

Multisensory Approach and Problem-Solving Proficiency in Business Mathematics

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Abstract

This study aimed to determine the effect of the multisensory approach on the problem-solving proficiency in Business Mathematics of Grade 11 General Academic Strand (GAS) students at Colacling National High School, Colacling, Lupi, Camarines Sur, Lupi District, Division of Camarines Sur during the School Year 2024–2025. Also, this specifically determined the status of students' problem-solving proficiency in Business Mathematics in terms of solving problems involving fractions, decimals, and percentages; direct, inverse, and partitive proportions; and buying and selling products; developed multisensory instructional materials in Business Mathematics; determined the level of students' problem-solving proficiency in Business Mathematics after using the multisensory instructional materials; assessed the significant difference between the students' problem-solving proficiency in Business Mathematics before and after the implementation of multisensory instructional materials; and assessed the effectiveness of multisensory instructional material in enhancing students' problem-solving proficiency in Business Mathematics. A total of 69 Grade 11 GAS students served as respondents of the study. A descriptive-comparative research design was utilized. Major conclusions were: students have a below-average problem-solving proficiency in Business Mathematics; the development of multisensory instructional materials in Business Mathematics successfully addressed the identified learning difficulties of students; the use of multisensory instructional materials enhanced the problem-solving proficiency of students in Business Mathematics from beginning to approaching proficiency; there was a significant improvement in the problem-solving proficiency of students in Business Mathematics after using the multisensory instructional materials; the multisensory instructional materials had a large and positive effect on enhancing the problem-solving proficiency of students across all learning areas.

Keywords: Multisensory Approach, Instructional Materials, Problem-Solving Proficiency

Introduction

Mathematics plays a crucial role in shaping analytical thinking and practical decision-making, particularly in the context of Business Mathematics. Concepts such as percentages, proportions, fractions, and financial computations require not only procedural knowledge but also the ability to apply understanding in real-life situations. However, many learners struggle to translate learned procedures into effective problem-solving strategies, often relying on memorization rather than conceptual understanding. This results in low problem-solving proficiency, where students find difficulty in analyzing problems and generating appropriate solutions. The multisensory approach, which integrates visual, auditory, and kinesthetic experiences, emerges as a promising strategy to address these challenges by promoting deeper understanding and meaningful engagement with mathematical concepts.

One approach that has shown potential in addressing these challenges is the multisensory approach, which incorporates visual, auditory, and kinesthetic learning experiences into instruction. The use of multisensory instructional materials; such as manipulatives, charts, diagrams, and interactive activities, serves as an intervention that engages multiple senses, allowing learners to interact with concepts in ways that enhance understanding and retention. By providing students with opportunities to see, hear, and actively manipulate mathematical ideas, these materials support the development of problem-solving proficiency and improve learners' ability to apply concepts effectively in various scenarios. Implementing multisensory instructional materials in the teaching of Business Mathematics aims to bridge the gap between conceptual understanding and practical application, fostering a learning environment that promotes active participation, meaningful engagement, and improved academic outcomes.

At the global level, improving mathematics education remains a significant concern, as reflected in international assessments and global educational frameworks. The United Nations, through the Sustainable Development Goals, particularly Sustainable Development Goal 4, emphasizes the need to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. This global agenda highlights the importance of adopting innovative and learner-centered teaching strategies that address diverse learning needs and improve learning outcomes. Despite these efforts, international large-scale assessments such as PISA continue to reveal that many students worldwide experience difficulties in mathematical problem-solving, reinforcing the need for effective instructional approaches like the multisensory approach. This SDG Goal 4 aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. This goal directly promotes access to quality education for all, where multisensory learning can be a powerful tool to engage diverse learners and enhance understanding for students with different learning styles.

Developing instructional materials is aligned with this goal by ensuring that students have access to quality learning resources tailored to their individual needs, allowing them to engage with concepts in ways that suit their unique learning styles. Instructional materials are essential tools in learning every subject in the school curriculum. They allow the students to interact with words, symbols and ideas in ways that develop their abilities in reading, listening, solving, viewing, thinking, speaking, writing, using media and technology (Bukoye, 2019) ^[3]. In this way, the instructional material serves as essential resources for bridging learning gaps and improving students' overall proficiency in mathematics.

Providing quality education remains a major concern. International large-scale assessments, such as the Program for International Student Assessment (PISA), have repeatedly revealed low levels of mathematical proficiency among students from different countries. As emphasized by Volpe and Gori (2019) ^[22], these difficulties at the foundational level often create long-term learning gaps, making it harder for learners to comprehend more abstract or complex mathematical ideas as they move up the grade levels. Because of this recurring global challenge, educators and researchers have increasingly sought instructional strategies that can support diverse learners and strengthen their ability to engage with mathematical tasks.

Around the world, as reflected in the data presented by OECD (2023) ^[17] in many developing nations, including those in Southeast Asia, the challenges in mathematics education are further intensified by contextual factors such as insufficient access to quality learning materials, overcrowded classrooms, varied learning capabilities among students, and limited opportunities for individualized teacher support. Studies conducted in Vietnam, for instance, have emphasized that even with ongoing curricular reforms,

students continue to face difficulties in translating mathematical concepts into problem-solving situations. This persistent gap between theoretical learning and practical application reflects a broader issue in mathematics classrooms where students often memorize procedures but fail to understand how to use them meaningfully.

In the recent years, the Philippines has actively participated in various assessments to gauge the effectiveness of its educational system. One of these is the National Achievement Test (NAT), administered by the Department of Education, which serves as a key tool in measuring the academic performance of students across the country. Reports show that mathematics performance in the Philippines has consistently performed poorly in international and national assessments. For instance, results from the 2018 NAT revealed a decline in mathematics scores from 57% to 46.3%. Similarly, findings from 2022 Programme for International Student Assessment (PISA) indicated that the Philippines only showed minimal improvement in mathematics from 353 in 2018 to 355 in 2022. These findings indicate that many Filipino students who belong below international standards in mathematics proficiency compared to their counterparts from other countries. (Chi,2023; Lapinid et al. 2022) ^[5, 9]

A similar concern is evident within the researcher's own local context. The Department of Education, through the Regional Memorandum No. 382, Series 2023, also known as the Albay Numeracy Assessment Tools. The tool aims to diagnose numeracy skills, generate baseline data, and inform instructional improvements to promote better math performance. The ALNAT result in mathematics of Colacling National High School, for the school year 2024 – 2025 revealed that Grade 11 General Academic Strand students obtained an overall score of 37.20%, which indicates Needs Major Support. One of the primary factors contributing to this low performance is difficulty in problem-solving, a core skill that is essential for understanding and applying mathematical concepts effectively. The school's performance remains notably below the national target of 75%, highlighting a critical need for targeted interventions and instructional strategies to enhance students problem-solving abilities and improve overall mathematics achievement, ensuring alignment with both school and national learning standards. This was supported by Machera (2017) ^[10] where interventions have benefits if administered properly; self-directing, cooperation and teamwork among students comprise some of the benefits. This is one of the many reasons why it is necessary to intervene. It will not only enable students to build their own emotional self, but will also help them to know that their teachers are involved. This only proves that it is of significant relevance to select an effective and efficient mathematical intervention.

To respond to abovementioned, the government creates program to emphasize the importance of providing a learner-centered, inclusive, and developmentally appropriate curriculum. To harness the full potential of education, it is crucial for the government to invest in innovative teaching methods, provide adequate training for educators, and ensure availability of resources that support inclusive and diverse learning style. With that, the government implemented the rules and regulations of the Republic Act No. 10533, also known as Enhanced Basic Education Act of 2013, an act mandates the integration of innovative and effective teaching strategies that cater to the diverse learning needs of students, ensuring that education is not only accessible but also of high quality: Section 10.2 Standard and Principles, the DepEd shall adhere to the following standards and principles, when appropriate, in developing basic education curriculum. The curriculum shall be flexible enough to enable and allow schools to localize, indigenize, and enhance the same based on their respective educational and social contexts; and 10.3 Production and Development of Materials. The production and development of locally produced teaching materials shall be encouraged and approval of these materials shall devolve to the regional and

division education unit in accordance with national policies and standards.

In line with the goals set by the Department of Education (DepEd), particularly through DepEd Order No. 001, s. 2025, which provides operational guidelines on the implementation of support to schools for improved learning outcomes. It underscores the need for developing critical thinking and problem-solving skills among students, aligning with the goals of the K to 12 Program. Emphasizes the need for innovative and differentiated instruction to address diverse learners. DepEd policy highlights the importance of providing varied learning opportunities to ensure that every student, regardless of their learning style or background, can succeed academically. Engaging multiple senses significantly enhances students' comprehension, retention, and application of mathematical concepts in real-world contexts. The National Council of Teachers of Mathematics (NCTM, 2018) ^[14] underscores the importance of connecting mathematical instruction with learners' experiences and interests, noting that such connections enhance critical thinking and problem-solving skills.

Several studies support the effectiveness of a multisensory approach in improving learning outcomes, particularly in mathematics. These suggests that engaging multiple sensory channels enhances retention and strengthens understanding because information processed through visual, auditory, and kinesthetic experiences creates stronger neural connections (Ardilla, 2024; Delpont, 2021; Nurhasanah et al., 2024; Williams, 2023) ^[2, 6, 15, 32]. In mathematics education, this approach has been found especially beneficial for learning abstract concepts and improving problem-solving proficiency, as multisensory strategies allow learners to actively manipulate materials and connect ideas through meaningful experiences (Ismaimuza et al., 2023, Schardt, 2018; Yurniwati, 2018) ^[8, 20, 24]

Moreover, integrating multisensory instruction with developmentally appropriate and differentiated learning experiences helps address diverse learning styles, close performance gaps, and promote inclusive classroom environments (Aguhayon et al., 2023; Hoskins & Smedley, 2019; Nurjanah et al., 2024) ^[1, 7, 16] Studies further indicate that stimulating multiple senses leads to deeper conceptual understanding and improved mathematical performance, highlighting its potential as an effective instructional approach for learners who struggle with abstract mathematical tasks (Rajkumar & Nachimutu, 2024)^[18]. Collectively, evidence from these studies demonstrates that integrating multisensory elements into instruction not only improves cognitive outcomes but also increases student engagement, motivation, and active participation, fostering a more effective and inclusive learning environment. Moreover, studies emphasize the importance of multisensory technologies and instructional materials in enhancing learner engagement and academic performance. Studies indicate that active participation supported by multisensory technologies improves learning outcomes, while well-designed instructional materials significantly influence students' competencies, attitudes toward learning, and effective learning strategies (Candelaria, 2021; Taljaard, 2016) ^[4, 21]

At the local level, similar challenges are evident within schools, where students continue to struggle with problem-solving in Business Mathematics. For instance, results from the Albay Numeracy Assessment Tool revealed that Grade 11 General Academic Strand students obtained a rating categorized as "Needs Major Support," significantly below the expected performance standard. This suggests that learners have difficulty translating mathematical concepts into practical solutions, particularly in solving business-related problems. Contributing factors may include limited use of interactive instructional materials, varied learning styles among students, and the abstract nature of mathematical concepts. These issues highlight the urgent need for targeted interventions, such as the integration of multisensory approaches, to improve students' engagement and problem-solving proficiency.

The significance of this study extends to various stakeholders in the educational community. For students, the study offers opportunities to improve problem-solving proficiency through engaging and interactive learning experiences. For teachers, the findings provide evidence-based strategies for integrating multisensory instructional materials into classroom practices. School heads may utilize the results to design intervention programs and promote innovative teaching approaches. The Department of Education may benefit from localized data that can inform curriculum enhancement and policy development. Future researchers may also use the study as a reference for further investigations on multisensory approaches and mathematics learning. Overall, the study contributes to the improvement of instructional practices and student learning outcomes.

The rationale for conducting this study is grounded in the observed gap between existing instructional practices and the persistent difficulties in problem-solving proficiency among Grade 11 General Academic Strand students in Business Mathematics. While various teaching strategies are employed to improve mathematical understanding, limited attention has been given to the use of multisensory approaches that actively engage learners through multisensory modalities. Most local studies tend to focus on students' academic performance without thoroughly examining how diverse sensory-based instructional methods influence their ability to analyze and solve business-related mathematical problems. This gap limits the development of more inclusive and effective teaching interventions that address different learning styles. By examining the effect of a multisensory approach on students' problem-solving proficiency, the study seeks to bridge this gap, and provide empirical evidence relevant to senior high school learners. The findings are essential in addressing existing learning challenges and contributing to improved mathematical understanding and performance at both the classroom and broader educational levels.

Objectives

- To determine the status of students' problem-solving proficiency in Business Mathematics in terms of solving problems involving fractions, decimals, and percentages; direct, inverse, and partitive proportions; and buying and selling products.
- To develop multisensory instructional materials in Business Mathematics.
- To determine the level of students' problem-solving proficiency in Business Mathematics after using the multisensory instructional materials.
- To assess the significant difference between the students' problem-solving proficiency in Business Mathematics before and after the implementation of multisensory instructional materials.
- To assess the effectiveness of multisensory instructional material in enhancing students' problem-solving proficiency in Business Mathematics.

Methodology

This research provides a comprehensive overview of the methodological framework that guides the conduct of the study. It outlines the research design employed, serving as the blueprint for addressing the research objectives. The discussion further presents the respondents of the study, including their characteristics and selection criteria, to ensure clarity and relevance. It also describes the research instrument used for data collection, along with the procedures of investigation followed in gathering the necessary data. In addition, this section highlights the ethical considerations observed to protect the

rights and welfare of the participants. Finally, it explains the data analysis techniques utilized to interpret and analyze the collected data in relation to the objectives of the study.

Population and Sample

The respondents of the study consisted of sixty-nine (69) Grade 11 General Academic Strand students of Colacling National High School, Colacling Lupi Camarines Sur, Lupi 2 District, Division of Camarines Sur, School Year 2024 – 2025. These students participated in the data-gathering process through teacher-made tests and questionnaire and were statistically treated using mean, standard deviation, weighted mean, and t-test. Participation was voluntary, and all responses were kept confidential through coded identification. The completed instruments provided the data sets necessary in determining the effectiveness of the intervention and understanding the respondents' learning experiences. The study used purposive sampling in selecting the respondents. This sampling method was appropriate because the research specifically focused on the Grade 11 GAS learners who were directly exposed to multisensory instructional approach. This method ensured that all respondents were capable of providing meaningful data relevant to the objectives of the study.

Data and Sources of Data

This study specifically determined the status of students' problem-solving proficiency in Business Mathematics in terms of solving problems involving fractions, decimals, and percentages; direct, inverse, and partitive proportions; and buying and selling products; developed multisensory instructional materials in Business Mathematics; determined the level of students' problem-solving proficiency in Business Mathematics after using the multisensory instructional materials; assessed the significant difference between the students' problem-solving proficiency in Business Mathematics before and after the implementation of multisensory instructional materials; and assessed the effectiveness of multisensory instructional material in enhancing students' problem solving proficiency in Business Mathematics. A descriptive-comparative research design was utilized, and statistical tools such as mean, weighted mean, standard deviation, proficiency level, paired t-test, and Cohen's d were used in the analysis and interpretation of data.

Theoretical Framework

Integrating the Multisensory Learning Theory by Samuel Orton, and Anna Gillingham (1878), as cited by Magulod (2019); Constructivist Theory by Jean Piaget (1896), as cited by Resnik and Glazer (2016); and Social Learning Theory by Albert Bandura (1977) as cited by McLeod (2025). These three foundational perspectives collectively illustrate how learners acquire, process, and apply mathematical knowledge, particularly in the context of Business Mathematics among Grade 11 General Academic Strand students.

Multisensory Learning Theory originally proposed by Samuel Torrey Orton and Anna Gillingham (1878), emphasizes that learning is most effective when multiple senses such as visual, auditory, kinesthetic, and tactile, are engaged simultaneously. Developed from Orton's early studies on children with reading difficulties such as Dyslexia, the theory highlights that integrating different sensory modalities strengthens memory, enhances understanding, and supports diverse learners. Gillingham translated these principles into structured and systematic instructional approaches, making the theory applicable in various educational settings, including mathematics, where abstract concepts can be better

understood through hands-on and visual experiences. This approach promotes active participation, improves retention, and accommodates different learning preferences. Moreover, as cited by Magulod (2019) ^[11], students commonly prefer visual, group-based, kinesthetic, and tactile learning styles, which further supports the effectiveness and relevance of the multisensory learning theory. The latest research also links the multisensory approach to improved problem-solving skills and academic performance, demonstrating its practical impact across various learning domains. This theory supports the study by providing a basis for the use of a multisensory approach that enhances the problem-solving proficiency of Grade 11 General Academic Strand (GAS) students in Business mathematics through the integration of visual, auditory, and kinesthetic learning experiences. Furthermore, it emphasizes that engaging multiple senses through a multisensory approach enhances students' retention, comprehension and active participation, which contributes to improving the problem-solving proficiency of Grade 11 GAS students in Business Mathematics.

Constructivist Theory rooted in the work of Jean Piaget (1896), posits that learners actively construct knowledge rather than passively receive it from their environment. Central to this theory is the principle of personal or trial constructivism, which emphasizes that learning occurs through the interaction between prior knowledge and new experiences. Instead of viewing knowledge as something transmitted by a more knowledgeable individual, constructivism highlights the learner's active role in making meaning, forming connections, and interpreting information based on existing cognitive structures. While this perspective raises questions regarding the nature of knowledge, the role of the environment, and how learners connect new information with prior understanding, it remains foundational in explaining how meaningful learning takes place. Furthermore, as cited by Resnick and Glaser (2016) ^[19], constructivism is a theory of learning or meaning-making that enables individuals to develop new understanding through the interplay of what they already know and the concepts they encounter, emphasizing a student-centered approach where the teacher functions as a facilitator rather than the sole source of knowledge. Recent studies also link constructivist approaches to enhanced critical thinking, problem-solving skills, and deeper comprehension, highlighting its continued relevance in contemporary education. This theory supports the study by emphasizing that students actively construct knowledge through experience, thereby justifying the use of multisensory instructional materials to improve their understanding and problem-solving proficiency in Business Mathematics. Furthermore, it highlights the importance of active learning where students construct knowledge through meaningful experiences, thereby strengthening their ability to analyze and solve problems in Business Mathematics using multisensory instructional materials.

Social Learning Theory developed by Albert Bandura (1977), posits that individuals acquire new behaviors, attitudes, and emotional responses through observing and imitating others within a social context. Central to this theory is the concept of observational learning or modeling, which suggests that learners can understand and replicate complex behaviors simply by watching others, even without direct experience or immediate reinforcement. This perspective highlights the importance of imitation, modeling, and reinforcement in shaping behavior, emphasizing that learning is not solely the result of direct instruction but also of social interaction and environmental influence. Furthermore, as cited by McLeod (2025) ^[12], Social Learning Theory underscores how individuals actively process observed behaviors and integrate them into their own actions, demonstrating that learning is both cognitive and social in nature. Bandura's contributions. This theory supports the study by highlighting the importance of social interaction and observational learning, which contribute to the development of student's

problem-solving proficiency in Business Mathematics within a multisensory learning environment. Furthermore, it underscores the role of social interaction and collaborative learning in developing problem-solving proficiency, enabling Grade 11 General Academic Strand (GAS) students to learn effectively through observation, imitation, and shared experiences within a multisensory learning environment.

Results and Discussions

The outcome of the study are stated below:

Table 1. Status of Students' Problem-Solving Proficiency in Business Mathematics

Areas	No. of Items	Mean Score	SD	PL	Int.
Solving problems involving direct, inverse and partitive proportion	10	5.03	2.26	50.29	B
Solving problems involving buying and selling products	10	3.70	2.05	36.96	B
Solving problems involving fractions, decimals and percentages	10	3.16	1.22	31.59	B
Average	30	3.96	1.84	31.61	B

Table 1 indicates that students obtained the highest mean score of 5.03 ($SD = 2.26$) in solving problems involving direct, inverse, and partitive proportion, with a proficiency level of 50.29. This was followed by solving problems involving buying and selling products, which obtained a mean score of 3.70 ($SD = 2.05$), a PL of 36.96. The lowest mean score was recorded in solving problems involving fractions, decimals, and percentages, with a mean of 3.16 ($SD = 1.22$), a PL of 31.59. Overall, the students obtained an average mean score of 3.96 ($SD = 1.84$) and an overall proficiency level of 31.61, which falls under the Beginning level.

These results reveal that across all areas of business mathematics assessed, the problem-solving proficiency of Grade 11 GAS students falls under Beginning level. Although solving problems involving direct, inverse, and partitive proportion ranked highest among the three areas, its proficiency level is still considerably low, indicating limited mastery of the required concepts and procedures. The relatively high standard deviations across areas suggest variability in students' performance, implying that while some students demonstrate partial understanding, many struggle with fundamental problem-solving proficiency. The lowest performance in fractions, decimals, and percentages highlights a critical area of weakness, as these concepts serve as foundational skills for higher-level business mathematics topics. The consistently low proficiency levels across all indicators point to a general difficulty in applying mathematical concepts to problem-solving situations.

The findings imply that Grade 11 GAS students have not yet developed sufficient problem-solving proficiency in Business Mathematics, as reflected by the Beginning level across all areas. The low mean scores suggest difficulties not only in procedural computation, but also in understanding and applying concepts to real-life business-related problems. Weak performance in fractions, decimals, and percentages may hinder students' ability to solve more complex Business Mathematics problems such as profit, loss and proportional reasoning. This indicates a need for targeted instructional interventions

focusing on conceptual understanding and problem-solving strategies to improve students’ mathematical proficiency.

Table 2. Level of Students’ Problem-Solving Proficiency in Business Mathematics after using the Multisensory Instructional Materials

Areas	No. of Items	Mean Score	SD	PL	Int.
Solving problems involving direct, inverse and partitive proportion	10	8.30	1.32	83.04	AP
Solving problems involving buying and selling products	10	7.38	1.75	73.77	B
Solving problems involving fractions, decimals and percentages	10	6.49	1.44	64.93	B
Average	30	7.39	1.50	73.91	B

Enhancing problem-solving proficiency is a fundamental aspect of mathematics education, as it enables students to apply concepts and procedures to real-life situations. In Business Mathematics, learners are expected to analyze given information, identify appropriate strategies, and arrive at accurate solutions. Developing this proficiency helps students strengthen their critical thinking, logical reasoning, and decision-making skills. As shown in Table 2, the results of the learners’ proficiency after using multisensory instructional materials were presented and discussed. The results indicate that the highest mean score was obtained in solving problems involving direct, inverse, and partitive proportion with a mean of 8.30 (SD = 1.32), corresponding to a proficiency level of 83.04 and interpreted as Approaching Proficiency, ranking first. This was followed by solving problems involving buying and selling products with a mean score of 7.38 (SD = 1.75), a PL of 73.77, interpreted as Beginning, and ranked second. The lowest mean score was recorded in solving problems involving fractions, decimals, and percentages with a mean of 6.49 (SD = 1.44), a PL of 64.93, also interpreted as Beginning and ranked third. Overall, the students achieved an average mean score of 7.39 (SD = 1.50) with an overall proficiency level of 73.91, interpreted as Beginning.

This levels of mastery across different problem-solving areas in Business Mathematics suggests that the relatively higher performance in proportion-related problems suggests that students were more able to analyze relationships between quantities and apply proportional reasoning, possibly due to clearer conceptual structure and real-life applications. In contrast, the lower performance in buying and selling products and in fractions, decimals, and percentages indicates persistent difficulties in numerical manipulation, conceptual understanding, and multi-step problem-solving. The standard deviation values further suggest moderate variability in students’ performance, implying differences in individual understanding and strategy use. Despite exposure to instruction, the overall Beginning proficiency level reflects the need for more targeted and reinforced instructional interventions to strengthen foundational skills.

From these findings, it can be inferred that while students have begun developing problem-solving skills in Business Mathematics, their proficiency remains limited, particularly in areas requiring strong number sense and procedural fluency. The relatively better performance in proportional reasoning indicates potential for improvement when concepts are presented in structured and contextualized ways. However,

the overall Beginning level suggests that students require sustained instructional support, scaffolding, and varied learning experiences to improve their problem-solving proficiency. These results underscore the importance of implementing instructional strategies that address conceptual gaps and support gradual skill development.

Table 3. Significant Difference between the Students' Problem-Solving Proficiency in Business Mathematics before and after the Implementation of Multisensory Instructional Materials

Pre test-Post test	t-value	df	p-value	Int.
Solving problems involving fractions, decimals and percentages	-14.178	68	0.001	S
Solving problems involving direct, inverse and partitive proportion	-9.657	68	0.001	S
Solving problems involving buying and selling products	-10.881	68	0.001	S

This presents the results of the test of significant difference between the pre-test and post-test scores of Grade 11 General Academic Strand students in Business Mathematics after the implementation of the multisensory instructional materials. Table 3 shows the computed t-values, degrees of freedom (df), p-values, and corresponding interpretations for three problem-solving areas: solving problems involving fractions, decimals, and percentages; solving problems involving direct, inverse, and partitive proportion; and solving problems involving buying and selling products. The results reveal t-values of -14.178, -9.657, and -10.881, respectively, all with 68 degrees of freedom and p-values of 0.001. All computed p-values are less than the 0.05 level of significance, and each indicator is interpreted as Significant (S).

The consistently large negative t-values indicate that post-test scores were significantly higher than pre-test scores across all areas of Business Mathematics. The greatest improvement was observed in solving problems involving fractions, decimals, and percentages, suggesting that multisensory instruction was particularly effective in addressing abstract and computation-heavy concepts. Substantial gains were also evident in proportion and buying-and-selling problems, which require conceptual understanding and real-life application. These improvements imply that the multisensory instructional materials successfully enhanced students' engagement, comprehension, and ability to apply mathematical concepts, resulting in statistically significant learning gains.

The implementation of multisensory instructional materials had a significant positive effect on the problem-solving proficiency of Grade 11 GAS students in Business Mathematics. The rejection of the null hypothesis across all learning areas confirms that these improvements were attributable to the instructional intervention rather than chance. This demonstrates that multisensory approaches effectively support learners in overcoming difficulties with abstract mathematical concepts. By engaging multiple senses, students are able to develop stronger problem-solving skills through varied and meaningful learning experiences.

Table 4. Effectiveness of Multisensory Instructional Material in Enhancing Students’ Problem-Solving Proficiency in Business Mathematics

Aspects	M ₁ -M ₂	D	Int.
Solving problems involving fractions, decimals and percentages	3.33	2.49	LE
Solving problems involving direct, inverse and partitive proportion	3.27	1.77	LE
Solving problems involving buying and selling products	4.22	1.93	LE

This explores how multisensory strategies can improve analytical skills, application of mathematical procedures, and overall problem-solving performance. Findings from this study provide insights into the potential of innovative instructional approaches to foster deeper engagement and academic success in Business Mathematics. In Table 4 presented the effectiveness of the multisensory instructional material in enhancing the problem-solving proficiency of Grade 11 General Academic strand (GAS) students in Business Mathematics. The table shows the mean difference between the pre test and post-test (M₁–M₂), the computed Cohen’s d effect size, and the corresponding interpretation for three problem-solving aspects: solving problems involving fractions, decimals, and percentages; solving problems involving direct, inverse, and partitive proportion; and solving problems involving buying and selling products. The results indicate mean differences of 3.33, 3.27, and 4.22, respectively. The computed effect sizes are 2.49 for fractions, decimals, and percentages; 1.77 for direct, inverse, and partitive proportion; and 1.93 for buying and selling products. All effect sizes are interpreted as Large Effect (LE), indicating a substantial impact of the multisensory instructional materials on students’ problem-solving performance. The computed Cohen’s d values for all problem-solving aspects exceed the threshold of 0.8, signifying large effect sizes and demonstrating a strong practical impact of the multisensory approach. The largest effect size was observed in solving problems involving fractions, decimals, and percentages, suggesting that this area experienced the most pronounced improvement. This is followed by buying and selling products and direct, inverse, and partitive proportion, all of which also reflect substantial learning gains. The consistently large mean differences further indicate that students’ post-test scores significantly increased compared to their pre-test scores across all areas, highlighting the effectiveness of multisensory instructional materials in improving problem-solving proficiency.

Based on the results, it can be inferred that the multisensory instructional material was highly effective in enhancing students’ problem-solving proficiency. The consistently large effect sizes indicate that the observed improvements were meaningful and educationally significant rather than incidental. The findings imply that students were able to develop deeper conceptual understanding, improved procedural fluency, and greater confidence in solving various types of business-related mathematical problems. Therefore, the use of multisensory strategies can be considered a powerful instructional approach for improving problem-solving proficiency among Grade 11 GAS students in Business Mathematics.

Conclusions

Grade 11 GAS students have a below-average problem-solving proficiency in Business Mathematics. Students performed slightly better in solving proportion problems but showed greater difficulty in applying concepts to buying and selling transactions and computations involving fractions, decimals,

and percentages. The development of multisensory instructional materials in Business Mathematics successfully addressed the identified learning difficulties of Grade 11 GAS students. Guided by the ADDIE Model, the materials incorporated visual, auditory, and kinesthetic strategies to enhance comprehension, engagement, and problem-solving skills. The use of multisensory instructional materials enhanced the problem-solving proficiency of students in Business Mathematics from beginning to approaching proficiency leading to improved understanding and application of concepts across all learning areas, especially in solving proportion problems. The results indicate a significant improvement in the problem-solving proficiency of Grade 11 GAS students in Business Mathematics after using the multisensory instructional materials, demonstrating that the intervention effectively enhanced students' understanding and application of mathematical concepts across all learning areas. Thus, rejecting the null hypothesis. And the multisensory instructional materials had a large and positive effect on enhancing the problem-solving proficiency of Grade 11 GAS students in Business Mathematics across all learning areas. Thus, rejecting the null hypothesis.

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