 'Extremely Acceptable' ratings from students with a weighted mean of 4.55. Learning Material 2 was rated 'Extremely Acceptable' by teachers giving it a weighted mean of 4.20 and students rating it 4.48. Learning Material 3 received 'Extremely Acceptable' ratings from both teachers and students with a weighted mean of 4.38 and 4.40, while Learning Material 4 was rated also as 'Extremely Acceptable' by teachers with a weighted mean of 4.63 and students with a weighted mean of 4.25. Learning Material 5 also received 'Extremely Acceptable' ratings from both groups, with a weighted mean of 4.63 and 4.40. In the average mean Learning Materials 2, 3, 4, and 5 all received extremely favorable ratings, with Learning Material 5 achieving the highest score of 4.52. Learning Material 1 received an average weighted mean of 4.18, rated as 'Highly Acceptable'. This suggests that the materials were generally effective in fostering collaboration, with Learning Material 5 being the most highly rated. Overall, the results affirm that the collaborative feature of the developed innovative materials is positively impacting students' learning experiences. In practice, incorporating more collaborative activities during the teaching learning process let the students engage easily since they have that confident that they will learn the lessons with the help also of their classmates.

In the Developmental Learning Tasks Feature, Learning Material 1 received 'Highly Acceptable' ratings from both with a weighted mean of 4.05 and 4.00. Learning Material 2 was rated 'Highly Acceptable' by teachers with a weighted mean of 3.90 and 'Extremely Acceptable' by students with a weighted mean of 4.35. Learning Material 3 received 'Extremely Acceptable' ratings from both teachers and students with a weighted mean of 4.40 and 4.23. Learning Material 4 was rated 'Extremely Acceptable' by teachers with a weighted mean of 4.63 but only 'Highly Acceptable' by students with a weighted mean of 4.18. Learning Material 5 received 'Extremely Acceptable' ratings from both groups, with teachers rating 4.65 and students rating 4.43. In the average mean Learning Materials 3, 4, and 5 received higher scores, with Learning Material 5 reaching 4.54, described as 'Extremely Acceptable'. Learning Material 1 and 2 received a scores of 4.03 and 4.13, rated as 'Highly Acceptable'. This demonstrates that the materials were perceived as highly acceptable in supporting developmental learning tasks, with Learning Material 5 standing out in this regard. Anecdotally, the developed innovative materials incorporate easy, average, to difficult set of activities that will guide the students to the step-by-step process of the solving problems in Business Mathematics that will make the process easier.

In the Problem-Solving Approach Feature, Learning Material 1 received 'Highly Acceptable' rating from teachers with a weighted mean of 3.98 and 'Extremely Acceptable' by students with a weighted mean of 4.28. Similarly, Learning Material 2 was rated 'Highly Acceptable' by teachers with a weighted mean of 3.90 and 'Extremely Acceptable' by students with a weighted mean of 4.25. Also, Learning Material 3 received 'Highly Acceptable' ratings from teachers with a weighted mean of 4.13 and 'Extremely Acceptable' ratings from students with a weighted mean of 4.40. While, Learning Material 4 was rated 'Extremely Acceptable' by teachers with a weighted mean of 4.28 and 'Highly Acceptable' by students with a weighted mean of 4.00. Learning Material 5 received 'Extremely Acceptable' ratings from both groups, with teachers rating it 4.23 and students rating it 4.25. Finally, the average mean indicates that Learning Materials 3 and 5 received scores of 4.27 and 4.24, respectively, both rated as 'Extremely Acceptable'. Learning Materials 1, 2, and 4 received an average weighted mean of 4.13, 4.08 and 4.14, described as 'Highly Acceptable'. This indicates that most materials were viewed favorably in terms of promoting problem-solving approaches, with Learning Materials 3 and 5 being particularly well-received. Overall, this feedback is motivating as it supports the effectiveness of the problem-solving approach in teaching. Problem-solving approach feature is a must in any learning materials since it let the students think critically. As my experience, letting the students solve word problems let their understanding deeper.

These implies that most learning materials were 'Highly Acceptable' or 'Extremely Acceptable' to both teachers and students. However, there were noticeable variations in the perception of specific materials, especially regarding the Developmental Learning Tasks Feature and the Problem-Solving Approach Feature, where certain materials were rated more highly by students than by teachers. This suggests that students might find these materials more engaging or accessible, while teachers may see room for improvement. Future research might explore ways to further improve the materials' effectiveness, especially in ensuring that both teachers and students find them equally beneficial in achieving learning outcomes.

3.5. The Enhancement in the Developed Innovative Learning Materials

Learning Material 1 focused on the topic Solving Problems Involving Percent. One of the areas that need for enhancements is the first indicator under contextualized. This indicator assesses if the learning materials provides real-life applications of the topic. Some examples that are present in the materials are too abstract that the students can encounter difficulty in connecting the concepts to their everyday live. To enhance this indicator, the problems that are generic were change to more diverse set of real-life scenarios of percent. The problems included are calculating discount during shopping, calculating interest rate for savings account, budgeting to an event or even personal allowances, and

scenarios in buying and selling. Students can now be able to better appreciate how percentages play a role in their daily activities.

Secondly, the second indicator under contextualized features which relates learning content to local information, also need for enhancements. To enhance this indicator, the problems that are out of the context that are not related locally were removed. Problems in the activities were change into localized data. Even the examples in the 'Target' section were also enhance into content that the students can directly relates such as their school or community. For example, personal savings, result of exams and buying scenario. The problems that were incorporated also are problems that is related into real life establishment that they observe and most familiar in their environment. By using the local data, students are likely to find the material more engaging that can enhance their understanding of the application of percentages into their everyday environment.

Lastly, the third indicator under developmental learning tasks also need an enhancement which evaluate if the activities encourage analysis, education, and synthesis of information. The activities in Learning Material 1 were enhanced to better promote higher-order thinking skills such as analysis, evaluation, and synthesis. Currently, the activities focus on basic problem-solving exercises, which not fully encourage critical thinking. To address this indicator, multi-step problems that require students to analyze and synthesize information were incorporated. In the 'Challenge' section a problem will determine first the cost of the whole cake to determine the amount of sales from the two customers and draw conclusions based on the amount computed. This could not only enhance students understanding of content which is about the percentages but also cultivate skills in analysis and evaluation, which are essential for problem-solving in real-life context.

By incorporating these enhancements, Learning Material 1 will better address the areas in need for improvement. These enhancements will provide and improve the learning experience by making the material more relevant, engaging, and interactive for students. Equipping them with valuable skills that extend beyond the classroom and into their daily lives.

4. Conclusion

The current status implies that their are learning materials used by teachers in teaching business mathematics. Some of these materials are available in their school for usage but some are not. The development process involved structuring the innovative learning materials focusing on lessons in Business Mathematics that need problem-solving skills. Specific learning competencies were identified, and corresponding key features were incorporated into the materials.

The jurors' evaluation showed positive reception of the developed innovative learning materials, particularly in contextualization, collaboration, and integrating problem-solving approach. However, there were areas in the developmental learning task feature identified for improvement, such as the second indicator under developmental learning task feature where the learning materials must have activities that are attainable by the students.

Meanwhile, after some adjustments based from the jurors suggestions, the level of acceptability indicated that the learning materials were extremely acceptable demonstrating the potential to effectively support the teaching and learning process. The study highlight the importance of continually refining educational materials to effectively address the needs of both the teachers and students. By incorporating again the comments and suggestions through proposed enhancements based from the evaluators, the developed innovative learning materials can improve in facilitating student learning and understanding of business related situations. However, further research is needed to evaluate the impact of these enhancements on student engagement, understanding, and problem-solving skills.

Compliance with ethical standards

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The authors declare no competing interests.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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