The Effects of Vedic Mathematics on the Basic Mathematical skills and Engagement of Grade 7 Students

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ABSTRACT

Vedic mathematics, a system of mental math techniques that simplifies operations on integers, has been gaining popularity for enhancing students' basic mathematical skills and engagement in the classroom. This study examined the effects of Vedic mathematics on the fundamental math abilities and engagement of Grade 7 students using a matching-only pre-test post-test control group, a quasi-experimental research design. An adapted mathematical engagement checklist and a basic mathematical skills test focused on operations with integers were used as data collection instruments. Additionally, a validated researcher-made module integrating Vedic mathematics was utilized as the intervention material for the experimental group. After implementation, the control group's post-test scores in basic mathematical skills were approaching proficiency, while the experimental group reached the proficiency level. A notable statistical difference was found between the post-test performances of the two groups. In terms of their engagement in mathematics, both groups were found to be moderately engaged. The result also showed significant difference in the engagement of the two groups. Moreover, both groups showed a significant improvement in mathematical performance and engagement from pre- to post-tests, with results favoring the experimental group.

As a result, the study concludes that Vedic mathematics is a more effective approach for improving students' basic mathematical skills and classroom engagement in mathematics. It is recommended that Vedic mathematics be incorporated into mathematics instruction to support better learning outcomes.

Keywords: Ancient indian mathematical system, Fundamental math abilities, Learner participation, Integer arithmetic.

INTRODUCTION

Mathematics education plays a vital role in developing students' problem-solving and analytical skills, which are essential for both academic success and real-world application. Despite this importance, conventional teaching methods often fail to fully engage learners or foster a deep understanding of mathematical concepts. Foundational operations such as addition, subtraction, multiplication, and division are critical building blocks in a student's mathematical journey. However, many Filipino students struggle to master these basic skills. These learning gaps are further reflected in the country's performance in international assessments.

According to the 2022 Programme for International Student Assessment (PISA), Filipino 15-year-olds scored an average of 355 in mathematics, significantly lower than the OECD average of 472. This substantial gap highlights the urgent need for innovative and effective strategies to improve mathematics education and support students in building stronger foundational skills. One promising alternative is Vedic mathematics, a system derived from ancient Indian texts that introduces sixteen mental calculation techniques—or sutras—that are designed to enhance speed, accuracy, and mental flexibility. Unlike traditional methods, Vedic Mathematics emphasizes intuitive and pattern-based learning, making complex problems more manageable and engaging for students. These techniques not only foster mathematical proficiency but also promote meaningful engagements, creative problem-solving and independent thinking.

In addition, recent research emphasizes that student engagement is a key factor in successful learning outcomes. Fredricks et al. (2016) asserted that engagement is critical to students' cognitive, behavioral, and emotional development. The Philippine K to 12 curriculum reinforces this idea by promoting student-centered approaches that prioritize active learning and participation. Furthermore, Grade 7 marks a critical transition point in mathematics education, where foundational skills are reinforced, and more abstract concepts are introduced. Yet, many students at this level continue to struggle, partly due to teaching approaches that do not sufficiently address diverse learning needs.This study aimed to examine the effectiveness of Vedic Mathematics in enhancing both basic mathematical skills and student engagement among Grade 7 learners. While its benefits have been documented in other educational settings, there remains a lack of research on its application in the Philippine context. This study addressed that gap by comparing the effects of Vedic and conventional methods, with the goal of informing future instructional practices and supporting improved outcomes in mathematics education.

STATEMENT OF THE PROBLEM

This study was conducted to investigate the effects of Vedic mathematics on the basic mathematical skills and engagement of Grade 7 students.

Specifically, it sought to answer the following questions;

1. What are the levels of basic math skills of the experimental and control groups after the intervention?
2. What are the levels of mathematics engagement of the experimental and control groups after the intervention?
3. Is there a significant difference between the post-test basic mathematical skills of Grade 7 students in experimental and control group?
4. Is there a significant difference between the levels of mathematics engagements of Grade 7 students in control and experimental groups after the intervention?
5. Is there a significant difference in the pre-test and post-test basic mathematical skills of Grade 7 students in the control group?
6. Is there a significant difference in the pre-test and post-test basic mathematical skills of Grade 7 students in the experimental group?
7. Is there a significant difference in the levels of mathematics engagement of Grade 7 students in the control group before and after the intervention?
8. Is there a significant difference in the levels of mathematics engagement of Grade 7 students in the experimental group before and after the intervention?
9. What are the basic mathematical skills and engagement mean gains of the experimental and control groups before and after the intervention?

HYPOTHESES OF THE STUDY

Given the above research questions, the following hypotheses were formulated:

1. There is no significant difference between the levels of mathematics engagements of Grade 7 students in control and experimental groups after the intervention.
2. There is no significant difference in the pre-test and post-test basic mathematical skills of Grade 7 students in the control group.
3. There is no significant difference in the pre-test and post-test basic mathematical skills of Grade 7 students in the experimental group.
4. There is no significant difference in the levels of mathematics engagement of Grade 7 students in the control group before and after the intervention.
5. There is no significant difference in the levels of mathematics engagement of Grade 7 students in the experimental group before and after the intervention.

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THEORETICAL FRAMEWORK

This study was anchored on different theories related to basic mathematical skills and learning engagement. These are the constructivist learning theory, cognitive development theory, and engagement theory. These theories served as the bases for conceptualizing this study.

Constructivist Learning Theory, deeply rooted in the foundational work of Jean Piaget and Lev Vygotsky, emphasizes that learners are not passive recipients of information but active participants in the learning process. According to this theory, knowledge is constructed through experience, reflection, and social interaction, rather than merely transmitted by teachers. Piaget highlighted the importance of cognitive development stages where learners build new understanding based on their prior knowledge, while Vygotsky stressed the role of social context and scaffolding in learning through the concept of the Zone of Proximal Development (ZPD).

In this framework, learning is most effective when students engage in hands-on exploration, discovery, and problem-solving activities that encourage them to identify patterns, ask questions, and test hypotheses. It promotes a student-centered classroom environment where learners take ownership of their educational journey, collaborating with peers and teachers to co-construct knowledge.

In the context of this study, Constructivist Learning Theory was operationalized through the application of Vedic mathematics, an ancient system emphasizing mental calculation and pattern recognition. Vedic mathematics provided students with alternative strategies for understanding mathematical concepts, allowing them to internalize principles through mental computation techniques rather than rote memorization of formulas. This method encouraged students to actively engage with numbers, explore relationships, and develop personalized problem-solving strategies, which aligns closely with the constructivist focus on meaningful, contextual learning.

By employing Vedic mathematics, the study fostered independent thinking and personal meaning-making, as learners were empowered to discover solutions and construct knowledge autonomously. This approach not only enhanced conceptual understanding but also nurtured learners' confidence and motivation, illustrating the constructivist principle that deep learning occurs when students build their own understanding based on active engagement with the material.

Cognitive Development Theory, originally proposed by Jean Piaget, asserts that learners progress through distinct stages of cognitive growth, each characterized by qualitatively different ways of thinking and understanding the world. Piaget identified stages such as the sensorimotor, preoperational, concrete operational, and formal operational stages, emphasizing that learning experiences and instructional strategies must be developmentally appropriate and matched to a learner’s current cognitive abilities. According to this theory, students are only capable of grasping certain concepts once they have reached the corresponding stage of cognitive maturity, which underscores the importance of aligning educational content with learners’ mental readiness to optimize understanding and skill acquisition.

Within the framework of this study, Cognitive Development Theory was applied by using Vedic mathematics as a developmentally appropriate intervention tailored specifically for Grade 7 students, who are typically transitioning from concrete operational to formal operational stages. The mental math strategies provided by Vedic mathematics—such as vertical and crosswise multiplication, base methods, and other rapid calculation techniques—were particularly suited to this developmental phase. These strategies leveraged students’ increasing capacity for abstract reasoning, logical thought, and mental manipulation of numerical information, which are hallmarks of Piaget’s formal operational stage.

The study demonstrated that not only did the Vedic mathematics techniques align with the cognitive level of the learners, but they also actively supported and enhanced their cognitive development. By practicing these mental math methods, students improved their computational speed and accuracy, which required them to internalize mathematical operations at a deeper level. This active engagement with numerical concepts helped foster greater cognitive flexibility and problem-solving ability, reinforcing Piaget’s notion that

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cognitive development is both a prerequisite and an outcome of effective learning experiences. In essence, the study highlighted how appropriately designed instructional interventions like Vedic mathematics can both respect learners' developmental stages and promote their ongoing cognitive growth.

Engagement Theory emphasizes that meaningful learning occurs when students are actively involved in their education through participation, collaboration, and sustained interest in learning tasks. This theory posits that students learn most effectively when they are emotionally invested, behaviorally involved, and cognitively engaged in the learning process. It underscores the importance of creating interactive, stimulating, and personally relevant learning experiences that foster deeper understanding and intrinsic motivation. According to Engagement Theory, engagement is multidimensional, involving not only attention and effort but also a connection to the content and a sense of belonging within the learning community.

In the context of this study, Engagement Theory was operationalized through the integration of Vedic mathematics techniques into classroom instruction. These techniques, characterized by mental calculation methods such as pattern recognition, shortcut strategies, and innovative problem-solving approaches, were specifically designed to capture and sustain students' interest in mathematics. By making math lessons more interactive and mentally stimulating, these techniques encouraged students to actively participate in classroom activities rather than passively receive information. The use of Vedic mathematics thus served to increase students' focus, motivation, and overall engagement, fostering a dynamic and participatory learning environment.

The application of Engagement Theory in this study supported the overarching goal of not only improving students' basic mathematical skills but also enhancing their emotional and cognitive involvement with the subject matter. This dual focus on skill development and engagement aligns with contemporary educational research highlighting that motivated and engaged learners tend to achieve better academic outcomes. Ultimately, the study demonstrated that incorporating strategies grounded in Engagement Theory can lead to more meaningful and enjoyable learning experiences for Grade 7 students, contributing to both their academic success and positive attitudes toward mathematics.

By integrating these theoretical perspectives, the study aims to provide a comprehensive understanding of how Vedic mathematics impacts the basic mathematical skills and engagement of Grade 7 students, informing the research design, data collection methods, and interpretation of findings, and contributing to the development of effective instructional strategies and educational interventions in mathematics education.

Conceptual Framework

The conceptual model of this study classified Vedic mathematics, a teaching-learning strategy, as the independent variable. Meanwhile, learners' basic mathematical skills and engagement in mathematics were classified as the dependent variables.

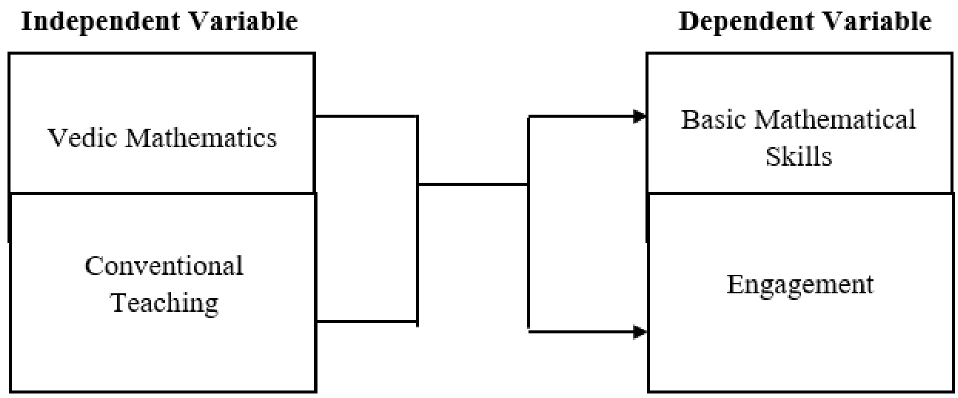

Figure 1. A schematic diagram showing the assumed effects of Vedic mathematics and conventional teaching on the basic mathematical skills and engagement in mathematics.

The students' basic mathematical skills and engagement were assumed to be dependent on Vedic mathematics as the teaching strategy. Guided by the constructivist learning theory, cognitive development theory, and engagement theory the conceptual framework was framed.

Significance of the Study

This study holds several significant implications for education, particularly in the field of mathematics. By exploring the potential benefits of Vedic mathematics techniques, the following would most likely be benefited:

Teachers. Vedic mathematics may provide an additional teaching strategy that can be incorporated into existing instructional practices. It enables teachers to create a stimulating classroom environment that fosters active participation and engagement in mathematics.

Students. Vedic mathematics may equip students with mental calculation techniques that allow them to perform complex computations accurately and efficiently. As they develop competence in mental math and problem-solving, their confidence and mathematical self-efficacy increase.

Parents. This study may provide parents with an alternative approach to teaching their children basic mathematical skills. By means of incorporating Vedic mathematics techniques at home, parents can help make math learning more engaging, enjoyable, and effective for their children.

School Administrators. The findings of this study may serve as a basis for designing projects, programs, and activities that address students' poor performance in mathematics. It may also guide administrators in improving facilities needed to implement math games and other Vedic-based activities, if proven effective.

Curriculum Planners and Developers. The results of the study may be used to support the development of an enhanced curriculum, particularly in improving instructional strategies for mathematics. It may also contribute to a more effective teaching and learning process.

Researchers. As prospective educators, researchers may benefit from the insights gained in this study. It introduces them to Vedic mathematics as an effective teaching and learning strategy in math instruction, helping to prepare them for their future roles as mathematics teachers.

Future Researchers. This study may serve as a foundation for future investigations into the impact of Vedic mathematics across diverse educational settings and populations. It also provides a basis for designing and implementing more extensive studies that explore the broader implications and long-term efficacy of Vedic Mathematics instruction.

Scope and Limitation of the Study

This study was focused only on the effects of Vedic Mathematics on students' basic mathematical skills and engagement in mathematics. A quasi-experimental design (specifically a matching-only pretest-posttest control group design) was utilized in determining whether significant differences exist between the pretest and posttest basic mathematical skills, and engagement in the experimental and control groups before and after the intervention was implemented. It was conducted in one of the secondary schools in Capiz in their mathematics subject during the fourth quarter of the school year 2024-2025 from February 21 to March 21, 2025.

A validated researcher-developed module covering topics on basic mathematical operations—including addition, subtraction, multiplication, and division of whole numbers—was utilized in the experimental group. To gather the necessary data, the study also employed an adopted 40-item Enhanced Regional Unified Numeracy Test (E-RUNT) to assess basic mathematical skills, along with a 30-item checklist on students' mathematical engagement, adapted from Magalona (2022). The validity of these instruments was confirmed by members of the advisory committee, which included one mathematics professor and three external experts (Master Teachers from DepEd). Additionally, the basic mathematical skills test and engagement checklist underwent pilot testing to ensure the reliability and consistency of the measurement tools used in the study.

Descriptive statistics, including frequency counts, means, and standard deviations, were utilized to summarize the data in this study. For inferential analysis, the Mann-Whitney U-Test and the Wilcoxon Signed-Rank Test were employed at a 0.05 level of significance. These non-parametric tests were used to determine whether significant differences existed between the pre-test and post-test scores on basic mathematical skills and engagement in mathematics within each group before and after the intervention. Additionally, these tests assessed differences between the two groups in terms of their mathematical skills and engagement following the intervention. The use of these statistical methods ensured a robust analysis of the impact of the Vedic mathematics intervention on the participants' performance and engagement.

Definition of Terms

For clarity and better understanding of the terms related to this study, the following terms were defined conceptually and operationally.

Affective engagement. It refers to students' emotional responses, both positive and negative, to their teachers, peers, academic assignments, and school in general (Fredricks et al., 2016).

In this study, it pertains to the participants' feeling (e.g. happy, excited, nervous) towards their teachers and classmates when learning mathematics before and after the integration of Vedic Mathematics.

Basic Mathematical skills. This refers to the foundational numerical abilities essential for understanding and performing core arithmetic operations such as addition, subtraction, multiplication, and division. These skills serve as the building blocks for more advanced mathematical learning, helping students develop numerical fluency and problem-solving abilities that are vital for academic success and daily functioning (Lyons et al., 2015).

In this study, basic math skills are the computational skills of students in the four fundamental operations.

Behavioral engagement. It refers to students' demonstrations of concentrating and showing persistence for learning, adopting different strategies to solve the mathematics problems, and trying to answer mathematics questions (Fredricks et al., 2016).

In this study, it pertains to the participation of the participants in the math class, including their respect and adherence to the school policies, and attendance, attention and learning focus during the math instruction and the integration of Vedic mathematics.

Cognitive engagement. It refers to students' motivation, effort, and strategy use; this includes psychological investment in learning, a desire to go beyond the requirements, and a preference for challenge (Fredricks et al., 2016).

In this study, this pertains to the strategies and techniques a participant imposes to understand the discussed topic and to the persistence of the participant to study for a long period despite the existence of factors, such as weather, class disruptions, etc.

Conventional teaching. It refers to a teacher-centered approach where instruction is primarily delivered through lectures, textbook-based content, and direct explanation. The teacher controls the learning environment, and students are expected to passively receive information, often focusing on memorization and standardized procedures rather than deep understanding or interactive learning (Kaymakci, 2017).

In this study, it referred to the mathematics instruction received by Grade 7 students in the control group, where the teacher follows the standard Department of Education-prescribed curriculum using traditional lecture-based methods, textbook exercises, and direct instruction without incorporating Vedic Mathematics techniques.

Engagement. It refers to the degree to which a student initiates effort, activity, and perseverance in their academic work, along with their overall emotional states during learning activities (Skinner et al., 2020).

In this study, engagement pertains to the participants' involvement shown during the learning intervention as well as the time and focus they exert when learning mathematics. This was divided into three dimensions: cognitive, behavioral, and affective.

Non-numerates. They are individuals who are unable to apply basic mathematical concepts and skills in practical, real-life contexts. They may struggle with understanding quantities, performing simple calculations, interpreting data, or solving everyday problems involving numbers (OECD, 2016).

In this study, it refers to Grade 7 students who scored 0-9 on their pre-test result on the Enhanced Regional Unified Numeracy Test, indicating significant difficulty with fundamental numeracy concepts and operations.

Vedic Mathematics. It refers to a system of mathematics rooted in ancient Indian scriptures, particularly the Vedas, which offers simplified, logical, and efficient techniques for performing arithmetic operations that emphasizes mental calculation, pattern recognition, and faster problem-solving strategies (Raikhola et al., 2020).

In this study, Vedic mathematics serves as a strategic intervention that employs a range of mental calculation techniques designed to simplify arithmetic operations. These techniques aim to enhance basic mathematical skills and improve engagement levels of the respondents.

REVIEW OF RELATED LITERATURE

Conceptual Literature

Vedic Mathematics

Vedic mathematics, which traces its origins to ancient Indian traditions and was systematized by Monk Bharati Krishna Tirtha in the early 20th century, consists of sixteen sutras designed to simplify complex mathematical operations. These sutras have proven effective in modern educational settings, particularly in improving mental calculation skills. When applied correctly, they not only help students tackle mathematical problems more efficiently but also enable them to perform better under pressure, such as during exams (Santhalakshmi, 2020).

Unlike traditional methods that focus on mechanical learning, Vedic mathematics emphasizes meaningful comprehension. Its mental strategies help alleviate anxiety and foster concentration, allowing students to grasp mathematical concepts more effectively. Research has shown that this approach enhances both student understanding and the ability of teachers to present content clearly. Furthermore, it supports a range of learners, stimulating creativity in advanced students while providing the necessary support for those who struggle with foundational concepts (Ramteke & Vaishnav, 2019).

This versatility makes Vedic mathematics a promising addition to classroom teaching.

Beyond the classroom, Vedic mathematics has found applications in technical fields, particularly in the development of digital algorithms and signal processing tools. Its simplicity and effectiveness make it a valuable resource in solving complex engineering problems. For example, its application in multiplication algorithms and biomedical signal analysis illustrates its utility in both academic and industrial contexts (Gaikwad et al., 2015). This broader applicability underscores the relevance of integrating Vedic mathematics into modern STEM curricula, where it can contribute to both academic learning and practical problem-solving.

Vedic mathematics stands out for its simplicity, clarity, and spiritual depth, offering a distinctive method for solving a wide variety of mathematical problems. Its directness makes it easy to learn and enjoyable to apply, particularly in mental arithmetic and verbal instruction. Mastering Vedic mathematics requires consistent practice, but its intuitive nature makes it accessible to learners of all ages and backgrounds. This approach encourages independent problem-solving, reducing the reliance on computers for basic calculations.

It also aligns with the views of eminent thinkers, such as Albert Einstein and the mathematical genius Srinivasa Ramanujan, who emphasized the vital role of intuition and creativity in mathematical thought (Rajesh, 2015). Vedic mathematics, a system rooted in ancient Indian scriptures, offers a holistic and innovative framework that prioritizes mental agility, pattern recognition, and logical consistency. It goes beyond traditional rote memorization by encouraging learners to see numbers and operations as flexible, interconnected entities. This cognitive shift fosters intuition and insight, allowing students to approach problems from multiple perspectives (Krishna, 2021).

One of the most distinctive features of Vedic mathematics is its use of sutras — concise verbal formulas — that guide mental computation. These sutras serve as cognitive tools that help simplify seemingly complex problems, making them more accessible and less intimidating. For example, multiplication, squaring, and factorization can be performed with surprising ease using mental techniques derived from these principles. Such approaches cultivate confidence, improve retention, and reduce the cognitive overload associated with conventional step-by-step methods (Suneha & Mamta, 2023).

Moreover, studies have demonstrated that the integration of Vedic mathematical techniques into school curricula can have a measurable impact on students' academic performance and overall attitude toward mathematics. According to Rajesh (2015), students exposed to Vedic methods exhibited improved test scores, faster problem-solving abilities, and greater engagement with the subject. This suggests that Vedic mathematics not only supports academic achievement but also positively influences learners' perceptions of their own mathematical competence — a crucial factor in reducing math-related anxiety.

Beyond the classroom, the mental discipline and flexibility cultivated through Vedic methods prove valuable in real-life contexts. From competitive exams to everyday financial decisions, individuals equipped with Vedic mathematical skills demonstrate enhanced numerical fluency and efficiency. This makes Vedic mathematics relevant not just as an academic enhancement, but as a life skill. As Krishna (2021) notes, its emphasis on simplicity and clarity also aligns well with modern educational goals, such as promoting critical thinking, creativity, and independent learning.

In a rapidly evolving educational landscape that values both innovation and inclusivity, Vedic mathematics stands out as a timeless yet forward-thinking approach. It bridges ancient intellectual traditions with contemporary pedagogical needs, offering learners a means to not only perform calculations quickly but to understand mathematics at a deeper, more intuitive level (Suneha & Mamta, 2023). As more educators and researchers recognize its potential, Vedic mathematics may play a crucial role in reshaping how mathematical thinking is taught and appreciated in the 21st century.

Day-ongao et al. (2022) argued that evaluating the long-term impact of integrating Vedic Mathematics methods into education requires longitudinal studies that span over extended periods. Such studies would not only assess the immediate effects on students' problem-solving skills but also provide insight into the retention and sustained benefits of these techniques. The authors highlighted the need for a quasi-experimental research design to effectively measure the impact of Vedic Mathematics across diverse student

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groups. This approach would enable a thorough analysis of how these methods influence both problem-solving abilities and student motivation toward mathematics.

By including various educational contexts and considering different student demographics, researchers could gain a more comprehensive understanding of how Vedic Mathematics methods can be tailored and optimized for diverse learning environments. This holistic approach would provide valuable information for educators and policymakers, helping them refine strategies to enhance mathematical education and maximize the benefits of Vedic Mathematics.

Basic Mathematical Skills

Early mastery of basic math skills is crucial for long-term academic success. Effective instruction during the early years not only fosters immediate arithmetic abilities but also supports ongoing academic achievement and mathematical proficiency (Dunst et al., 2018).

Several studies emphasized the role of instructional methods in enhancing basic math skills. Traditional methods like rote memorization and repetitive practice are effective for skill acquisition. However, integrating modern techniques such as manipulatives, interactive activities, and technology can further enhance understanding and retention. Sarama and Clements (2016) advocated for using these approaches to cater to diverse learning styles and make abstract concepts more concrete and accessible. Their work underscores the importance of combining traditional and contemporary methods to support comprehensive mathematical learning and improve students' overall mathematical competence.

A supportive learning environment is vital for the acquisition of fundamental mathematical skills. Research consistently shows that parental involvement plays a significant role in enhancing children’s math achievement by fostering positive attitudes toward learning and providing essential encouragement (Hill & Tyson, 2016). Parents who actively engage in their children's education by helping with homework, communicating high expectations, and maintaining a positive outlook on mathematics contribute to better academic outcomes. Moreover, the quality of parental involvement matters; supportive and constructive engagement is linked to higher motivation and persistence in math learning.

In addition to the home environment, teachers’ instructional practices and beliefs critically shape students' engagement and success in mathematics. Tomasetto, Alparone, and Cadinu (2017) found that teachers who display confidence in their teaching abilities and hold positive beliefs about their students’ potential create classroom environments that foster motivation and active participation. Effective teachers utilize a range of instructional strategies, including scaffolding, formative assessment, and differentiated instruction, to meet diverse learners’ needs and promote conceptual understanding.

The interplay between home and school environments is crucial; collaboration between parents and teachers can reinforce consistent messages about the importance of mathematics and create a cohesive support system for students. When parents and educators work together to provide encouragement and tailored support, students are more likely to develop strong foundational skills and maintain sustained interest in mathematics throughout their education. This holistic approach addresses both the cognitive and affective domains of learning, underscoring that academic success in math depends not only on intellectual abilities but also on emotional support and positive reinforcement (Hill & Tyson, 2016; Tomasetto et al., 2017).

The development of foundational number sense is particularly critical during the early stages of mathematical learning. Studies have shown that early mastery of number sense is a strong predictor of later success in mathematics. Children who gain a solid understanding of basic number concepts and numerical relationships tend to perform better in more complex mathematical tasks throughout their education (Geary et al., 2017). A solid foundation in number sense not only supports immediate arithmetic abilities but also facilitates the acquisition of more advanced mathematical concepts. This underscores the need for effective instructional strategies that prioritize these basic skills to support long-term academic achievement in mathematics (Geary et al., 2017).

Instructional methods have been shown to vary in effectiveness, with traditional approaches like direct instruction and rote memorization still playing a valuable role in teaching basic math skills. However, integrating traditional methods with modern strategies can significantly enhance student engagement and understanding. For instance, the use of manipulatives and technology has been demonstrated to improve students' number sense and arithmetic abilities by transforming abstract concepts into more tangible and understandable forms. Interactive tools, digital games, and hands-on activities provide dynamic and engaging learning experiences that reinforce foundational math skills and accommodate diverse learning styles (Sarama & Clements, 2016). This hybrid approach not only supports the development of basic math skills but also fosters a deeper understanding of mathematical concepts and greater interest in the subject. By combining traditional and modern methods, educators can create a more comprehensive and engaging learning environment.

Socio-economic status (SES) also plays a significant role in the development of basic math skills. Children from lower SES backgrounds often face challenges such as limited access to educational resources and extracurricular support, which can hinder their mathematical development. Research has shown that these disparities can be mitigated through targeted interventions and support programs aimed at providing equitable access to quality education and resources. Recent studies by Jordan et al. (2018) emphasize the importance of addressing socio-economic disparities to improve mathematical outcomes for disadvantaged students.

By implementing targeted support and resources, educators can help mitigate the effects of socio-economic factors, ensuring that all students have an equal opportunity to develop strong foundational math skills. Ensuring equitable access to education is crucial for fostering academic success and reducing achievement gaps related to SES (Jordan et al., 2018).

Students' Engagement in Mathematics

Engagement is a complex construct shaped by a combination of factors such as participation, emotional involvement, intention, interest, and the underlying needs of individuals. Skinner et al. (2020) described engagement as involving more than just physical presence in an activity; it requires deeper involvement driven by intrinsic motivation and emotional investment. This multifaceted view highlights the importance of understanding these factors to develop strategies that can effectively enhance engagement.

Educators and researchers use this knowledge to create learning environments that not only encourage active participation but also sustain students' interest, ensuring that they remain motivated and genuinely invested in their educational experiences (Skinner et al., 2020). Such approaches ultimately contribute to achieving more meaningful and impactful educational outcomes.

Krause and Coates (2008) further expanded the concept of engagement, suggesting that it is a broad, multidimensional phenomenon that includes academic, non-academic, and social dimensions. They argued that engagement extends beyond classroom activities to include students' social interactions and participation in extracurricular activities. This comprehensive framework underscores that engagement involves cognitive, emotional, and social components, all of which influence students' overall motivation and involvement in their academic journey.

Zepke and Leach (2017) supported this perspective, emphasizing the necessity of understanding the complexity of student engagement in order to develop strategies that address the various ways students engage with both their educational environments and communities. By acknowledging these multiple dimensions, educators and researchers can design more effective interventions that cater to the diverse needs and experiences of students, fostering deeper and more sustained engagement.

Fredricks et al. (2018) also examined the structure of student engagement, highlighting its behavioral, emotional, and cognitive dimensions. Their work reviews the evolution of engagement theories and models developed by scholars such as Willms, Christenson, Reeve, and Wang. The article emphasizes the importance of understanding engagement in its full complexity, offering insights into how educators can develop strategies that enhance student involvement and motivation across these different dimensions.

Recent studies have highlighted that student engagement in mathematics can be understood across three interrelated dimensions: emotional, social, and cognitive (Wang et al., 2016). Emotional engagement pertains to students' affective responses toward mathematics, including their levels of interest, enthusiasm, anxiety, and overall attitude. Pekrun and Stephens (2019) and Wang and Holcombe (2017) emphasized that emotional engagement reflects the motivational and affective elements influencing a student's willingness to participate in classroom activities. These emotional responses have been found to play a significant role in shaping students' engagement and learning outcomes.

Social engagement, on the other hand, relates to students' interactions with peers and teachers, as well as their adherence to classroom norms and participation in group activities. Goodenow and Miller (2016) underscored the importance of students' sense of belonging, which contributes to their academic performance and personal development. According to Korpershoek et al. (2016), social engagement includes behaviors such as punctuality, collaboration, and mutual support, all of which have been associated with improved academic outcomes. Fostering this form of engagement is essential for creating a positive and supportive learning environment.

Cognitive engagement involves the mental effort and strategic learning processes students employ when interacting with academic content. Fredricks et al. (2020) defined this dimension as encompassing self-regulation, persistence, and the use of deep learning strategies. Bingham and Okagaki (2017) noted that cognitively engaged students demonstrate a higher investment in understanding concepts rather than relying on rote memorization.

Similarly, Reeve (2018) observed that students who exhibit cognitive engagement tend to utilize thoughtful, individualized approaches to learning, which enhances comprehension and academic performance. Skinner and Pitzer (2020) further emphasized that sustained cognitive engagement leads to deeper conceptual understanding and improved learning outcomes.

Cognitive engagement is reflected through various learner behaviors, such as posing questions, engaging with challenging tasks, reviewing learned material, exploring supplementary resources, and utilizing diverse learning strategies. Students who exhibit high cognitive engagement exert greater effort to comprehend complex concepts and actively participate in their own learning process (Gonzalez et al., 2017). Additionally, cognitive engagement encompasses an awareness of one's academic capabilities, emotional investment in subject matter, and active involvement in educational tasks (Guthrie & Wigfield, 2017; Nayir, 2015). This form of engagement is critical for promoting deep learning and academic success, as it drives students to remain persistent and motivated, even when faced with difficulties (Gonzalez et al., 2017).

In mathematics education, student engagement is essential for enhancing the effectiveness of both teaching and learning (Nayir, 2015). Consequently, there is a growing emphasis on research aimed at understanding and improving student engagement and academic performance (Bouzid, 2020).

As cited by Alrashidi et al. (2016), described student engagement as the psychological investment and commitment learners put into acquiring and mastering the intended knowledge and skills. He also defined engagement as the degree of effort, participation, and emotional involvement students exhibit during academic tasks.

These perspectives underscore the multidimensional nature of engagement and its significant impact on student achievement.

Related Studies

Vedic Mathematics and Students' Basic Mathematical Skills

Several studies have explored the integration of Vedic Mathematics into education and its potential benefits. Shastri et al. (2023) found that combining Vedic Mathematics with Yogic Breathing techniques significantly reduced math anxiety in children. This combination was shown to alleviate negative thoughts, improve cognitive flexibility, and foster a positive self-image, thereby enhancing both students' mathematical performance and their mental well-being. The study highlighted the importance of incorporating these practices into the curriculum to promote more engaged and resilient learners.

On the other hand, Joshi (2017) conducted a comparative study to assess the effectiveness of Vedic Mathematics versus traditional teaching methods. Specifically focusing on the Nikhilam multiplication technique, Joshi's research revealed that Vedic Mathematics led to improvements in student behavior, including increased creativity, faster calculation skills, and better concentration.

The study concluded that Vedic Mathematics not only improved learning outcomes but also provided a more engaging and efficient approach to learning compared to traditional methods.

In the field of digital design, Shembalkar et al. (2017) demonstrated that Vedic Mathematics could significantly enhance the speed and efficiency of multiplication operations, offering a more efficient alternative to traditional logical circuits. Their research suggested that applying Vedic methods to digital circuit design could streamline calculations and reduce processing delays, potentially revolutionizing digital design and computational efficiency.

Bandala (2023) conducted a quasi-experimental study that examined how practicing Vedic Mathematics influenced students' academic performance. The results indicated substantial improvements in students' pre- and post-test scores, with qualitative findings emphasizing enhanced engagement, simplified concepts, and adaptability to various learning styles. The study concluded that while Vedic Mathematics was effective, a balanced educational approach integrating various strategies was essential to fully realize its potential in the classroom.

Vedic Mathematics has gained attention for its ability to improve student performance, particularly in time-sensitive academic contexts. Kakkar (2016) highlighted the significant benefits of Vedic Mathematics in competitive exams, where time management is crucial. The study found that Vedic techniques not only helped reduce math anxiety but also simplified complex calculations, thus enabling students to work more efficiently. This was particularly beneficial for middle school students, where the ability to perform quickly under pressure is essential. By enhancing calculation speed and accuracy, Vedic Mathematics helped students develop a more confident and efficient approach to problem-solving, regardless of their initial mathematical abilities.

Similarly, Prasad (2016) examined the time-saving advantages of Vedic Mathematics across a range of mathematical operations. The study revealed that using Vedic methods substantially reduced the time required for complex calculations, such as finding square and cube roots, multiplying large numbers, and performing operations near a base value. The statistical analysis demonstrated a clear improvement in efficiency compared to traditional methods. This reduction in calculation time not only enhanced students' ability to solve problems quickly but also contributed to a more effective problem-solving process in various mathematical contexts.

Moreover, Solanki (2021) provided a comprehensive review of Vedic Mathematics, emphasizing its role in deepening students' understanding of mathematical concepts. Rooted in ancient Indian texts, Vedic Mathematics offers specialized techniques for fundamental operations like addition, subtraction, division, and multiplication. These methods provide a more insightful and efficient approach to basic mathematics, enhancing the learning experience for students.

The study also noted the growing relevance of Vedic Mathematics in both educational settings and competitive exams, where time-saving techniques are particularly beneficial. Researchers have increasingly recognized its potential to improve both performance and understanding, particularly in environments where time constraints are a significant factor. Similarly, Sharma's 2020 study examined how Vedic Mathematics techniques can improve basic arithmetic skills in elementary school students. The research involved incorporating Vedic methods into the classroom and evaluating their impact on students' abilities in addition, subtraction, multiplication, and division. The study found significant improvements in both accuracy and calculation speed. Additionally, the research highlighted an increase in student engagement and confidence in mathematics, suggesting that Vedic techniques are effective in enhancing fundamental arithmetic skills and providing a solid foundation for future mathematical learning.

Verma (2021) conducted a comparative study to evaluate the effectiveness of Vedic Mathematics techniques versus traditional methods in enhancing basic mathematical skills. The study analyzed students' performance in arithmetic operations such as addition, subtraction, multiplication, and division, finding that Vedic methods led to improved accuracy and faster problem-solving. The results indicated that students taught with Vedic techniques had significant advantages over those taught using conventional methods, reinforcing the potential of Vedic Mathematics to enhance basic math proficiency.

In 2019, Gupta's study focused on the impact of Vedic Mathematics on primary school students' numerical abilities. The research explored how Vedic techniques could boost students' skills in fundamental arithmetic operations. The findings revealed that students who were exposed to Vedic Mathematics showed notable improvements in both numerical accuracy and calculation speed. Gupta's research emphasized the effectiveness of Vedic Mathematics in enhancing basic math skills and creating a more engaging learning environment for young learners.

Rao (2022) explored the role of Vedic Mathematics in developing essential mathematical skills. The study incorporated Vedic techniques to teach basic arithmetic concepts and assessed their influence on students' understanding and proficiency. Results indicated that students who practiced Vedic methods demonstrated substantial improvements in their grasp of fundamental math skills, including enhanced calculation speed and accuracy. Rao's research positioned Vedic Mathematics as a valuable tool for laying a strong foundation in mathematical education.

Vedic Mathematics and Students' Engagement in Mathematics

Rao's 2020 study investigated how Vedic Mathematics techniques influence student engagement in elementary schools. By comparing engagement levels before and after the introduction of Vedic methods, the research showed a significant increase in student interest and participation in math classes. The study highlighted that Vedic Mathematics not only improves students' enthusiasm for math but also fosters a more interactive and participatory classroom environment.

While, Agarwal's (2019) study compared student motivation in classrooms using Vedic Mathematics versus conventional teaching methods. The research revealed that students exposed to Vedic techniques demonstrate higher motivation and eagerness to engage in math lessons. Agarwal's findings suggested that Vedic Mathematics can significantly boost students' intrinsic motivation to learn and actively participate in mathematics education.

Moreover, Patel's (2021) study explored the impact of Vedic Mathematics on student engagement in middle school classrooms. Through detailed classroom observations and student surveys, the research reveals that Vedic Mathematics significantly increases student focus and interest in math lessons. The study demonstrated that students are more actively involved and motivated when Vedic techniques are incorporated into their learning process, suggesting that Vedic Mathematics effectively enhances student engagement and makes math more engaging and participatory.

In 2022, Deshmukh's study examined how Vedic Mathematics can promote active learning in mathematics. The research found that Vedic techniques encourage students to participate more in class discussions, ask questions, and explore mathematical concepts independently. By using Vedic methods, the study showed a notable increase in student engagement and interactive learning, indicating that Vedic Mathematics can serve as a powerful catalyst for fostering a more dynamic and participatory approach to mathematics education.

Focusing on how Vedic Mathematics influenced high school students' attitudes towards math. The study of Sharma (2023) demonstrated that students exposed to Vedic techniques develop a more positive attitude and increased confidence in their mathematical abilities. By integrating Vedic Mathematics into the curriculum, the research found that students experience reduced math anxiety and greater enthusiasm for the subject. This study highlighted the potential of Vedic Mathematics to foster a supportive and encouraging learning environment in mathematics education.

While, Babar Khan's (2021) work emphasized the critical role of active and dynamic teacher involvement in delivering effective mathematics education and advocates for incorporating various teaching techniques, including Vedic Mathematics. The study highlighted the need for robust in-service teacher training programs to enhance educators' skills and improve teaching quality. Integrating innovative methods like Vedic Mathematics can foster a more engaging learning environment and support diverse learning needs.

Sevak and Vyas (2019) also conducted a study to evaluate the impact of Vedic Mathematics on the academic achievement of 9th-grade students. Their research demonstrated that students who were taught using Vedic Mathematics techniques outperformed their peers in the control group, who received traditional instruction. The findings indicate that Vedic Mathematics can be a highly effective method for enhancing students' achievement levels. The study highlights that the Vedic approach not only improves performance in mathematics but also fosters a deeper understanding of mathematical concepts. By employing Vedic techniques, students may benefit from improved calculation speed, better problem-solving skills, and increased engagement with the subject matter. The positive outcomes suggested that integrating Vedic Mathematics into the curriculum could be a valuable strategy for educators aiming to boost student performance and mathematical proficiency. This research supported the potential of Vedic Mathematics as a transformative educational tool, emphasizing the need for further exploration and implementation in diverse educational settings to maximize its benefits for student learning and achievement.

Yogeshwari (2022) investigated the effects of Vedic Mathematics on students' attitudes toward learning mathematics across various types of schools. The study revealed that Vedic Mathematics significantly enhances students' perceptions of math, fostering a more positive and engaged attitude regardless of their educational environment. By incorporating Vedic techniques, students experience a more enjoyable and less intimidating approach to mathematics. The study highlighted that Vedic Mathematics not only makes the learning process more accessible and enjoyable but also supports faster and more accurate calculations. This method encourages a confident and fearless attitude toward math, reducing anxiety and increasing overall interest in the subject.

The findings suggest that Vedic Mathematics can be effectively integrated into different educational settings to improve students' mathematical experiences and performance. By making math more engaging and less daunting, Vedic Mathematics holds promise as a valuable pedagogical tool that can enhance students' attitudes and outcomes in mathematics education, thereby contributing to a more positive and productive learning environment.

Several international studies have also explored the impact of Vedic Mathematics. In a study conducted in the United States, Smith and Stein (2018) found that Vedic Math techniques significantly improved the mathematical problem-solving abilities of middle school students, leading to higher test scores and increased confidence in their mathematical skills. Similarly, a study in the United Kingdom by Johnson and McNeill (2019) demonstrated that incorporating Vedic Math into the curriculum enhanced students' mental arithmetic abilities and reduced their math-related anxiety.

In Australia, a research project by Patel and Wilson (2020) showed that students who were taught using Vedic Math methods exhibited faster calculation speeds and greater accuracy in solving complex mathematical problems compared to those taught using traditional methods. These international studies collectively support the effectiveness of Vedic Mathematics in improving mathematical skills and reducing anxiety, highlighting its potential for broader application in diverse educational settings.

In the Philippines, several studies have explored the impact of Vedic Mathematics on students' mathematical skills and engagement. Santos and Cruz (2021) examined the effects of Vedic Mathematics on Grade 7 students in a public school in Manila. The researchers found that students who were taught using Vedic Mathematics techniques demonstrated significant improvements in their speed and accuracy of calculations compared to those taught using traditional methods. This study also reported increased student engagement and a more positive attitude towards mathematics. Garcia and Reyes (2022) conducted a quasi-experimental study in Cebu, comparing the performance of students taught using Vedic Mathematics with those using conventional methods. Their findings indicated that students exposed to Vedic Mathematics scored higher on standardized math tests and showed enhanced problem-solving skills.

Additionally, the study highlighted a decrease in math anxiety among students using Vedic Math techniques. Villanueva (2023) explored the integration of Vedic Mathematics in a blended learning environment in the Philippines. The study reported that students who used Vedic Math in an online learning setup were more motivated and participated more actively in math-related activities. The research suggested that the simplicity and efficiency of Vedic Math make it an effective tool for enhancing math learning in both traditional and digital classrooms.

These studies align with international research, reinforcing the benefits of Vedic Mathematics in improving mathematical skills, reducing anxiety, and increasing student engagement. The positive outcomes in the Philippine context suggest that Vedic Math can be a valuable addition to the country's educational strategies, potentially leading to better math proficiency among students.

A study by Dunst et al. (2018) found that children who develop strong arithmetic skills early tend to perform better in mathematics throughout their schooling. This highlighted the importance of effective teaching strategies in early education to build a solid mathematical foundation.

Research also explored the impact of socio-economic factors on basic math skills acquisition. More recent studies, such as those by Jordan et al. (2018), highlighted that children from lower socio-economic backgrounds often face challenges, such as limited access to educational resources, which can impede their mathematical learning. Addressing these disparities through targeted interventions and support programs is crucial for ensuring equitable educational outcomes (Jordan et al., 2018).

Other significant studies include those by Siegler and Ramani (2018), who demonstrated that playing number board games can enhance numerical understanding in low-income children. This research highlighted the potential of interactive and engaging activities to improve math skills. Geary et al. (2017) emphasized the importance of number sense, noting its critical role in the development of arithmetic skills and overall mathematical competence. Their work underscores how foundational number sense contributes to later mathematical success.

Additionally, Baroody (2017) discussed the relationship between early number skills and later mathematical achievement, stressing the significance of early interventions. This study emphasized that addressing number skills early can have lasting positive effects on mathematical achievement. Together, these studies highlighted the importance of innovative educational strategies and early interventions in improving mathematical outcomes and supporting students from diverse backgrounds (Siegler and Braithwite, 2017).

Parental involvement and teacher support are crucial in developing basic math skills. Research indicates that children whose parents actively engage in their education, particularly through activities that reinforce math skills, tend to perform better academically. For instance, recent studies highlight that parental participation in educational activities, such as homework help and enrichment activities, positively affects children's mathematical achievements (Mendez, Casteel, & Smith, 2016). Additionally, teachers who employ positive reinforcement and adaptive teaching methods significantly impact students' mathematical outcomes. Effective teaching practices, including personalized feedback and engaging instructional techniques, are shown to enhance students' understanding and performance in mathematics (Hattie, 2015). By fostering supportive home environments and employing adaptive teaching strategies, both parents and teachers play vital roles in supporting students' mathematical development and academic success (Mendez et al., 2015).

Engagement in mathematics courses reflects students' motivation, achievement, confidence, and emotional states concerning the subject. It plays a crucial role in the acquisition of mathematical knowledge and skills. Higher levels of engagement are associated with greater openness to learning and more profound commitment to the mathematics lesson. This, in turn, impacts both the affective and cognitive aspects of students' experiences with mathematics (Miller et al., 2020; Zheng, 2020). Students who are more engaged in their learning tend to demonstrate enhanced emotional and cognitive investment, leading to improved performance and a more positive attitude.

Synthesis

This study drew on educational theories, mathematical pedagogy, and research on Vedic mathematics. It was grounded in constructivism and experiential learning, which emphasized active engagement and practical application. Vedic mathematics, with its systematic techniques, promoted mental calculations, pattern recognition, and problem-solving, simplifying arithmetic and stimulating cognitive processes crucial for mathematical understanding.

Research showed that Vedic mathematics improved students' arithmetic speed and accuracy by offering intuitive methods. It also enhanced conceptual understanding by breaking down complex problems into simpler steps, fostering a holistic grasp of mathematics. The literature also highlighted Vedic Mathematics' role in student engagement. Its innovative techniques captured students' interest, boosted participation, and fostered collaboration, creating a supportive learning environment. Comparative studies showed that students taught with Vedic techniques outperformed their peers, particularly those who struggled with mathematics.

While Vedic mathematics showed promise, challenges such as teacher training and curriculum integration remained. The literature suggested that further investigation was needed on its long-term impact and applicability across diverse educational contexts.

Hence, the researcher was motivated and highly curious about the effects of Vedic mathematics on the basic mathematical skills and engagement of grade 7 students and these enlightened her to pursue this investigation.

METHODOLOGY

Research Design

This study used a quasi-experimental design, specifically the matching-only pretest-posttest control group design to determine the effects of Vedic Mathematics on Grade 7 student’s basic mathematical skills and engagement in mathematics. Quasi-experimental research design investigates the cause-and-effect relationship between an intervention and an outcome for a target population without randomly assigning subjects to a group (Maciejewski, 2020). The study, specifically, used matching only as a technique where subjects in the experimental group were mechanically matched to those in the control group on certain variables which does not necessarily give assurance that subjects of both groups are equivalent of each other. In this study, the experimental and control groups were mechanically paired using their pretest result on the Enhanced Regional Unified Numeracy Test (E-RUNT) conducted by the Division of Capiz. Only those who had 0-9 scores was randomly chosen as the respondents of the study. This ensured that the participants included in the study had comparable baseline mathematical skill levels, allowing for a more accurate assessment of the intervention's impact.

Locale of the Study

This study was conducted in a secondary school located in Capiz, Philippines, within the framework of the Department of Education's K-12 curriculum. The research was implemented during the 4th quarter of the 2024-2025 academic year, providing a relevant and timely context for assuming the impact of Vedic Mathematics on the basic mathematical skills and engagement of Grade 7 students.

Participants of the Study

The participants in this study consisted of selected Grade 7 students from a public high school under the Schools Division of Capiz during the 2024–2025 academic year. These students were identified based on their performance in the Enhanced Regional Unified Numeracy Test (E-RUNT), which was administered by the Division to assess basic math skills. Only those who scored between 0 and 9 were included to ensure that all participants started at a similar level. After identifying the qualified students, the researcher grouped them according to their test results and randomly assigned them to either the experimental or control group. One of the groups was randomly selected to receive Vedic Mathematics instruction, while the other continued with the conventional math lessons. To avoid any possible influence of the time of day, the class schedules - 3:00 to 4:00 PM and 4:00 to 5:00 PM - were also randomly assigned. Since the participants were minors, the researcher obtained written consent from their parents or legal guardians before the study began. This process aimed to create balanced groups and reduce potential biases, ensuring that any observed effects could be more confidently attributed to the intervention.

Sample Size and Sampling Procedure

A simple random sampling technique was used in selecting the participants of experimental and control groups from Grade 7 students with 30 students per group. The result of their Enhanced Regional Unified Numeracy Test (E-RUNT) conducted by the Division of Capiz was used as basis in choosing and match-pairing of 60 students that were the respondents included in this study. The pre-determined samples weren't informed that they underwent the intervention to ensure the validity of the result.

RESEARCH INSTRUMENT

This study utilized three primary instruments across the pre-intervention, treatment, and post-intervention phases to evaluate the effect of Vedic mathematics on grade 7 student's basic mathematical skills and engagement. The first instrument was a 40-item E-RUNT test, adopted to assess students' proficiency in basic mathematical operations, specifically addition, subtraction, multiplication, and division involving integers. This test was administered to both the experimental and control groups before and after the intervention to gauge their progress. The second instrument was a 30-item Mathematical Engagement Checklist, adopted from Magalona (2022), designed to assess students' level of engagement in mathematics. This checklist used a 5-point Likert scale, where 5 indicated "extremely engaged" and 1 indicated "somewhat engaged." the items were equally distributed across three engagement domains.

1. Affective engagement (10 items), which measured students' emotional interest and enthusiasm.
2. Behavioural engagement (10 items), which focused on effort, participation, and task persistence.
3. Cognitive engagement (10 items), which captured students' investment in learning and use of strategies.

This instrument was administered to both groups during the pre-intervention and post-intervention phases.

Validity and Reliability of the Research Instrument

A researcher-developed module underwent rigorous content and face validity testing. This process involved a panel of experts, a professor, and three master mathematics teachers from DepEd selected based on stringent criteria: (a) completion of a bachelor's degree in mathematics education; (b) holding a master's or doctoral degree in mathematics education; (c) a minimum of five years' experience teaching mathematics; and (d) current employment as a mathematics instructor/teacher.

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The iterative refinement of the investments incorporated feedback from these validators, with undergoing re-evaluation to ensure the integration of all suggested corrections. Since the instruments (basic mathematical skills and engagement checklist) were adopted from DepEd Regional Office and from published research, the reliability of these instruments was already established with Cronbach's alpha value of 0.948. The engagement checklist adopted from Magalona (2022) reported a Cronbach's alpha of 0.87, indicating high internal consistency.

Data Gathering Procedures

Data were collected following the acquisition of necessary approval from both the research adviser and the Dean of the College of Education, Arts and Sciences. Formal authorization was subsequently obtained from the principal of a secondary school in Capiz, the designated site for data collection. To ensure data accuracy and authenticity, the researcher personally administered the pre-intervention. Participant selection was predicated upon scores achieved on the Enhanced Regional Unified Numeracy Test (E-RUNT), ensuring comparable levels of mathematical ability between the control and experimental groups.

As reflected in Table 1, the treatment phase lasted for 20 instructional days, with the researcher serving as the instructor for both groups. While both groups received instruction the representation of absolute value, and the addition, subtraction, and multiplication of integers, the instructional approaches and materials differed significantly. The control group received instruction using the standard Department of Education (DepEd) module, which employed conventional strategies such as number lines, signed tiles, and procedural drills. Lessons followed a conventional structure emphasizing rule-based learning without the incorporation of mental computation techniques. In contrast, the experimental group received instruction using a researcher-developed module grounded in Vedic mathematics. This module introduced students to mental math strategies designed to simplify calculations and promote engagement. Each lesson within the Vedic module incorporated a concept introduction, explanation of Vedic strategies, guided examples, real-life applications, independent practice, and formative quizzes. Although both groups were exposed to identical mathematical content, the control group received standard instruction, while the experimental group benefited from a more interactive, mentally stimulating approach through Vedic Mathematics.

Table 1 Intervention Schedule for the Experimental and Control Group

Date	Day	Control Group (DepEd Module)	Experimental Group (Vedic Mathematics)
February 21	Friday	Pre-test (E-RUNT) and Checklist Administration	Pre-test (E-RUNT) and Checklist Administration
February 24	Monday	Lesson 1: Representing Absolute Value of a Number	Lesson 1: Representing Absolute Value of a Number
February 25	Tuesday	Lesson 2: Adding Integers – Part I Using Number Line and Signed Tiles	Lesson 2: Addition of Integers – Part I Introduction to Vedic Sutra for Addition
February 26	Wednesday	Addition Rules (Same/Different Signs)	Addition Using Integer Rules
February 27	Thursday	Practice and Guided Exercises on Integer Addition	Practice and Guided Exercises on Integer Addition
February 28	Friday	Quiz	Quiz
March 3	Monday	Lesson 3: Subtraction of Integers	Lesson 3: Subtraction of Integers Introduction to Vedic Subtraction
March 4	Tuesday	Subtraction Using Integer Rules	Strategy 1-4: 1. Completing the Whole 2. Subtracting Left to Right 3. All from 9, last from 10 4. Adding Zeros

Table 1 continued

Date	Day	Control Group (DepEd Module)	Experimental Group (Vedic Mathematics)
March 5	Wednesday	Guided Practice and Drill Exercise	Strategy 5-8: 5. One Less 6. Number Splitting 7. Removing Bar Numbers 8. Removing
March 6	Thursday	Word Problem Solving	Subtraction Using Integer Rules
March 7	Friday	Quiz	Quiz
March 10	Monday	Lesson 4: Multiplication of Integers	Lesson 4: Multiplication of Integers Strategy 1. Doubling 2. Multiplying by 4 & 8 3. Extending Tables 4. Multiplying by 5, 50, 25 5. Multiplication Check
March 11	Tuesday	Multiplication Using Integer Rules	Strategy Vedic Squares 6. Number Line 7. Multiplying Left to Right 8. Number Splitting 9. Times Tables Review 10. Numbers Just Over 10 11. Numbers Close to 100
March 12	Wednesday	Guided Practice and Drill Exercise	Strategy 12. Russian Peasant Multiplication 13. "First by First, Last by Last" 14. Multiplication by 11 15. One More Than One Before Using the Average
March 13	Thursday	Word Problem Solving	Multiplication Using Integer Rules
March 14	Friday	Quiz	Quiz
March 17	Monday	Lesson 5: Division of Integers	Lesson 5: Division of Integers 1. Number Splitting Digit Sum Check
March 18	Tuesday	Division Using Integer Rules	Strategy 1. Division by 9, 8, etc. 2. Short Division Regression
March 19	Wednesday	Guided Practice and Drill Exercise	Guided Practice and Drill Exercise
March 20	Thursday	Quiz	Quiz
March 21	Friday	Post-test (E-RUNT) and Checklist Administration	Post-test (E-RUNT) and Checklist Administration

Categorization of Variables

There were two key variables that were included in this study: basic mathematical skills and engagement. These variables were essential in evaluating the effectiveness of the Vedic Mathematics intervention on Grade 7 students.

Basic Mathematical Skills. Basic mathematical skills referred to the learners' ability to perform fundamental arithmetic operations, including addition, subtraction, multiplication, and division of whole numbers. These skills were assessed using the 40-item Enhanced Regional Unified Numeracy Test (E-RUNT), which was administered by the researcher before and after the intervention.

Table 2 presented the scoring rubrics used to interpret the students' performance. The scores obtained by the participants were categorized into levels as stipulated in the rubric, allowing the researcher to determine the progression or improvement in the learners' basic mathematical skills based on the comparison between the pre-test and post-test results.

Engagement. Engagement referred to the level of students' emotional, behavioral, and cognitive involvement during mathematics instruction. To measure this, the researcher utilized a 30-item adopted engagement checklist by Magalona (2022), which was administered to both control and experimental groups during the pre-test and post-test phases. This instrument assessed various indicators of student engagement, such as participation, attention, motivation, enthusiasm, and perseverance in mathematical tasks. The responses were rated using a 5-point Likert scale, and the computed mean scores were interpreted using a standardized rubric. Table 3 presented the scale used to interpret the students' level of engagement in mathematics. The range of means corresponded to five qualitative levels: Extremely Engaged, Very Engaged, Moderately Engaged, Engaged, and Somewhat Engaged. It provided a descriptive interpretation of the students' behaviors, attitudes, and emotional responses toward learning mathematics.

Table 2 Scale for Interpreting Students' Basic Mathematical Skills

Range of Means	Verbal Description	Interpretation
32.01 – 40.00	Advanced	Demonstrates a thorough and accurate understanding of basic mathematical concepts and can apply them effectively to solve complex problems. Shows high levels of precision and problem-solving skills.
24.01 – 32.00	Proficient	Exhibits a solid grasp of basic mathematical concepts and can perform calculations and solve problems with minimal errors. Shows an ability to apply concepts in most scenarios.
16.01 – 24.00	Approaching Proficiency	Has a basic understanding of mathematical concepts but may make occasional errors or require guidance. Capable of solving standard problems but may struggle with more complex scenarios.
8.01 – 16.00	Developing	Shows an emerging understanding of basic math skills but struggles with accuracy and application. Requires additional practice and support to improve proficiency.
0.00 – 8.00	Beginning	Demonstrates limited understanding of basic mathematical concepts and often makes frequent errors. Requires significant improvement and support to reach a functional level of proficiency.

Note. Adopted scale from William (2024).

Table 3 Scale for Interpreting Students' Level of Engagement

Range of Means	Verbal Interpretation	Description
4.50 – 5.00	Extremely Engaged	Students show exceptional depth of understanding, interest, and proficiency in mathematical concepts. They constantly exhibit initiative and exemplary behaviour by going above and beyond in terms of participation, focus, and effort. They demonstrate extraordinary enthusiasm, passion, and satisfaction along with high confidence, perseverance, and intrinsic desire when engaged in mathematical tasks.
3.50 – 4.49	Very Engaged	Students at the level show a high level of interest and proficiency in understanding mathematical concepts. They actively participate, show persistent effort and focus, and listen attentively with a desire to solve problems. They always display positive attitudes,

		confidence and enthusiasm with optimism and perseverance when engaged in mathematical tasks.
2.50 – 3.49	Moderately Engaged	Students display consistent interest and proficiency in understanding mathematical concepts. They consistently participate, show persistent effort and focus, and listen attentively during instruction and tasks. They display positive attitudes and confidence with enthusiasm when engaged in mathematical tasks.
1.50 – 2.49	Engaged	At this level, students show interest and understanding in mathematical concepts. They actively participate and listen attentively with consistent effort during instruction and tasks. They display positive attitude with confidence when engaged in mathematical tasks.
1.00 – 1.49	Somewhat Engaged	Students at this level demonstrate occasional interest and understanding of mathematical concepts. They participate infrequently with occasional focus during instruction and tasks. They occasionally show frustration or anxiety but with some confidence when engaged in mathematical tasks.

Note. Adapted scale from Nagy (2016)

Data Analysis Procedure

After the evaluation of the participants' responses on the given instruments, the data gathered were subjected to the data processing procedure for organization, presentation, and statistical treatment to analyze and interpret the results obtained. The statistical calculations were carried out using the Statistical Package for Social Sciences (SPSS) software. The following statistical tools was used:

Frequency (f). This was used to determine the number participants from the experimental and control groups who responded in the research instruments.

Mean (M). This was used to get the average of raw scores of the participants' basic mathematical skills and engagement both in experimental and control groups.

Standard Deviation (SD). This was used to describe the dispersion of pretest scores, posttest scores and levels of engagement about the mean.

Mann-Whitney U-Test (U). Set at 0.05 alpha level of significance, this was used to determine whether there exists a significant difference between the pre-test and post-test skills and the engagement before and after the intervention of 2 different groups, the experimental and control group.

Wilcoxon Signed Rank Test (Z). Set at 0.05 alpha level of significance, this was used to determine whether there exists a significant difference in the pre-test and post-test skills within the experimental and control groups and in their engagement before and after the intervention.

PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

Basic Mathematical Skills of Experimental and Control

Groups after the Intervention

The basic mathematical skills of both the experimental and control groups are shown in Table 4. Results revealed that the basic mathematical skills of the experimental group are proficient (M = 27.20, SD = 7.76). This means that the students exhibit a solid grasp of basic mathematical concepts and can perform calculations and solve problems with minimal errors. They also show an ability to apply concepts in most scenarios. This level of proficiency suggests that the intervention used with the experimental group have positively influenced their basic mathematical skills.

This result supports the findings of Cahyani et al., (2021), who implemented the REACT (Relating, Experiencing, Applying, Cooperating, and Transferring) learning strategy combined with graphic organizers to improve students' problem-solving abilities in mathematics. In their study, students showed a marked improvement in performance over several learning cycles, indicating that exposure to structured and interactive learning interventions significantly boosts mathematical understanding. Similarly, the intervention in the current study appears to have fostered a deeper engagement with mathematical concepts, leading to enhanced skill proficiency among the experimental group.

On the other hand, the control group's basic mathematical skills were approaching proficiency (M = 20.40, SD = 6.74). This result implied that these students have a basic understanding of mathematical concepts but may make occasional errors or require guidance. They are capable of solving standard problems but may struggle with more complex scenarios. The lower mean score compared to the experimental group suggested that the conventional teaching methods used with the control group may not have been as effective in developing higher-level proficiency but this could be verified only by the test of difference.

This finding supports the study of Mursalin and Saputra (2023), which showed that students taught using traditional methods demonstrated lower problem-solving performance compared to those taught through cooperative learning strategies like Think-Pair-Share. Their study emphasized that there were limitations of conventional instruction in engaging students actively and fostering deeper conceptual understanding. Likewise, the control group in this study may have lacked the interactive and student-centered strategies necessary to promote higher levels of mathematical proficiency. This may explain why their performance was relatively lower, as they were not provided with opportunities to collaborate, explore, and construct knowledge meaningfully.

Table 4 Basic Mathematical Skills of the Experimental and Control Groups after the Intervention

Groups	N	M	SD	Verbal Description
Experimental group	30	27.20	7.76	Proficient
Control Group	30	20.40	6.74	Approaching Proficiency

Note. Interpretation is based on the scale: 0.00 – 8.00 (Beginning), 8.01 – 16.00 (Developing), 16.01 – 24.00 (Approaching Proficiency), 24.01 – 32.00 (Proficient), and 32.01 – 40.00 (Advanced).

Engagement in Mathematics of the Participants in the Experimental and Control groups After the Intervention as a Whole

Presented in Table 5 is the engagement in mathematics of the participants in experimental and control groups after the intervention. The results revealed that the engagement in mathematics to both the experimental (M = 3.22, SD = 0.24) and control (M = 2.75, SD = 0.13) groups were at moderately engaged. This means that the in both groups the students display consistent interest and proficiency in understanding mathematical concepts. They consistently participate, show persistent effort and focus, and listen attentively during instruction and tasks. They display positive attitudes and confidence with enthusiasm when engaged in mathematical tasks. But, the slightly higher mean score in the experimental group suggests that the use of Vedic mathematics may have contributed to improved student motivation, interest, and active participation.

This result supports the study of Raju and Subhash (2016), who found that students exposed to Vedic mathematics techniques showed increased engagement and enthusiasm in learning math due to the simplified and mentally stimulating nature. Their findings emphasize that the novelty and clarity offered by Vedic approaches can lead to higher levels of student involvement and interest in mathematical learning, aligning with the observed outcomes in the present study. In this study, students who learned through Vedic techniques displayed greater focus and enjoyment during math sessions. This suggests that incorporating such alternative strategies can make learning more accessible and enjoyable, particularly for learners who struggle with conventional methods.

Table 5 Engagement in Mathematics of the Participants in the Experimental and Control Groups After the Intervention as a Whole

Group	N	M	SD	Verbal Interpretation
Experimental Group	30	3.22	0.24	Moderately Engaged
Control Group	30	2.75	0.13	Moderately Engaged

Note. Interpretation is based on the scale: 4.50 – 5.00 (Extremely Engaged), 3.50 – 4.49 (Very Engaged), 2.50 – 3.49 (Moderately Engaged), 1.50 – 2.49 (Engaged), 1.00 – 1.49 (Somewhat Engaged)

Affective Engagement in Mathematics of the Participants in the Experimental and Control Groups After the Intervention

Presented in Table 6 is the affective engagement in mathematics of the participants in the experimental group after the intervention. Results revealed that the students in the experimental group were moderately engaged in mathematics (M = 3.23, SD = 0.16). Among the ten statements assessed, the top three with the highest mean scores were: “I enjoy learning mathematics” (M = 3.63, SD = 0.49), “I find joy in understanding math concepts” (M = 3.50, SD = 0.51), and “I get a great deal of satisfaction out of solving a mathematical problem” (M = 3.33, SD = 0.48). The first two statements were verbally interpreted as very engaged, indicating that students at this level exhibit a strong interest and enjoyment in learning mathematics. They actively participate in class, persist through challenges, maintain focus, and demonstrate a positive attitude, confidence, and enthusiasm when solving mathematical problems. The third statement, which was interpreted as moderately engaged, suggests that students regularly show interest and effort in mathematical tasks. They are attentive during instruction, engage consistently, and demonstrate a developing sense of satisfaction from problem-solving activities, though this may not yet be as strong or widespread as the top two responses.

On the other hand, the statements with the lowest mean scores were: “I feel happy when I get good mathematics results” (M = 3.20, SD = 0.41), “I feel satisfaction and confidence when solving math problems” (M = 3.00, SD = 0.26), and “I really like mathematics” (M = 2.93, SD = 0.45), all of which were also interpreted as moderately engaged. These responses suggest that while students demonstrate consistent interest and participation, their emotional connection to success in mathematics and their overall liking of the subject may still be developing. This indicates a need for continued support in building students’ confidence, intrinsic motivation, and deeper emotional attachment to mathematics.

Table 6 Affective Engagement in Mathematics of the Participants in the Experimental Group After the Intervention

Statement		N	M	SD	Verbal Description
1.	I enjoy learning mathematics.	30	3.63	0.49	Very Engaged
2.	I find joy in understanding math concepts.	30	3.50	0.51	Very Engaged
3.	I get a great deal of satisfaction out of solving a mathematical problem.	30	3.33	0.48	Moderately Engaged
4.	I am happy to learn mathematics.	30	3.23	0.50	Moderately Engaged
5.	I love solving mathematics problems.	30	3.23	0.63	Moderately Engaged
6.	I feel a definite positive reaction towards math.	30	3.23	0.43	Moderately Engaged
7.	I feel happy when I get good mathematics results.	30	3.20	0.41	Moderately Engaged
8.	I am confident when participating in math class discussion.	30	3.03	0.18	Moderately Engaged

9.	I feel satisfaction and confidence when solving math problems.	30	3.00	0.26	Moderately Engaged
10.	I really like mathematics.	30	2.93	0.45	Moderately Engaged
	Overall Result	30	3.23	0.16	Moderately Engaged

Note. Interpretation is based on the scale: 4.50 – 5.00 (Extremely Engaged), 3.50 – 4.49 (Very Engaged), 2.50 – 3.49 (Moderately Engaged), 1.50 – 2.49 (Engaged), 1.00 – 1.49 (Somewhat Engaged)

Likewise, Table 7 shows that the students in the control group were moderately engaged in mathematics (M = 2.77, SD = 0.20). The top three statements with the highest mean scores—all verbally interpreted as moderately engaged—were: “I feel happy when I get good mathematics results” (M = 2.93, SD = 0.45), “I feel satisfaction and confidence when solving math problems” (M = 2.87, SD = 0.43), and “I really like mathematics” (M = 2.83, SD = 0.59). These responses suggested that the students generally show a steady interest in mathematics. They participate regularly, maintain focus, and make consistent efforts during math-related tasks. Additionally, they exhibit positive attitudes and a developing sense of confidence and enjoyment in engaging with mathematical activities.

On the other hand, the statements that received the lowest mean scores were: “I enjoy learning mathematics” (M = 2.70, SD = 0.54), “I am happy to learn mathematics” (M = 2.67, SD = 0.48), and “I love solving mathematics problems” (M = 2.67, SD = 0.48), which were also interpreted as moderately engaged. Although these still indicate moderate engagement, they reflect a comparatively lower emotional connection to learning and problem-solving in mathematics. This suggests that while students may participate and perform adequately, their intrinsic motivation and enthusiasm for learning math might not be as strong.

This result supports the findings of Bhakta and Dutta (2016), who reported that integrating Vedic mathematics into instruction enhanced students’ enjoyment, reduced anxiety, and fostered a more positive attitude toward math learning. Their study emphasized that the structured and simplified techniques in Vedic mathematics helped students feel more in control and confident, which in turn nurtured emotional engagement and satisfaction during problem-solving

Table 7 Affective Engagement in Mathematics of the Participants in the Control Group After the Intervention

Statement		N	M	SD	Verbal Description
1.	I feel happy when I get good mathematics results.	30	2.93	0.45	Moderately Engaged
2.	I feel satisfaction and confidence when solving math problems.	30	2.87	0.43	Moderately Engaged
3.	I really like mathematics.	30	2.83	0.59	Moderately Engaged
4.	I am confident when participating in math class discussion.	30	2.80	0.41	Moderately Engaged
5.	I find joy in understanding math concepts.	30	2.77	0.43	Moderately Engaged
6.	I get a great deal of satisfaction out of solving a mathematical problem.	30	2.73	0.45	Moderately Engaged
7.	I enjoy learning mathematics.	30	2.70	0.54	Moderately Engaged
8.	I feel a definite positive reaction towards math.	30	2.70	0.47	Moderately Engaged
9.	I love solving mathematics problems.	30	2.67	0.48	Moderately Engaged
10.	I am happy to learn mathematics.	30	2.67	.48	Moderately Engaged
	Overall Result	30	2.77	0.20	Moderately Engaged

Note. Interpretation is based on the scale: 4.50 – 5.00 (Extremely Engaged), 3.50 – 4.49 (Very Engaged), 2.50 – 3.49 (Moderately Engaged), 1.50 – 2.49 (Engaged), 1.00 – 1.49 (Somewhat Engaged)

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Behavioral Engagement of the Participants in the Experimental and Control Groups After the Intervention

Presented in Table 8 is the behavioural engagement of the participants in experimental group after the intervention. Result revealed that the students in the experimental group were moderately engaged (M = 3.20, SD = 0.30) in mathematics. The statements that received the top three highest mean are I listen to the mathematics teachers' instructions attentively (M = 3.63, SD = 0.56); I persistently engage in math assignments due to my love for problem-solving (M = 3.50, SD = 0.63) which was verbally interpreted as very engaged; and I always try my best to solve mathematical problems (M = 3.43, SD = 0.57) which was verbally interpreted as moderately engaged. Meanwhile, the following statements are at the bottom of the list and are interpreted as moderately engaged: I want to develop my mathematical skills through solving mathematics problem (M = 3.03, SD = 0.81); I am sure I will get the right answer if I keep trying to solve mathematics problems (M = 2.93, SD = 0.52); and I focus when the mathematics teacher teaches in the classroom (M = 2.63, SD = 0.56).

Similarly, Table 9 revealed that the students in the control group were also moderately engaged in mathematics (M = 3.20, SD = 0.30). The top three statements with the highest mean scores—all verbally interpreted as moderately engaged—were: "I focus when the mathematics teacher teaches in the classroom" (M = 2.93, SD = 0.37), "I am sure I will get the right answer if I keep trying to solve mathematics problems" (M = 2.93, SD = 0.52), and "I listen to the mathematics teacher's instructions attentively" (M = 2.90, SD = 0.48). These responses suggested that students in the control group generally exhibit consistent classroom behaviors such as listening attentively, focusing during instruction, and maintaining a degree of perseverance when solving problems.

On the other hand, the bottom three statements—"I try to use a different method if I continue to not be able to solve the mathematics problems" (M = 2.50, SD = 0.51), "I want to develop my mathematical skills through solving mathematics problems" (M = 2.47, SD = 0.57), and "I like to solve new problems in mathematics" (M = 2.40, SD = 0.50)—also received a verbal interpretation of moderately engaged, but with noticeably lower mean scores. These results suggest a lack of initiative and adaptability among some students when faced with challenging tasks.

This outcome supports the findings of Srivastava and Kumar (2020), who emphasized that using Vedic mathematics in instruction promotes sustained student effort, enhances classroom focus, and fosters problem-solving perseverance due to the accessibility and mental clarity of the techniques. Their study reported that students taught with Vedic strategies showed more consistent participation, followed instructions more attentively, and exhibited stronger persistence in mathematical tasks. Similarly, the experimental group in the present study displayed stronger behavioral indicators such as attentiveness and perseverance, suggesting that the intervention helped develop more disciplined and motivated learning behaviors. In contrast, the control group, which received traditional instruction, showed relatively lower engagement and less consistent on-task behavior.

Table 8 Behavioral Engagement in Mathematics of the Participants in the Experimental Group After the Intervention

Statement		N	M	SD	Verbal Description
1.	I listen to the mathematics teachers' instructions attentively.	30	3.63	0.56	Very Engaged
2.	I persistently engage in math assignments due to my love for problem-solving.	30	3.50	0.63	Very Engaged
3.	I always try my best to solve mathematical problems.	30	3.43	0.57	Moderately Engaged
4.	I tackle math problems with consistent effort and effective strategies.	30	3.33	0.55	Moderately Engaged

5.	I participate in discussions during mathematics learning.	30	3.13	0.35	Moderately Engaged
6.	I want to develop my mathematical skills through solving mathematics problems.	30	3.03	0.81	Moderately Engaged
7.	I am sure I will get the right answer if I keep trying to solve mathematics problems.	30	2.93	0.52	Moderately Engaged
8.	I try to use a different method if I continue to not be able to solve the mathematics problems.	30	3.20	0.66	Moderately Engaged
9.	I like to solve new problems in mathematics.	30	3.20	0.66	Moderately Engaged
10.	I focus when the mathematics teacher teaches in the classroom.	30	2.63	0.56	Moderately Engaged
	Overall Result	30	3.20	0.30	Moderately Engaged

Note. Interpretation is based on the scale: 4.50 – 5.00 (Extremely Engaged), 3.50 – 4.49 (Very Engaged), 2.50 – 3.49 (Moderately Engaged), 1.50 – 2.49 (Engaged), 1.00 – 1.49 (Somewhat Engaged)

Table 9 Behavioral Engagement in Mathematics of the Participants in the Control Group After the Intervention

Statement		N	M	SD	Verbal Description
1.	I focus when the mathematics teacher teaches in the classroom.	30	2.93	0.37	Moderately Engaged
2.	I am sure I will get the right answer if I keep trying to solve mathematics problems.	30	2.93	0.52	Moderately Engaged
3.	I listen to the mathematics teachers' instructions attentively.	30	2.90	0.48	Moderately Engaged
4.	I participate in discussions during mathematics learning.	30	2.83	0.46	Moderately Engaged
5.	I persistently engage in math assignments due to my love for problem-solving.	30	2.77	0.43	Moderately Engaged
6.	I always try my best to solve mathematical problems.	30	2.70	0.47	Moderately Engaged
7.	I tackle math problems with consistent effort and effective strategies.	30	2.50	0.51	Moderately Engaged
8.	I try to use a different method if I continue to not be able to solve the mathematics problems.	30	2.50	0.51	Moderately Engaged
9.	I want to develop my mathematical skills through solving mathematics problems.	30	2.47	0.57	Moderately Engaged
10.	I like to solve new problems in mathematics.	30	2.40	0.50	Moderately Engaged
	Overall Result	30	2.69	0.17	Moderately Engaged

Note. Interpretation is based on the scale: 4.50 – 5.00 (Extremely Engaged), 3.50 – 4.49 (Very Engaged), 2.50 – 3.49 (Moderately Engaged), 1.50 – 2.49 (Engaged), 1.00 – 1.49 (Somewhat Engaged)

Cognitive Engagement of the Participants in the Experimental and Control Groups After the Intervention

Table 10 presents the cognitive engagement of participants in the experimental group after the intervention. The results revealed that the students in the experimental group were moderately engaged in mathematics (M = 3.22, SD = 0.34). The statements "I believe studying math helps me with problem solving in other subjects" (M = 3.60, SD = 0.56) and "I think the best way to learn mathematics is to try to do drills" (M = 3.57, SD = 0.50) received the highest mean scores and were verbally interpreted as very engaged. These responses suggest that students see a clear connection between mathematics and problem-solving skills in other areas of study.

Additionally, their preference for hands-on practice, such as drills, indicates a proactive and methodical approach to mastering mathematical concepts. This level of engagement highlighted the effectiveness of the intervention in promoting a deeper understanding of mathematics and its practical applications. Following these, "I think studying advanced mathematics is useful" (M = 3.33, SD = 0.61) was also interpreted as moderately engaged, reflecting students' recognition of the value of advanced mathematical learning, even if their interest or engagement may not be as intense.

On the other hand, the bottom three statements—"I prefer to understand the concepts behind formulas over memorizing them for solving mathematical problems" (M = 3.03, SD = 0.67), "I experiment with varied problem-solving methods in mathematics" (M = 2.93, SD = 0.52), and "I relate the things I learn in mathematics to other subjects" (M = 2.83, SD = 0.65) received lower scores and were verbally interpreted as moderately engaged. These responses suggested that while students show some cognitive engagement, they may still rely on rote memorization rather than fully exploring mathematical concepts and problem-solving strategies. Furthermore, the lower engagement with relating mathematics to other subjects indicates that students may not yet fully appreciate the interdisciplinary connections that mathematics can offer. This suggests that while the intervention improved engagement, there is still room to foster a deeper, more integrated approach to learning mathematics.

Similarly, Table 11 shows that the students in the control group were moderately engaged in mathematics (M = 2.79, SD = 0.21). Among the statements assessed, the top three with the highest mean scores were: "I actively explore beyond classroom teachings to understand mathematics better" (M = 2.93, SD = 0.52), "I relate the things I learn in mathematics to other subjects" (M = 2.87, SD = 0.43), and "I relate the things I learn in mathematics to the things I go through in real life" (M = 2.80, SD = 0.48). These responses were all verbally interpreted as moderately engaged, indicating that students in the control group engage with mathematics beyond the classroom, making connections between mathematical concepts and other subjects, as well as real-life experiences. This suggests that they are somewhat motivated to make mathematics relevant and applicable, though the level of engagement might still be developing.

On the other hand, the three statements that received the lowest mean scores were: "I think studying advanced mathematics is useful" (M = 2.77, SD = 0.43), "I prefer to understand the concepts behind formulas over memorizing them for solving mathematical problems" (M = 2.77, SD = 0.43), and "I experiment with varied problem-solving methods in mathematics" (M = 2.60, SD = 0.50). These responses were also verbally interpreted as moderately engaged, but the lower mean scores suggest that students are less inclined to see advanced mathematics as useful, prefer memorization over conceptual understanding, and may not actively experiment with different problem-solving methods.

This outcome aligns with the work of Shukla and Sharma (2017), who found that Vedic Mathematics enhanced students' cognitive engagement by fostering a deeper understanding of mathematical concepts and encouraging them to apply these concepts to solve problems in other disciplines. Their study emphasized the importance of conceptual understanding and problem-solving techniques in strengthening cognitive engagement, which is reflected in the experimental group's engagement with problem-solving drills and understanding mathematics as a tool for broader academic success. The current results support the notion that interventions like Vedic mathematics can promote a more integrated and practical approach to learning mathematics, helping students connect mathematical skills with real-world applications and other areas of study.

This integrative thinking was evident in students' improved ability to transfer learned concepts to unfamiliar contexts during class discussions. As students became more confident in their mathematical reasoning, they also began to approach interdisciplinary challenges with greater enthusiasm and insight.

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Table 10 Cognitive Engagement in Mathematics of the Participants in the Experimental Group After the Intervention

Statement		N	M	SD	Verbal Description
1.	I believe studying math helps me with problem solving in other subjects.	30	3.60	0.56	Very Engaged
2.	I think the best way to learn mathematics is to try to do drills.	30	3.57	0.50	Very Engaged
3.	I think studying advanced mathematics is useful.	30	3.33	0.61	Moderately Engaged
4.	I value understanding formulas over memorization for learning mathematics.	30	3.27	0.74	Moderately Engaged
5.	I relate the things I learn in mathematics to the things I go through in real life.	30	3.27	0.52	Moderately Engaged
6.	I can think of many ways to use mathematics outside of school.	30	3.23	0.82	Moderately Engaged
7.	I actively explore beyond classroom teachings to understand mathematics better.	30	3.13	0.43	Moderately Engaged
8.	I prefer to understand the concepts behind formulas over memorizing them for solving mathematical problems.	30	3.03	0.67	Moderately Engaged
9.	I experiment with varied problem-solving methods in mathematics.	30	2.93	0.52	Moderately Engaged
10.	I relate the things I learn in mathematics to other subjects.	30	2.83	0.65	Moderately Engaged
	Overall Result	30	3.22	0.34	Moderately Engaged

Note. Interpretation is based on the scale: 4.50 – 5.00 (Extremely Engaged), 3.50 – 4.49 (Very Engaged), 2.50 – 3.49 (Moderately Engaged), 1.50 – 2.49 (Engaged), 1.00 – 1.49 (Somewhat Engaged)

Table 11 Cognitive Engagement in Mathematics of the Participants in the Control Group After the Intervention

Statement		N	M	SD	Verbal Description
1.	I actively explore beyond classroom teachings to understand mathematics better.	30	2.93	0.52	Moderately Engaged
2.	I relate the things I learn in mathematics to other subjects.	30	2.87	0.43	Moderately Engaged
3.	I relate the things I learn in mathematics to the things I go through in real life.	30	2.80	0.48	Moderately Engaged
4.	I think the best way to learn mathematics is to try to do drills.	30	2.80	0.48	Moderately Engaged
5.	I can think of many ways to use mathematics outside of school.	30	2.80	0.41	Moderately Engaged
6.	I think studying advanced mathematics is useful.	30	2.77	0.43	Moderately Engaged
7.	I prefer to understand the concepts behind formulas over memorizing them for solving mathematical problems.	30	2.77	0.43	Moderately Engaged
8.	I believe studying math helps me with problem solving in other subjects.	30	2.77	0.50	Moderately Engaged
9.	I experiment with varied problem-solving methods in mathematics.	30	2.77	0.43	Moderately Engaged
10.	I value understanding formulas over memorization for learning mathematics.	30	2.60	0.50	Moderately Engaged
	Overall Result	30	2.79	0.21	Moderately Engaged

Note. Interpretation is based on the scale: 4.50 – 5.00 (Extremely Engaged), 3.50 – 4.49 (Very Engaged), 2.50 – 3.49 (Moderately Engaged), 1.50 – 2.49 (Engaged), 1.00 – 1.49 (Somewhat Engaged)

Test of Difference in the Basic Mathematical Skills of the Experimental and Control Group after the Intervention

The result of the test of difference in the basic mathematical skills between the experimental and control group is shown in Table 12. The result revealed a very highly significant difference in the post-test scores between the experimental group (Md = 28.00, Mean rank = 37.78, n = 30) and control group (Md = 18.00, Mean rank = 23.22, n = 30), U = 231.500. $p < .001$. This indicates that the Vedic mathematics technique applied to the experimental group had a significant positive effect on students' basic mathematical skills. The higher median and mean rank suggest that students in the experimental group consistently achieved better results in the post-test compared to those in the control group. This finding supports the effectiveness of Vedic mathematics in enhancing students' understanding and skills in basic mathematics.

This finding supports the study of Mehta and Shah (2017), which concluded that Vedic mathematics significantly improved students' computational speed, accuracy, and confidence in solving mathematical problems. Their research highlighted how the use of Vedic techniques can simplify complex calculations and foster greater engagement with mathematical tasks. In the present study, the significant improvement in the experimental group's post-test performance mirrors these outcomes, reinforcing the effectiveness of Vedic Mathematics as a pedagogical tool for enhancing foundational mathematical skills. This increased proficiency also appeared to encourage a more positive attitude toward learning mathematics among the students.

Table 12 Difference in the Basic Mathematical Skills of the Participants in the Experimental and Control Groups after the Intervention

Groups	N	Md	Mean rank	U	p-value
Experimental Group	30	28.00	37.78	231.500	< .001
Control Group	30	18.00	23.22		

Test of Difference in the Engagement in Mathematics between the Experimental and Control Groups After the Intervention

The result of the test of difference in the engagement in mathematics between the experimental and control group after the intervention is shown in Table 13. The result revealed that there is a significant difference in engagement between experimental group (Md = 3.1, Mean rank = 45.50, n = 30) and control group (Md = 2.77, Mean rank = 15.50, n = 30), U = 0.000, $p < .001$. This suggests that the intervention implemented with the experimental group had a substantial positive effect on their engagement levels compared to those who did not receive the intervention.

This finding supports the work of Chandra and Singhal (2018), who noted that the application of alternative teaching methods, such as Vedic mathematics, significantly enhances student engagement in mathematics. Their study reported that students exposed to such methods exhibited higher levels of enthusiasm, participation, and intrinsic motivation in mathematical tasks compared to students in conventional teaching environments. In the present study, the experimental group's significantly higher engagement aligns with Chandra and Singhal's findings, suggesting that Vedic Mathematics can foster deeper cognitive, emotional, and behavioral involvement in the subject.

Table 13 Difference in the Engagement in Mathematics of the Participants in the Experimental and Control Groups after the Intervention

Groups	N	Md	Mean rank	U	p-value
Experimental Group	30	3.17	45.50	0.000	< .001
Control Group	30	2.77	15.50		

Test of Difference in the Pre-test and Post-test Performance in Mathematics of the Control Group

The result of the test of the difference in the pre-test and post-test performance in mathematics of the control group is shown in Table 14. The result revealed a high significant difference in the pre-test (Md = 5, n = 30) and post-test (Md = 18, n = 30) scores for control group, $Z = -4.786$, $p < .001$. This finding implies that the intervention implemented with the experimental group had a substantial positive effect on students' mathematical performance, leading to marked improvement from pre- to post-test. The sharp increase in median scores suggests that students benefited meaningfully from the instructional strategy or tool applied during the intervention.

This outcome is consistent with the findings of Singh and Gupta (2016), who observed significant improvements in students' mathematical performance following targeted interventions in mathematics, even in conventional settings. In their study, students showed considerable growth in mathematical skills after being exposed to structured, focused, and consistent practice, which aligns with the improvement seen in the control group here. The current results reinforce the notion that sustained engagement can lead to measurable improvement in students' performance over time.

Table 14 Difference in the Pre-test and Post-test Performance in Mathematics of the Control Group

Variable	Ranks	N	Md	Mean Rank	Z	p-value
Pre-test	Negative Ranks	0	5.00	0.00	-4.786	< .001
Post-test	Positive Ranks	30	18.00	15.50		
	Ties	0				

Test of Difference in the Pre-test and Post-test Performance in Mathematics of the Experimental Group

The result of the test of the difference in the pre-test and post-test performance in mathematics of the experimental group is shown in Table 15. The result revealed a high significant difference in the pre-test (Md=5, n=30) and post-test (Md=28, n=30) scores for experimental group, $Z = -4.784$, $p < .001$. This substantial increase in median scores suggests that the intervention implemented with the experimental group had a strong positive impact on their mathematical performance. The sharp improvement from pre- to post-test demonstrates that the teaching strategy or instructional tool used effectively enhanced students' understanding and mastery of mathematical concepts.

This finding aligns with the work of Sharma and Tiwari (2017), who found that the application of innovative instructional strategies, such as Vedic mathematics, significantly improved students' performance in mathematical tasks. Their study highlighted that students exposed to Vedic mathematics showed remarkable progress in mathematical skills, particularly in areas requiring calculation speed and problem-solving ability. Similar to the current study, the experimental group demonstrated a significant increase in their mathematical performance, suggesting that such intervention strategies can have a lasting and positive impact on students' academic achievements in mathematics.

Table 15 Difference in the Pre-test and Post-test Performance in Mathematics of the Experimental Group

Variable	Ranks	N	Md	Mean Rank	Z	p-value
Pre-test	Negative Ranks	0	5.00	0.00	-4.784	< .001
Post-test	Positive Ranks	30	28.00	15.50		
	Ties	0				

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Test of Difference in the Engagement in Mathematics Before and After the Intervention of the Control Group

The result of the test of difference in the engagement in mathematics before and after the intervention of the control group is shown in Table 16. The result revealed a significant difference in the engagement in mathematics before (Md = 1.60, n = 30) and after (Md = 2.77, n = 30) the intervention of the control group, Z =-4.785, p < .001. This suggests that even without receiving the specialized intervention provided to the experimental group, the control group still experienced a meaningful increase in their engagement with mathematics.

This finding supports the research by Pekrun et al. (2017), who demonstrated that engagement in mathematics can improve through consistent exposure to supportive classroom environments, where teachers foster motivation and provide positive feedback. Their study found that students' engagement in academic tasks could increase significantly with even modest changes in instructional strategies, underscoring that engagement is not solely dependent on specialized interventions but also on fostering a positive and supportive atmosphere.

Table 16 Difference in the Engagement in Mathematics Before and After the Intervention of the Control Group

Variable	Ranks	N	Md	Mean Rank	Z	p-value
Pre-test	Negative Ranks	0	1.60	0.00	-4.785	< .001
Post-test	Positive Ranks	30	2.77	15.50		
	Ties	0				

Test of Difference in the Engagement in Mathematics Before and After the Intervention of the Experimental Group

The result of the test of difference in the engagement in mathematics before and after the intervention of the experimental group is shown in Table 17. The result revealed a significant difference in the engagement in mathematics before (Md = 1.63, n = 30) and after (Md = 3.17, n = 30) the intervention of the control group, Z = -4.784, p < .001. This substantial increase in median engagement scores suggests that the intervention applied had a strong positive impact on students' engagement in mathematics. The result implies that the technique used with the experimental group was effective in stimulating greater interest, motivation, and active participation in math-related tasks.

This finding aligns with the work of Kotsopoulos (2015), who demonstrated that interventions incorporating alternative teaching methods, such as those that make learning more interactive and engaging, significantly enhance student engagement and motivation in mathematics. Their study found that students exposed to these methods showed a higher level of active participation, demonstrating that teaching techniques that encourage participation and enthusiasm can lead to substantial improvements in engagement. Similarly, the intervention in the current study proved effective in motivating the experimental group, fostering a deeper connection with mathematics and a more proactive approach to learning. This suggests that interactive strategies not only boost motivation but also cultivate a learning environment where students are more engaged and responsive. As a result, students are more likely to develop a positive attitude toward mathematics and persist through challenging tasks.

Table 17 Difference in the Engagement in Mathematics Before and After the Intervention of the Control Group

Variable	Ranks	N	Md	Mean Rank	Z	p-value
Pre-test	Negative Ranks	0	1.63	0.00	-4.784	< .001
Post-test	Positive Ranks	30	3.17	15.50		
	Ties	0				

Mean Gains of Students Basic Mathematical Skills Before and After the Intervention

Table 18 shows the mean gains of the students' basic mathematical skills before and after the intervention in both the experimental and control groups. The data indicates that the experimental group showed a significant improvement in their mathematical performance, with a mean gain of 21.83. Specifically, the pre-test mean score was 5.37 (SD = 1.71), and the post-test mean increased markedly to 27.20 (SD = 7.76). In contrast, the control group also demonstrated improvement, but with a lower mean gain of 15.47, where the pre-test mean was 4.93 (SD = 1.57) and the post-test mean increased to 20.40 (SD = 6.74). These results clearly show that while both groups made progress, the students in the experimental group outperformed those in the control group in terms of the increase in basic mathematical skills after the intervention. This suggests that the intervention implemented with the experimental group had a substantial positive impact on their learning outcomes.

This finding supports the research by Moyer-Packenham and Westenskow (2016), who showed that students exposed to interactive and engaging teaching methods, such as those incorporated in their study of innovative instructional strategies, made greater gains in mathematical skills compared to those who received conventional instruction. Their study highlighted that specialized interventions, which integrate active learning techniques, significantly improve students' conceptual understanding and problem-solving abilities. The substantial gain in the experimental group in the current study further emphasizes the effectiveness of intervention-based strategies in enhancing students' mathematical performance.

Table 19 presents the mean gains in students' engagement in mathematics before and after the intervention across two groups: the experimental group and the control group. In the experimental group, the pre-test mean score was 1.62 (SD = 0.17), while the post-test mean score increased to 3.22 (SD = 0.24), resulting in a mean gain of 1.60. In contrast, the control group had a pre-test mean score of 1.61 (SD = 0.13) and a post-test mean of 2.75 (SD = 0.13), yielding a lower mean gain of 1.14. These results indicate that while both groups showed improved engagement in mathematics after the intervention, the experimental group demonstrated a greater increase. This suggests that the intervention applied to the experimental group had a more substantial impact on enhancing student engagement compared to the control group. This finding is consistent with the work of Hattie (2015), who concluded that instructional interventions that actively involve students in the learning process, such as hands-on, participatory strategies, lead to more significant improvements in engagement and learning outcomes. Hattie's research emphasized that engaging students in active learning and fostering enthusiasm for the subject matter results in stronger engagement, which is reflected in the larger increase in the experimental group's engagement scores in this study. The greater mean gain in the experimental group further supports the notion that such interventions can foster greater student motivation, participation, and sustained interest in mathematics.

Table 18 Mean Gains of Students' Basic Mathematical Skills Before and After the Intervention in Two Groups

Category	Control Group				Experimental Group			
	N	M	SD	Mean Gain	N	M	SD	Mean Gain
Pre-test	30	4.93	1.57	15.47	30	5.37	1.71	21.83
Post-test	30	20.40	6.74		30	27.20	7.76	

Table 19 Mean Gains of Students' Engagement in Mathematics Before and After the Intervention in Two Groups

Category	Control Group				Experimental Group			
	N	M	SD	Mean Gain	N	M	SD	Mean Gain
Pre-test	30	1.61	.13	1.14	30	1.62	.17	1.60
Post-test	30	2.75	.13		30	3.22	.24	

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Test of Difference Between the Mean Gains of Basic Mathematical Skills of the Experimental and Control Group

Table 20 reveals the test of difference between the mean gains of the basic mathematical skills of the experimental and control group. It was shown that there is a significant difference between the mean gains of both the experimental and control group, $Z = -3.106$, $p < 0.002$, in terms of their basic mathematical skills. This suggests that the experimental group, which was exposed to Vedic mathematics, showed significantly greater improvement in basic mathematical skills compared to the control group. The significant difference indicates that the use of Vedic mathematics strategies had a positive impact on students' learning outcomes and is more effective than conventional methods in enhancing mathematical competence.

This result supports the study of Rathod and Shah (2016), who found that students taught with Vedic Mathematics techniques achieved significantly higher results in mathematics compared to those taught using conventional methods. Their study concluded that Vedic Mathematics helps improve computational ability, fosters interest in math, and builds learners' confidence.

Table 20 Test of Difference Between the Mean Gains of Basic Mathematical Skills of the Experimental and Control Group

Groups	N	Pre-test	Post-test	Mean Gain	Z	p-value
Experimental Group	30	1.62	3.22	1.60	-3.106	<.002
Control Group	30	1.61	2.75	1.14		

Test of Difference Between the Mean Gains of the Engagements of Both the Experimental and Control Group

Table 21 reveals the test of difference between the mean gains of the student’s engagement in mathematics of the experimental and control group. It was shown that there is a significant difference between the mean gains of both the experimental and control group, $Z = -4.712$, $p < 0.001$, in terms of their engagement in mathematics. This suggests that the experimental group, which was exposed to Vedic Mathematics strategies, experienced a significantly higher increase in engagement compared to the control group. The high level of significance indicates that the intervention had a substantial positive impact on students’ affective, behavioral and cognitive engagement.

This finding supports the study of Wang and Dego (2016), who emphasized that student engagement in mathematics increases when instruction includes cognitively challenging, relevant, and novel problem-solving experiences. Their research identified that engagement is influenced not only by the subject matter but also by how it is taught—highlighting the value of innovative instructional approaches.

Table 21 Test of Difference Between the Mean Gains of the Students’ Engagement in Mathematics of the Experimental and Control Group

Groups	N	Pre-test	Post-test	Mean Gain	Z	p-value
Experimental Group	30	1.62	3.22	1.60	-4.712	<.001
Control Group	30	1.61	2.75	1.14		

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

This study was conducted to investigate the effect of Vedic mathematics on the basic mathematical skills and engagement in mathematics of Grade 7 students.

Specifically, the study sought to (1) determine the levels of basic math skills of the experimental and control groups after the intervention; (2) determine if a significant difference exists in the post-test performances of the students in control and experimental groups; (3) determine the engagement in mathematics of the experimental and control groups after the intervention; (4) determine if a significant difference exists between the engagements in mathematics of the students in control and experimental groups after the intervention; (5) determine if a significant difference exist in the pre-test and post-test performance of the students in the control group; (6) determine if a significant difference exists in the pre-test and post-test performance of the students in the experimental group; (7) determine if a significant difference exists in the engagement in mathematics of Grade 7 students in the control group before and after the intervention; (8) determine if a significant difference exists in the levels of Mathematics engagement of Grade 7 students in the experimental group before and after the intervention; and (9) determine the performance and engagement mean gains of the experimental and control groups before and after the intervention.

It utilized a quasi-experimental design, specifically a matching-only pre-test-posttest control group design, to determine whether significant differences exist between the pre-test and posttest basic mathematical skills and the engagement in mathematics of the students in the experimental and control groups before and after the intervention was implemented.

The study was conducted in one of the secondary schools in Capiz in their mathematics subject during the fourth quarter of the school year 2024-2025 starting from February 21, 2025 until March 21, 2025.

The participants of the study were the 60 Grade 7 students in one of the secondary schools in Capiz during the fourth quarter of the school year 2025-2024. The E-RUNT performance of the participants was used as basis in performing mechanical matching to ensure the fair pairing of participants in the two groups.

In the analysis, descriptive statistics such as frequency count, mean, mean percentage score, median, and standard deviation were utilized in this study. On the other hand, Mann-Whitney U-Test and Wilcoxon Signed Rank Test set at 0.05 level of significance were used to test the difference between the pre-test and post-test mathematical skills and the engagement before and after the intervention of the students in the experimental and control groups.

Findings of the Study

Based on the results of this research, the findings are as follows:

1. The post-test basic mathematical skills of the experimental group was at the proficient level while that of the control group was at the approaching proficiency level.
2. There was a significant difference between the post-test performance of the experimental and control groups.
3. Grade 7 students in the experimental and control groups were both moderately engaged after the intervention. Specifically, both the experimental and control groups were moderately engaged in the affective aspect. The same result was revealed in terms of behavioral engagement as well as in the cognitive aspect.
4. There was a significant difference in the engagement of the experimental and control groups after the intervention.
5. There was a significant difference in the pre-test and post-test basic mathematical skills of grade 7 students in the control group.
6. There was a significant difference in the pre-test and post-test performance of grade 7 students in the experimental group.
7. There was a significant difference in the engagement in mathematics of grade 7 students in the control group before and after the intervention.
8. There was a significant difference in the engagement in mathematics of grade 7 students in the experimental group before and after the intervention.

9. There were significant differences in the mean gains between the experimental and control groups in both basic mathematical skills and engagement.

CONCLUSIONS

Based on the findings of the study, the following conclusions were made.

1. The group taught using Vedic mathematics reaches proficiency in basic mathematical skills, while the control group, which receives conventional teaching, is only approaching proficiency. This indicates that both instructional strategies are effective in developing students' understanding and application of mathematical concepts, though to different extents.
2. Vedic mathematics proves to be more effective than the conventional method in enhancing students' basic mathematical skills. This highlights the value of integrating ancient, simplified, and mentally efficient techniques into modern instruction to improve students' mastery of foundational skills. Aligning curriculum goals with innovative methods like Vedic mathematics fosters deeper understanding and more efficient problem-solving.
3. Students in both the experimental and control groups demonstrate a moderate level of interest and proficiency in understanding mathematical concepts during the intervention. They consistently participate in classroom activities, display focused effort, and listen attentively during instruction. Additionally, they exhibit positive attitudes, confidence, and enthusiasm when engaged in mathematical tasks.
4. Vedic mathematics significantly increases the engagement of students in the experimental group, indicating its superiority over the conventional approach. This finding underscores the potential of Vedic mathematics to enhance learning experiences and student outcomes by promoting greater interest and involvement in mathematics.
5. Both Vedic mathematics and conventional teaching approaches lead to improved performance in mathematics among students in the experimental and control groups. This suggests that while both methods are effective, the degree of effectiveness varies, with Vedic mathematics showing stronger results overall.
6. Engagement in mathematics increases in both the experimental and control groups. However, the experimental group taught with Vedic mathematics shows significantly higher gains, indicating that the intervention is more effective in improving both basic mathematical skills and student engagement compared to the conventional teaching method.

RECOMMENDATIONS

Based on the aforementioned findings and conclusions of this investigation, the researcher hereby recommended the following:

1. Educators may use the Vedic mathematics as a teaching approach as it effectively increased the performance and engagement of the learners. The researcher-made module consisting the incorporation of Vedic mathematics in the teaching and learning process can be further enhanced and be used as a basis in developing Vedic mathematics modules of other topics in mathematics. Additionally, the integration of Vedic mathematics in the curriculum may foster a deeper appreciation for mathematical concepts and improve students' problem-solving abilities.
2. Curriculum planners and developers may include the Vedic mathematics as teaching approach in developing curriculusm, especially when enhancing the teaching strategies of the teachers.
3. School administrators may initiate a training in Vedic mathematics that will address the poor mathematics performance of the students.
4. A different research design, such as a mixed-method or qualitative approach, may be utilized in future studies to explore low engagement in mathematics, focusing on different mathematical concepts covered in the module. A wider scope, such as division level, and other learners' context might be taken into consideration.

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