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| RESEARCH ARTICLE

The Role of Technology Integration in Enhancing Secondary Mathematics Achievement

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| ABSTRACT

This study conducted at a National High School in Minglanilla, Cebu, Philippines during the 2023–2024 school year, examined the role of technology integration in enhancing secondary mathematics achievement among Senior High School students. Utilizing a descriptive method, the research sampled 50 senior high school students and five Mathematics teachers, using instruments adapted from the Department of Education's Central Office Learning Modules and Mathematics Learning Materials. It assessed technology's applicability across specific mathematics competencies, pre-test and post-test scores, and challenges in teaching Probability and Statistics. Findings showed that technology integration was rated as "Utilized," effectively boosting engagement and motivation, though there was no significant correlation between the extent of technology use and students' academic performance. Most students achieved satisfactory grades, suggesting that while technology supports engagement, it may not directly improve academic outcomes. The study recommends an action plan focused on strategic implementation, teacher development, and collaborative learning to enhance the impact of technology integration on academic performance.

| KEYWORDS

Mathematics Education, technology integration, academic performance, descriptive correlational research design, Philippines

| ARTICLE INFORMATION

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INTRODUCTION

Technology integration has become increasingly prevalent in education, offering new opportunities to enhance teaching and learning experiences. In the context of secondary mathematics education, the incorporation of technology holds significant promise for improving student outcomes and fostering deeper understanding of mathematical concepts.

The role of technology integration in enhancing secondary mathematics achievement stems from several key considerations. First, as technology continues to advance rapidly, it has become an integral part of daily life, including education. Given its pervasive influence, it is essential to understand how technology can be effectively leveraged to support mathematics instruction and improve student learning outcomes. Also, secondary mathematics education often presents unique challenges, as students are introduced to more complex mathematical concepts and problem-solving strategies. Technology tools and resources have the potential to provide additional support and scaffolding to help students navigate these challenges, making abstract mathematical concepts more accessible and engaging.

Furthermore, technology integration offers opportunities for personalized learning experiences, allowing students to explore mathematical concepts at their own pace and access resources tailored to their individual needs. This personalized approach can cater to diverse learning styles and abilities, promoting greater inclusivity and equity in mathematics education. Moreover, in an increasingly digital world, proficiency in mathematical skills is essential for success in various fields, including science, technology, engineering, and mathematics (STEM). By investigating the role of technology integration in enhancing secondary mathematics achievement, this study seeks to contribute to the broader goal of preparing students for future academic and professional endeavors.

In investigating the role of technology integration in enhancing secondary mathematics achievement, several gaps in the existing research literature emerge, delineating areas for further exploration and analysis. One notable gap is the limited understanding of effective integration strategies. Despite the increasing use of technology in mathematics education, there remains a lack of consensus on the most effective instructional practices for integrating technology into secondary mathematics instruction. While many studies provide a broad overview of technology tools and their potential benefits, detailed insights into specific instructional strategies that lead to improved student outcomes are lacking.

Furthermore, there is a dearth of research exploring student perspectives on technology integration in mathematics classrooms. While much of the existing literature focuses on educators' perspectives and instructional strategies, understanding how students engage with technology and how it impacts their learning experiences is essential. Exploring students' experiences and perceptions can provide valuable insights into effective technology integration practices from the learner's perspective.

Moreover, variability in access to technology among schools and districts presents another significant gap in the research literature. Disparities in access to technology tools and resources can lead to unequal opportunities for students to engage with technology in mathematics education. Factors such as socioeconomic status, geographic location, and school resources can significantly influence the effectiveness of technology integration efforts, yet these disparities are often overlooked in research studies.

The Philippines' Department of Education (DepEd) has implemented the DepEd Commons, a web-based Learning Management System (LMS), to modernize education. This platform facilitates educational content planning, delivery, management, and evaluation. DepEd Commons provides teachers, students, and parents access to quality resources and fosters collaboration. Features include online content delivery, assessment, and tracking, promoting technology-enhanced learning and 21st-century skills ("DepEd Learning Management System and Electronic Self-learning Modules," 2020). This initiative aims to enhance education delivery efficiency, effectiveness, and accessibility to diverse learning resources. The issue of effectively integrating digital technology into teaching and learning practices has become increasingly significant, particularly as education systems worldwide rapidly digitize. This acceleration follows the implementation of legislation and action plans by many nations aimed at expediting the digitalization process.

At a National High School in Minglanilla, Cebu Province, Philippines teachers continue on their efforts to integrate technology into their teaching practices to enhance the learning experience for students, particularly in the field of secondary mathematics. However, one of the primary challenges they face is the lack of sufficient knowledge about the various technologies available and how to effectively incorporate them into their lessons. This challenge directly relates to the broader topic of the role of technology integration in enhancing secondary mathematics achievement. While digital tools and resources hold great potential for improving students' understanding and engagement with mathematical concepts, their successful implementation depends on teachers' ability to effectively utilize them in the classroom.

Without adequate knowledge and training in how to leverage technology for educational purposes, teachers may struggle to fully capitalize on its benefits and may not be able to create truly interactive and impactful learning experiences for their students. Therefore, addressing the specific challenge faced by teachers at the National High School regarding technology integration is crucial for advancing the broader goal of enhancing secondary mathematics achievement through the use of digital tools.

Hence, the researcher aimed to explore the role of technology integration in enhancing secondary mathematics achievement, examining its potential benefits and challenges within the educational landscape. This study sought to explore the potential of technology integration as a tool for enhancing secondary mathematics achievement, addressing gaps in the existing literature, and providing insights that can inform instructional practices and curriculum development in mathematics education.

Theoretical Background

The Technology Acceptance Mode (TAM) Theory (Davis 1989), Cognitive Load Theory (Sweller, 1988) and Constructivism Theory (Piaget 1980) were the theories that served as framework of this study while the Republic Act 10612 and Republic 10533 served as legal bases.

The Technology Acceptance Model (TAM) Theory, developed by Davis in 1989, posits that users' perceptions of the usefulness and ease of use of technology significantly influence their acceptance and adoption of it. In the context of secondary mathematics education, TAM provides a valuable framework for understanding how teachers and students perceive the role of technology in enhancing learning outcomes. According to TAM, if teachers and students perceive technology as useful and easy to use, they are more likely to integrate it into their teaching and learning practices.

Research by Venkatesh and Davis (2000) supports the applicability of TAM in educational settings, emphasizing the importance of perceived usefulness and ease of use in determining technology adoption. In the context of secondary mathematics achievement, teachers' and students' perceptions of technology can influence the extent to which they incorporate technological tools and resources into mathematics instruction and learning activities. For example, if teachers perceive technology as a valuable tool for delivering interactive lessons and providing personalized instruction, they may be more inclined to integrate it into their teaching practices. Similarly, if students view technology as a helpful tool for exploring mathematical concepts, practicing problem-solving skills, and receiving immediate feedback, they may be more motivated to engage with mathematics content through technological platforms.

By understanding teachers' and students' perceptions of technology and addressing any concerns or barriers they may have regarding its use, educators can effectively leverage technology to enhance secondary mathematics achievement. This involves providing training and support to teachers in integrating technology into their instructional practices, as well as designing technology-enhanced learning experiences that align with students' learning preferences and needs. Ultimately, TAM offers valuable insights into the factors that influence the successful integration of technology in secondary mathematics education, thereby contributing to improved learning outcomes for students.

While, Cognitive Load Theory, proposed by Sweller (1988), offers valuable insights into how technology integration can enhance secondary mathematics achievement. According to this theory, the human mind has limitations on the amount of information it can process simultaneously. In the context of mathematics education, where complex concepts can overwhelm students, technology can play a pivotal role in managing cognitive load. By presenting information in more manageable formats, such as through interactive simulations and multimedia resources, technology helps break down complex mathematical ideas into simpler components. For example, interactive graphs and visualizations can provide students with intuitive representations of abstract concepts, reducing the cognitive burden associated with understanding them. Research by Kalyuga, Ayres, Chandler, and Sweller (2003) supports the effectiveness of technology-based learning environments in reducing cognitive load and improving learning outcomes by providing scaffolding and guidance to learners.

Also, with the Constructivism, as articulated by Piaget in 1980, emphasizes the active role of learners in constructing their understanding of concepts through interactions with their environment. In secondary mathematics education, technology integration can align seamlessly with constructivist principles by providing students with opportunities for exploration, collaboration, and the creation of authentic artifacts. Digital tools such as interactive simulations, collaborative online platforms, and multimedia presentations can facilitate student-centered learning experiences that promote active engagement and knowledge construction. For instance, students can explore mathematical concepts through interactive activities, collaborate with peers on problem-solving tasks, and create multimedia presentations to demonstrate their understanding.

On the other hand, Philippines Republic Act No. 10612, also known as the Fast-Tracked Science and Technology Education Program, aims to bolster the country's science and technology education by addressing the shortage of qualified teachers in science, mathematics, and engineering. By fast-tracking graduates in these fields to become secondary school teachers, the government seeks to improve the quality of science and mathematics instruction across the country. This legislative initiative recognizes the crucial role that well-trained and competent teachers play in fostering students' interest and proficiency in these critical subjects. Research has shown that teacher quality significantly impacts student learning outcomes in mathematics (Hanushek, 2011). Therefore, initiatives like RA 10612 are essential for enhancing secondary mathematics achievement by ensuring that students have access to knowledgeable and skilled educators who can effectively teach these subjects.

Similarly, Philippines Republic Act No. 10533, also known as the Enhanced Basic Education Act of 2013, plays a pivotal role in shaping the landscape of secondary education in the Philippines. By expanding the years of schooling from 10 to 12 years and introducing senior high school (Grades 11 and 12) into the basic education system, RA 10533 provides students with additional opportunities to deepen their knowledge and skills in various subjects, including mathematics. The implementation of senior high school allows students to specialize in academic tracks aligned with their interests and career goals, including Science, Technology, Engineering, and Mathematics (STEM). Moreover, the enhanced basic education curriculum emphasizes the integration of technology across all subject areas to prepare students for the demands of the 21st-century workforce.

The introduction of senior high school and the emphasis on science and technology education under these legislative measures create a conducive environment for technology integration in enhancing secondary mathematics achievement. By providing students with access to well-trained teachers and an extended educational pathway, coupled with the integration of technology in teaching and learning, these initiatives can contribute significantly to improving mathematics outcomes among secondary school students. Therefore, aligning efforts to integrate technology in mathematics education with the provisions of RA 10612 and RA 10533 is critical for advancing secondary mathematics achievement in the Philippines.

Thus, the Technology Acceptance Model (TAM), Cognitive Load Theory, and Constructivism provide valuable insights into the role of technology in enhancing secondary mathematics achievement. TAM emphasizes technology's perceived usefulness and ease of use, guiding effective integration strategies. Cognitive Load Theory stresses the importance of managing cognitive load, which technology can aid by presenting information in digestible formats. Constructivism highlights active student engagement, which technology supports through exploration and collaboration. Additionally, legal frameworks such as Republic Act No. 10612 and Republic Act No. 10533 support technology integration, enhancing mathematics education in the Philippines. Aligning technology integration efforts with these theories and legal frameworks has the potential to significantly improve secondary mathematics achievement.

Technology utilization in Mathematics. To comprehend the meaning of good mathematics teaching practice, one must be aware of the general features of math classes in the Philippines, the Department of Education's recommendations for math teaching strategies, and the opinions of important math teachers regarding these strategies. In a similar vein, it's critical to understand the data collection approach that yielded these best practices.

Technology-related informal learning activities are those that entail using ICTs for informal learning processes. These days, everyone has access to personal computers and cellphones with internet connectivity, giving students lots of chances to look up the materials and knowledge they require. The effects that technology-related informal learning activities have on students remain largely unexplored, as this is a new and emergent learning style. To the best of our knowledge, the effects of technology-related informal learning activities on other characteristics, like learning attitudes and beliefs, have seldom been studied; in other words, the majority of prior research have solely examined the effects of these activities on students' academic achievement (Jiang et al., 2024).

According to Susuoroka et al. (2023) in their study about on how Ghanaian senior high school math teachers use technology and to determine what factors influence this use, result shoed that district's Senior High School level used less technology to teach mathematics, according to the results (2.048.85388). According to the study, SHS teachers use technology to teach mathematics. Digital/computer-based, audiovisual, and manipulative technologies were all consolidated into one category. The results demonstrated that most math teachers (3.120 ± 1.063) employed manipulatives in their lessons. Graph boards and cardboards were the least used manipulatives by math teachers in the district, according to the poll, but protractors were used with them more frequently. The statistics also showed that the district's math teachers never used computer-based or digital aids, such as Globaloria computer games, mobile phones, calculators, geometry pads, stepping stones 2.0 comprehensive mathematics, or virtual protractors.

Another study of Viberg et al. (2020) supports the findings of Susuoroka et al. (2023). Findings of their study revealed that students find it challenging to use the tool efficiently when teachers don't try to create common practices for using technology. Teachers cannot truly comprehend how students can learn from a tool if they do not actively use it themselves, nor can they assist students in combining tool and teacher teachings. Instead of receiving integrated instructor instruction and technological support, students wind up with "two masters" battling against each other.

The post-test findings of Rizada & Rey's (2023) study showed a substantial rise, with the experimental group's results rising by 2.58% compared to the control group. Technology-assisted instruction improved students' academic performance in mathematics, and it was found to be superior to traditional teaching methods or lecture-style instruction.

Level of Effectiveness of technology utilization in Mathematics. In the twenty-first century, using technology in the classroom is neither unusual nor uncommon. Every aspect of community life and education has been impacted by technology. Every facet of contemporary life has been impacted by technology, not the least of which is early childhood education. Therefore, it is imperative that everyone use technology to enhance their learning experiences. Numerous stakeholders have suggested the possible application of technology for more than 20 years in education in maths. But despite all of this integration, there are still a number of challenges and worries, particularly with regard to teaching mathematics to young children (Novita & Herman, 2020). In the study of Bright et al., (2024) which determined the impact of of using technology in mathematics in teaching and learning, both the good and considerable impact of technology and the positive and significant impact of mathematics interest on mathematics performance are shown by the analysis's findings. Technology has had a good and noteworthy influence on mathematics interest as well. Lastly, students' enthusiasm in mathematics serves as a partial mediating factor in the relationship between the use of technology in mathematics instruction and learning and students' performance in the subject. mathematics, and there is statistical significance in this link. The report also recommended that technology be used in mathematics education and learning for the Ministry of Education and the Ghana Education Service to increase the performance and interest of senior high school students in the subject.

The Mixed-method research of Pocan et al. (2023), the study's findings demonstrated that the experiment group's AAT and MMS scores differed statistically significantly from one another. Nonetheless, there was no noteworthy distinction observed across the cohorts for intrinsic goal orientation and test anxiety scores, which are sub-dimensions of motivation. The results of the AAT, MMS, and student opinions demonstrated that the usage of mobile technology applications in non-school learning situations has a good impact on education.

The researcher concurs with the findings of the aforementioned studies that indeed technology utilization has now penetrated into the classrooms.

Another study of Aldover (2017) mentioned were thought of to be most effective by science and math teachers in schools and are recognized as benchmarks in teaching and learning practices were: self-discovery because it improves students' learning capability; cooperative learning because students can share better knowledge when they work in groups rather than alone; and hands-on experience because it brings students to their fullest learning capacity because they depend on themselves. Furthermore, a student's future depends critically on their ability to learn mathematics. The national standards movement has placed a strong emphasis on reforming mathematics instruction and learning Robleyer (2018). Furthermore, Muijs and Reynolds (2017) noted that many adults and students consider mathematics to be one of the hardest topics.

Dossey et al. Al (2019) proposed that the application of various teaching techniques and strategies results in the instillation of mathematical knowledge. The problem-based learning strategy is one method that helps to build problem-solving abilities. With this approach, students work with ideas, identify instances of conceptual understanding, label them, and provide examples of how to solve problems. When students correctly choose and implement procedures—that is, when they understand addition and determine the correct sum—they also exhibit procedural knowledge.

However, Martin (2019) proposed that algebraic thought becomes material. When students grow interested in the proportional ratio relationship in their early algebra studies, they start to exhibit algebraic thinking. Graphs are one of the main tools used by students studying algebra to arrange data in statistics. Numerous numerical and visual formats have been used to record data. Data collection and recording were regarded as mathematical instruments.

Salahuddin's (2020) study examined the lack of specific attention paid to teaching mathematics to students with autism. Actually, a lot of autistic kids can do math well—some even better than average. It compels educators to devise and implement successful teaching methods for students with autism. The purpose of this study was to identify best practices for teaching autistic students and how teachers should behave. The research for this study was intended to be a qualitative case study. Parents, the student, the assistant teacher, and a math teacher were all involved. Through interviews and observations, data were gathered.

Yu-Han Hu & Jun Xing (2018) assert that the basis of science in daily life is mathematics. Rather than being a topic reserved for the most gifted pupils, mathematics is a necessary skill that all children, including those with autism, should be able to perform. There is a problem with mathematics, though.

According to Holm et al. (2020), the PISA test results from 2015 revealed that Indonesian pupils' mathematical proficiency was rated as low. It exhorts the fight to enhance mathematical education. Teachers must help autistic kids learn mathematics in the best possible way by facilitating and supporting their learning. The low proficiency in mathematics among Indonesian pupils serves as a driving force for both educators and learners to improve.

Providing teacher training on the use of digital tools greatly reduced the overall effect. Utilizing simulations like dynamic mathematics tools or intelligent tutoring systems proved to be substantially more advantageous than hypermedia systems. Descriptively speaking, the use of digital tools in conjunction with other teaching approaches rather than as a replacement had a greater effect size. The findings suggest fresh lines of inquiry for future studies and can help guide evidence-based choices about the use of digital technologies in the classroom (Hillmayr et al., 2020).

According to the Ngiamsunthorn (2020) study, teachers should give autistic pupils the best help possible when it comes to mathematics instruction in order to maximize their mathematical learning abilities. However, the resources have to be specially and suitably adapted for pupils with a range of special needs. It has a significant impact on students' learning growth at every level. In actuality, depending on the severity of the challenges, the development of students with autism differs in terms of behavior, social communication, and interpersonal interactions.

According to Powell et al. (2020), learning mathematics involves more than just traditional classroom settings with teachers and students; it also calls for learning resources, common practices, and encouraging and supportive environments. In order to support learning activities, particularly in mathematics, teachers must also actively innovate and be creative in their research and material production.

Sabaruddin (2019) asserts that adequate infrastructure and facilities, such as learning materials and props that are customized to the requirements of SLB students, are necessary to promote students' success in mathematics learning. However, when creating learning plans, educators should consider the unique qualities of autistic kids, including their physical, mental, emotional, and social circumstances. It is suggested that they are supplied by customized learning programs, especially in mathematics, which include approaches, methods, and tactics in addition to the kind of instruction that can meet the unique needs of each student. Learning mathematics will help kids develop their analytical abilities and strengthen their moral character.

According to Arthur et al. (2017), teachers must therefore use creativity when coming up with ideas or approaches to give autistic kids the greatest education possible. Since the educational environment for autistic children is more complex than that of typical students, learning tactics and approaches must be chosen with their unique needs in mind. "Fun learning" that is tailored to the interests of kids with special needs is essential to inclusive education. Their learning capacities and attentiveness are inferior to those of typical students in terms of psychological condition.

In the study of Young (2023), he stressed the advantages and difficulties of integrating technology while highlighting the significance of fair access, teacher preparation, and customized teaching strategies. We base our discussion on the most recent research and industry best practices. In order to effectively lobby for additional funding and support for technology initiatives in urban schools, the editorial emphasizes the necessity of stakeholder collaboration. Furthermore, he said that through the adoption of cutting-edge techniques like virtual reality, instructional applications, and online collaborative projects, educators can establish dynamic learning environments that enable students to achieve mathematical excellence. To achieve educational fairness and excellence for every student, it is imperative that the continuing discussion and initiatives regarding the use of technology in urban mathematics education continue. It is still critical that educators and legislators give top priority to technology integration plans that meet the various demands of urban students as the field of technology continues to advance.

Serin (2023) in his study stated, that in order to fulfill the demands of their pupils in mathematics education, educators must use technology as they move into a new era. The ability of these gadgets to enhance efficacy through their characteristics makes learning potentially beneficial for mathematics teaching and learning. Technology helps promote critical thinking in math classes, learners' abilities, successes, drive, and self-efficacy. Logical thinking and problem-solving skills are necessary for mastering mathematics. The development of these skills in students through textbook use is not simple. Nevertheless, technology can provide a genuine learning environment where students can experience learning and gain a deeper comprehension of mathematical ideas.

The results of Liburd's (2021) study demonstrated the usefulness of technology as a teaching tool for coordinate geometry ideas. In comparison to students who learnt using traditional methods, it may be stated that pupils who received instruction through the use of technology demonstrated a higher degree of conceptual knowledge.

Van Garderen (2016) has this idea as he urged students to use drawing as a means of clarifying their understanding. Drawing an applied or "word" problem is one simple heuristic tool that students can use to assist in solving it. The drawing technique also has the added advantage of helping the teacher identify any misconceptions that students may have about how to construct or answer the word problem. The instructor distributes a worksheet with at least six-word problems to the class in order to introduce them to the drawing technique. The instructor explains to the class that occasionally a word problem can be made simpler and easier to solve by drawing a picture of it. After that, each worksheet problem is independently illustrated by the teacher and the pupils. Subsequently, the pupils exhibit their illustrations for every task, elucidating each illustration and its correlation with the given word difficulty. Participating in the class or group, the teacher explains his or her paintings. When students encounter difficult word issues, they are then instructed to work independently to create drawings as a step toward an intermediate problem-solving process. It seems that using this tactic in later primary classes is more beneficial than doing it in early ones.

According to Williams (2019), if students adhere to an effective 4-step process that involves comprehending the problem, coming up with a plan, carrying it out, and reviewing the plan, they can regularly do higher on applied math tasks. Understanding the issue is the first step. The learner can summarize the issue in their own words, highlight important details, and point out any information that is missing in order to completely understand it. The plan is the second gadget. The learner can create a table, sketch a figure, or convert the verbal problem into an equation in order to map out a solution. Putting the strategy into action is the third. The student carries out the plan's steps, demonstrating and verifying their work at each stage. Step Four: The pupil verifies the outcomes. If the solution is expressed as an equation, the student verbalizes the findings and determines if the solution responds to the original word problem's query.

The reviewed research literatures have close bearings to the present study for they also dealt with varied technology integration in the delivery of Mathematics lessons.

OBJECTIVES OF THE STUDY

This research assessed the technology utilization and academic performance of Grade 11 students at a National High School in Cebu Province Division, Cebu, Philippines for the school year 2023-2024, which formed the basis for an action plan.

Specifically, it sought answers to the following questions:

1. What is the extent of technology utilization of the respondents in learning Mathematics?
2. As perceived by the respondents, what is the level of effectiveness of technology utilization in learning Mathematics?
3. What is the level of academic performance of the respondents in Mathematics?
4. Is there a significant relationship between the:
   4.1. extent of technology utilization and academic performance of the respondents in Mathematics,
   4.2. effectiveness of technology utilization and academic performance of the respondents in Mathematics?
5. Based on the findings, what action plan can be proposed?

Statement of the Null Hypothesis

Based on the objectives of the study, the following null hypothesis was tested at a 0.05 level of significance:

Ho1: There is no significant relationship between the extent of technology utilization and the academic performance of the respondents in Mathematics.

Ho2: There is no significant relationship between the effectiveness of technology utilization and the academic performance of the respondents in Mathematics.

METHODOLOGY

Research Design

The researcher employed the descriptive correlational method to explore the relationship between technology integration and secondary mathematics achievement. Creswell (2014) defines a descriptive correlational design as a research approach that examines relationships between two or more variables without manipulating them, enabling researchers to identify trends and patterns within the data. This design was deemed appropriate for investigating how technology integration correlates with student achievement in mathematics. The study focused on two primary variables: technology integration, which included the frequency, types, and modes of technology use in mathematics instruction, and secondary mathematics achievement, measured through standardized tests and classroom performance records.

Data collection involved direct classroom observations to document how teachers utilized technological tools, the specific types of technology employed, and the level of student engagement during instruction. Additionally, surveys were conducted to gather broader perspectives on teachers' and students' attitudes, perceptions, and experiences with technology. These surveys delved into the frequency of technology use, perceived benefits and challenges, and preferences for specific technological tools. In line with Dovetail Editorial Team (2023), descriptive research aims to comprehensively record and monitor factors and circumstances influencing a phenomenon, making it a suitable approach for understanding the dynamics of technology integration in education.

The Input is the extent of technology utilization of respondents in teaching Mathematics; level of effectiveness of technology utilization in learning Mathematics; level of mathematics performance of respondents; and test of significant relationship between the extent of technology utilization and the and the academic performance of the respondents and the significant relationship between the effectiveness of technology utilization and the academic performance of the respondents.

The Process commenced with a request for permission to conduct the study to the school principal of the identified school where the study was conducted. After the approval was secured, post-test examination was distributed to respondents. The respondents were given enough time to answer the questionnaire to ensure that data needed will be completed. Retrieval of the answered questionnaire followed. The collected data will be tabulated, statistically analyzed, interpreted.

The findings served as basis for the crafting of the output of the study which is the Action Plan.

Environment

The research was conducted in a National High School, established on June 13, 1994, was the result of collaborative efforts by notable figures including the former Congressman of the First District of Cebu, Hon. Eduardo Gullas, former Municipal Mayor of Minglanilla, the late Hon. Eduardo Selma, and former Barangay Captain of Barangay Tungkop, the late Hon. Angelina "Bebot" Geonzon. Their collective vision aimed to provide accessible education to students from Barangay Tungkop and neighboring areas who lacked access to private secondary schools.

The inaugural First Year High School Class for S.Y. 1994-95 comprised 60 students, with 40 males and 20 females. Initially, only three teachers managed the diverse subjects for the entire class, overseen by the school head of Guindaruhan National High School. Remarkably, these three teachers remain dedicated to their profession to this day. The school's first graduation ceremony took place in March 1998 at the Elementary School Stage. Enrolment has steadily increased since SY 1995, necessitating additional classrooms and teachers each year. In response to the escalating demand, innovative measures, such as class shifting, were implemented to address the shortage of facilities. From its modest beginnings with 60 enrollees, the school's population has grown significantly to 1,863 students in the current school year. This expansion is mirrored by the growth of teaching staff, which has increased from three to 52 under the leadership of the dynamic school principal.

Students represent a critical stage in education where students are preparing for higher education or entering the workforce. Mathematics proficiency during this period is crucial for future academic and career success, making it an opportune time to assess the effectiveness of technology integration in enhancing mathematics achievement.

The National High School serves as the research setting, providing a real-world context for investigating the impact of technology integration on secondary mathematics achievement. By selecting students from this school, the researcher can tailor interventions and assessments to the student population's specific needs and demographics, ensuring the study findings' relevance and applicability. Furthermore, including senior high school students aligns with the broader goals of educational institutions to equip students with 21st-century skills, including digital literacy and problem-solving abilities. Integrating technology into mathematics instruction enhances students' conceptual understanding and fosters their ability to adapt to an increasingly technology-driven world.

Respondents

The researcher selected Grade 11 students from the National High School for the research study, which is significant in the context of exploring the role of technology integration in enhancing secondary mathematics achievement. By focusing on this specific group of students, the researcher gained insights into how technology impacts learning outcomes in mathematics among adolescent Grade 11 Senior high school students. Table 1 presents the distribution of the respondents.

Table 1. Distribution of respondents by gender

Gender	Frequency	Percent
Male	15	37.50
Female	25	62.50
Total	**40**	**100.00**

This study used sampling technique since all 40 Grade 11 Senior students taking the subject served as respondents.

Instrument

The survey questionnaire utilized by the researcher was adopted from Smith & Jones (2020) to explore various aspects of technology integration in Mathematics education and its impact on student performance. Part I has 9-item indicators that assessed the extent of technology utilization by asking respondents to rate the statements regarding technology tools such as interactive whiteboards, online resources, educational games, and digital simulations. It revealed how frequently technology has been incorporated into mathematics instruction, the types of technology used, and the opportunities for students to engage with technology for problem-solving and exploration. The rating has the highest of 5 – Highly utilized; 4-Utilized; 3-Moderately utilized; 2-Less utilized; and the lowest is 1 – Not utilized.

Part II of the instrument was adopted and modified from several studies to ensure its relevance and alignment with the research objectives. These sources include M. Matulac (2013) in "Experiences in Technology Integration: ICTs in Basic Education," Fosiah Mahmood (2014) in "Factors Affecting Teachers' Utilization of Technology in Malaysian ESL Classrooms," and Ronald N. Llerin (2019) in "The Effectiveness of Using Technology-Enhanced Learning Strategy for the Delivery of K–12 Education Programs in Senior High Schools in the Division of Cebu City, Department of Education Amidst the COVID–19 Pandemic."

This section focused on the perceived level of effectiveness of technology utilization in enhancing mathematics learning. It featured 10-item indicators rated on a 5-point Likert scale: 5 – Very effective, 4 – Effective, 3 – Moderately effective, 2 – Less effective, and 1 – Not effective. Respondents assessed statements about the impact of technology on various aspects of learning, including student engagement, understanding, achievement, and motivation. The instrument provided valuable insights into how technology was perceived to influence students' grasp of mathematical concepts, their motivation to learn, and their preparedness for future technological demands.

Part III gathered data on respondents' academic performance in Mathematics, using metrics such as grades or test scores to establish a baseline of proficiency and achievement. Ranges of scores and categories was used to determine the levels of learning proficiencies in Mathematics: 8-10, Outstanding; 6-7, Very satisfactory; 4-5, Satisfactory; 2-3, Fair; and 0-1, Poor.

This information will help the readers understand current performance levels and facilitated comparative analysis.

Finally, the survey explored the relationship between technology utilization and academic performance. It investigated whether there was a significant correlation between the extent of technology use and students' academic outcomes and whether the perceived effectiveness of technology in learning correlated with actual performance in Mathematics.

Data Gathering Procedure

The data gathering procedure was guided by three stages. Pre-data gathering stage, data gathering stage, and the post-data gathering stage.

Pre-data gathering stage. A letter request to conduct the study was submitted to the Superintendent and the Principal, indicating the researcher's intention to conduct the survey at the National High School. In her letter, the researcher specified that the study has to be implemented over four weeks in the fourth quarter of the academic year 2023-2024.

Data gathering stage. The pre-test was conducted first. Answers were discussed right after the students had taken the pre-test. The teacher checked and recorded the test questionnaires as a basis for comparison. A post-test was then given to the group to identify the comparison before and after using technology integration. The students' mean scores in the pre-test and post-test, administered before and after the discussion on the topic, were used to determine the student's learning gain scores.

For the survey questionnaire on the extent of technology utilization and the level of effectiveness of technology utilization, the assistant researcher distributed the survey questionnaire to the respondents for administration. Respondents were given ample time to answer the questionnaire, and a date was scheduled for retrieval. Retrieval of questionnaire was made once noticed from the respondents were received that retrieval is ready.

Post-data gathering stage. Once the questionnaires were retrieved, the data were tallied, tabulated, and subjected to statistical treatment. Analysis and interpretation of the results were conducted to provide meaning to the study's findings.

Statistical Treatment

This study's treatment of data involved using descriptive and inferential statistical tools to address the research questions effectively. Frequency count, percentage, weighted mean, and standard deviation were used to determine the extent of technology utilization in learning Mathematics. These tools provided insights into how frequently respondents utilized technology and the variability in usage across participants. Similarly, the perceived effectiveness of technology utilization in learning Mathematics was analyzed using the weighted mean and standard deviation, enabling the researcher to assess the average perception of respondents and the consistency of their responses.

The academic performance of respondents in Mathematics was examined using frequency count, percentage, and mean score to describe the distribution of performance levels and determine the overall achievement of the group. For the relationship between variables, Pearson's correlation coefficient was employed to test the significance of the relationship between the extent of technology utilization and academic performance, as well as between the perceived effectiveness of technology utilization and academic performance. This statistical test provided insights into the strength and direction of the relationships, helping to establish whether technology utilization was linked to educational outcomes in Mathematics.

Ethical Considerations

To ensure ethical compliance, voluntary and informed consent was secured from all participants. Respondents were clearly informed that participation was entirely voluntary and that they were free to withdraw at any time without penalty. They were also assured that the study was conducted solely for academic purposes.

Furthermore, the researcher guaranteed strict confidentiality and data security. Confidentiality was maintained by anonymizing personal data, replacing respondent names with unique alphanumeric codes, and restricting access to the code master list to the principal researcher only. All data files were protected through password encryption and secured storage, and any physical records containing identifying information were immediately destroyed or securely archived once no longer required for the research.

RESULTS AND DISCUSSION

Extent of Technology Utilization

The extent of technology utilization refers to the breadth and depth with which technological tools and systems are integrated into various aspects of society and industry. This encompasses the application of advanced technologies in sectors such as healthcare, education, business, and daily life, leading to enhanced efficiency, productivity, and innovation. The scope of technology utilization underscores its pivotal role in driving modern advancements and transforming traditional practices.

In this particular problem, the respondents were made to answer nine (9) indicators which they have to choose among five rating scale, hence: 5 – Highly utilized; 4 – Utilized; 3 – Moderately utilized; 2 – Less utilized; and 1 – Not utilized. Table 2 displays the extent of technology utilization of the respondents in learning Mathematics.

Table 2. Extent of technology utilization of the respondents in learning Mathematics

S/N	Indicators	WM	Verbal Description
1	Interactive whiteboards or smart boards are utilized by teachers to explain mathematical concepts in the classroom.	3.95	Utilized
2	Teachers incorporate online resources, such as educational websites or video tutorials, to supplement classroom instruction.	3.83	Utilized
3	Teachers frequently incorporate educational digital games or simulations in mathematics instruction.	3.48	Utilized
4	Teacher provides opportunities to use technology to explore real-world applications of mathematics concepts.	3.98	Utilized
5	Students are encouraged to use technology for problem-solving and exploration of mathematical concepts.	3.53	Utilized
6	Assessments in mathematics classes often include tasks that require the use of technology.	3.53	Utilized
7	Teachers provide training or guidance on how to effectively use technology tools for mathematical learning.	3.80	Utilized
8	Teacher assesses student understanding and progress through technology-based assessments in mathematics.	3.78	Utilized
9	Teachers frequently collaborate with students to share best practices on integrating technology in mathematics instruction in the classroom.	3.95	Utilized
	Aggregate Weighted Mean	**3.76**	**Utilized**

Legend: *4.21-5.00-Highly Utilized; 3.41-4.20- Utilized ; 2.61-3.40-Moderately Utilized ; 1.81-2.60- Less Utilized ; 1.00-1.80-Not Utilized*

The data from Table 2, indicating an aggregated weighted mean of 3.76 or "Utilized," suggests a significant integration of technology in learning mathematics among respondents.

Another glance at the table, it is shown that indicator Number 4 has the highest mean of 3.98 or Utilized which says that Teacher provides opportunities to use technology to explore real-world applications of mathematics concepts. This finding is an indication that Mathematics teachers have already used technology in mathematics teaching, hence, not new to the students and expected to enhance the students' love for the subject and eventually improve their performance. The next higher ranked items, namely the use of interactive whiteboards or smart boards for explaining mathematical concepts and the frequent collaboration between teachers and students to integrate technology which both got a weighted mean of 3.95 or Utilized, reflect a positive trend towards embracing digital tools in education.

The implications of these findings are manifold. Firstly, the effective use of technology in mathematics education can lead to improved student outcomes and a deeper understanding of complex concepts. Teachers' willingness to collaborate and share best practices indicates a supportive learning environment that can adapt to the evolving technological landscape. Additionally, these practices can prepare students with the necessary skills for future academic and career pursuits in a technology-driven world.

These findings are consistent with numerous studies highlighting the benefits of technology in enhancing mathematical understanding. For instance, research by Onal & Demir (2017) found that educational technology applications significantly improve mathematics achievement in K-12 classrooms. Interactive whiteboards, in particular, have been shown to foster student engagement and facilitate more dynamic and effective teaching methods. Furthermore, the collaborative efforts between teachers and students in utilizing technology align with the constructivist approach to learning, which emphasizes active, collaborative, and contextualized learning experiences (CITE Journal, 2016).

Another related study of De Veyra & Balgua (2023) showed that while chat rooms and Microsoft Teams are used as digital platforms, computers and cellphones are the primary tools used by math teachers in the classroom. The most popular digital teaching tools are Google Workspace and Microsoft Office, while the most popular free math program is GeoGebra. While devices, digital platforms, and digital tools are used somewhat, the usage of various free mathematics applications is "low.".

The study of Susuoroka et al. (2023) indicated different scenario having employed manipulatives rather than computer-based strategies. Findings indicated that when teaching mathematics, the majority of teachers (3.120 ± 1.063) employed manipulatives. According to the poll, protractors were used with manipulatives more often than cardboard and graph boards, which were the least used by math teachers in the district. The statistics also showed that the district's math teachers never used computer-based or digital tools, such as globaloria computer games, stepping stones 2.0 comprehensive mathematics, mobile phones, calculators, geometry pads, and virtual protractors. Likewise, the study provides evidence that the district's math teachers never used audio-visual technologies, such as television, pie chart assignments based on TV shows, or other audio-visual gadgets (1.416 ±.712).

Thus, the extent of technology utilization in mathematics education, as evidenced by the respondents' feedback, underscores the importance of integrating digital tools and fostering collaborative learning environments. This alignment with contemporary educational research suggests that continued investment in educational technology and professional development for teachers can further enhance the quality of mathematics instruction and student achievement (Hennessy et.al.,2022).

Level of Effectiveness of Technology Utilization in Learning Mathematics

The effectiveness of technology utilization in learning mathematics examines how well digital tools and technological resources enhance students' educational experience and outcomes. It involves evaluating the impact of various technologies, such as interactive whiteboards, educational software, and online collaboration platforms, on students' understanding, engagement, and performance in mathematics. Understanding the effectiveness of these technologies is crucial for optimizing teaching strategies, improving learning outcomes, and ensuring that technological investments in education yield significant benefits.
Table 3 presents the results of this.

Table 3. Level of effectiveness of technology utilization in learning Mathematics

S/N	Indicators	WM	Verbal Description
1	Technology integration enhances student engagement in mathematics learning.	4.10	Effective
2	The use of technology improves students' understanding of mathematical concepts.	3.70	Effective
3	Technology integration positively impacts student achievement in mathematics.	3.68	Effective
4	Integrating technology in mathematics classrooms prepares students for future technological demands.	3.73	Effective
5	Technology resources, such as computers and interactive tools, enhance student learning in mathematics.	3.65	Effective
6	Technology integration in mathematics instruction motivates students to learn.	3.55	Effective
7	The use of technology in mathematics classrooms improves student performance	3.80	Effective

8	Technology integration fosters a deeper understanding of mathematical concepts.	3.68	Effective
9	Technology helps create a less-anxious mathematics environment for students.	3.73	Effective
10	Technology integration in mathematics classrooms enhances student motivation.	3.83	Effective
	Aggregate Weighted Mean	**3.74**	**Effective**

Legend: *4.21-5.00-Very Effective; 3.41-4.20- Effective; 2.61-3.40- Moderately Effective; 1.81-2.60- Less Effective;*
1.00-1.80- Not Effective

The data presented in Table 3 indicates that the respondents rated the level of effectiveness of technology utilization in learning mathematics as with an aggregate weighted mean of 3.74 of Effective. The highest weighted mean is associated with the statement "Technology integration enhances student engagement in mathematics learning" with 4.10 or Effective. "Technology integration in mathematics classrooms enhances student motivation has a weighted mean of 3.83 or Effective. Conversely, the statement "Technology integration in mathematics instruction motivates students to learn" received the lowest weighted mean with 3.55 or Effective.

Another closer look at Table 3, it is noteworthy to say that all indicators were rated as Effective. This implies that there is yet more to do among Mathematics teachers in as motivation of students is concerned to make technology integration Very Effective. Teaching strategies in Mathematics is one factor to this. Moreover, implications of these findings suggest that technology plays a crucial role in increasing student engagement and motivation in mathematics. The high ratings for engagement and motivation highlight that students find technological tools to be beneficial in making mathematical concepts more accessible and interesting. This aligns with research by Li and Ma (2010), which demonstrated that technology use in math education significantly boosts student engagement and achievement. The dynamic and interactive nature of technology can transform traditional teaching methods, making learning more appealing and effective.

Moreover, the disparity between the highest and lowest rated statements suggests a nuanced perspective among respondents. While technology clearly enhances engagement and motivation, there may be factors affecting its overall motivational impact that require further investigation. For instance, the lowest rating for the statement on motivation might indicate that while technology is beneficial, it alone is not sufficient to fully motivate all students. This aligns with findings by Kim (2021) who noted that while technology can improve performance, its impact can vary based on implementation and context. Continued investment in educational technology and research into its optimal use can further enhance its effectiveness, ensuring that all students benefit from these advancements (Ascione, 2023)

Thus, the effective utilization of technology in mathematics instruction, as reflected by the respondents' feedback, underscores its vital role in enhancing student engagement and motivation. To maximize these benefits, educational institutions should focus on comprehensive integration strategies, continuous teacher training, and addressing any underlying factors that may affect student motivation.

Level of Mathematics Performance of the Respondents

The respondents' mathematics performance level reflects their proficiency and achievement in mathematical concepts and problem-solving skills with the utilization of technology. This assessment provides valuable insights into their understanding, application, and retention of mathematical knowledge, which are critical for academic success and future career opportunities. Analyzing these performance levels helps educators identify strengths and areas needing improvement, guiding instructional strategies and resource allocation to enhance learning outcomes. Table 4 has the data on this.

Table 4. Level of Mathematics Performance of the Respondents

Level	Numerical Range	f	%
Very Satisfactory	31-40	11	27.50
Satisfactory	21-30	19	47.50
Fairly Satisfactory	11-20	10	25.00
Poor	0-10	-	-
Total		**40**	**100.00**
Mean		*25.45*	*Satisfactory*
St. Dev.		*6.77*	

The data from Table 4, which outlines the level of mathematics performance of the respondents, indicates that the majority of respondents achieved a Satisfactory performance, with 19 respondents or 47.50 percent scoring within the numerical range of 31-40. This is followed by 11 respondents (27.50%) who achieved a "very satisfactory" performance, scoring between 21-30, and lastly, 10 respondents (25%) who were rated as "fairly satisfactory," scoring between 11-20. It is noteworthy to note that no one from the respondents got a rating of Outstanding, although majority of them are in the Very satisfactory and Satisfactory level.

The implications of these findings suggest a generally positive performance in mathematics among the respondents, with nearly half demonstrating satisfactory proficiency. This indicates that most students have a solid understanding of mathematical concepts but also highlights the need for targeted interventions to elevate those in the "fairly satisfactory" category to higher performance levels. Educational strategies should thus focus on differentiated instruction and additional support for lower-performing students to ensure all learners can achieve their full potential.

Related studies support these findings by emphasizing the importance of tailored instructional methods to improve mathematics performance. For instance, research of Victoria State Government. (2022) suggests that effective feedback and individualized learning plans are crucial in enhancing student achievement. Additionally, a study by Ozan & Kıncal (2018) found that clear, structured instruction and regular formative assessments significantly contribute to better student outcomes in mathematics.

On a related study of Liburd & Jen (2021), total of 35 high school students in Grade 10/Senior High (Experimental group = 18 and Control group = 17) were included in the study. The experimental group was taught using an interactive technological approach, specifically the GeoGebra software, while the control group received the same instruction using a traditional method without the use of technology. A free program called GeoGebra may be used to teach a variety of math subjects. The study uses Analysis of Covariance (ANCOVA), and the results demonstrate that technology is a useful tool for teaching coordinate geometry concepts. In comparison to students who learnt using traditional methods, it may be stated that pupils who received instruction through the use of technology demonstrated a higher degree of conceptual knowledge.

However, this particular finding is contradicted by Susuoroka et al. (2023) who said that math teachers in the district have never used digital or computer-based resources like Globaloria, cell phones, calculators, geometry pads, stepping stones 2.0 comprehensive mathematics, or virtual protractors. Similarly, the study's findings also shows that district math teachers never used audio-visual technologies, such as television or pie charts that students were assigned based on TV shows.

The study of Bukhatwa et al., (2022) looked into the benefits of using multimedia tools in the mathematics and statistics classroom. It looks at producing instructional videos using tablet PCs. By using the learning platform Moodle, these techniques enable lecturers to give students extra assistance with their studies. The experiences of three lecturers in creating an interactive, technology-based teaching strategy to enhance student learning are covered in this paper. The "solved examples" in the video materials are helpful in illustrating statistical concepts, according to the findings. In order to help the students participate more actively in the learning process, the article also exhorts lecturers to build learning tools and learn from their experiences.

Moreover, there are compromises when using technology in the classroom. Put another way, there is a balance between the benefits and drawbacks of using technology. Technology is more of a tool, one that, depending on how it is incorporated, student could use both positively and negatively. Most of the research in this field supports the notion that technology use has a greater influence than actual technology. Students occupying that classroom may be impacted by elements like teacher supervision of technology use (Martin, 2022).

In conclusion, while the majority of respondents exhibit satisfactory performance in mathematics, there remains a substantial proportion of students who require further support to improve their understanding and skills. Addressing these gaps through targeted interventions and evidence-based teaching practices can lead to overall improvement in mathematics performance. Continued research and implementation of best practices are essential to ensure all students achieve high levels of mathematical proficiency (Aguhayon et.al,2023).

Significance of the Relationship Between the Extent of Technology Utilization, the Effectiveness of Technology Utilization and the Academic Performance of the Respondents

Two Null hypotheses were tested at 0.05 level of significance:
Ho1: There is no significant relationship between the extent of technology utilization and the academic performance of the respondents in Mathematics.
Ho2: There is no significant relationship between the effectiveness of technology utilization and the respondents' academic performance in Mathematics.

Test of Relationship Between the Extent of Technology Utilization and Academic Performance

The test of the relationship between the extent of technology utilization and the academic performance of respondents in mathematics aims to explore how the use of technological tools and resources influences students' mathematical achievement. By examining this correlation, educators and researchers can better understand the impact of technology on learning outcomes, providing insights into effective teaching strategies and the potential benefits of integrating technology into mathematics instruction. Table 5 displays the data on this particular aspect.

Table 5. Test of the significance of the relationship between the extent of technology utilization and academic performance of the respondents in Mathematics

Variables	r-value	Strength and direction of Correlation	***p*** **- value**	Decision	Result
Technology Utilization and Academic Performance	0.005	Negligible Positive	0.975	Do not reject Ho	Not Significant

**significant at p<0.05 (two-tailed)*

The statistical analysis illustrated a minor positive correlation between the extent of technology utilization and academic performance in Mathematics, with an r-value of 0.005 and a p-value of 0.975. These findings emphasize no significant relationship between the variables, as the p-value transcend the 0.05 threshold. Thus, the null hypothesis is not rejected.

This result shows the extent of technology use in learning Mathematics does not significantly influence students' academic performance. While technology may give benefits such as increased engagement and motivation, this result suggests that it does not directly translate to improved academic outcomes in Mathematics. This shows that the complex nature of academic success, where components such as teaching quality, curriculum design, and individual student variation likely display more substantial roles in molding academic achievements.

Related studies have produced mixed results regarding the impact of technology on academic performance. For instance, Cheung and Slavin (2013) found that while technology can enhance learning outcomes, its effectiveness varies widely depending on implementation and context. Similarly, a meta-analysis by Dziuban et.al. (2018) indicated that technology generally has a small to moderate positive effect on learning, but its impact is highly contingent on how it is integrated into the educational process.

In the study of Bright et al. (2024) examination's findings indicate that the Positive and significant effects were seen in both the technology and mathematics interest/performance relationships. Additionally, technology has had a beneficial and substantial impact on interest in mathematics. Lastly, students' interest in mathematics serves as a partial mediating factor in the statistically significant relationship between the use of technology in mathematics teaching and learning and students' performance in the subject. In order to increase senior high school students' interest in and performance in mathematics, the study also recommended that the Ghana Education Service and the Ministry of Education integrate technology into mathematics instruction and learning.

On the contrary, there is a weak positive correlation between the position and compensation of math teachers and how often they use technology. Additionally, a weak but significant association was found between the vertical articulation of mathematical teachers' educational degrees and their use of digital teaching tools, digital teaching platforms, and free mathematics software (De Veyra & Balgua, 2023).

According to Simões et al. (2022), the three main factors that have a beneficial impact on Academic Achievement are moms' education, internet use, and work motives. On the other hand, loneliness, the school atmosphere, interest motivations, and enjoyment attitudes all have a detrimental impact on AA. Additionally, computer use acts as a mediator between computer learning environments and academic achievement, whereas family size and computer self-efficacy function as moderators.

Thus, the lack of a significant relationship between technology utilization and mathematics performance in this study underscores the need for a nuanced approach to educational technology. It is essential to focus not only on the availability of technological tools but also on how they are used to support pedagogical goals. Effective teacher training, robust instructional strategies, and a supportive learning environment are critical components that, when combined with technology, can enhance student learning outcomes (Suchita et.al.,2023).

Test of Relationship Between the Effectiveness of Technology Utilization and Academic Performance

The test of the relationship between the effectiveness of technology utilization and the academic performance of respondents in mathematics seeks to determine how the quality and impact of technological integration influence students' mathematical achievements. This analysis provides insights into whether effective use of technology correlates with improved academic outcomes, informing educational practices and the strategic implementation of technological tools in mathematics instruction. Table 6 shows the data

Table 6. Test of the significance of the relationship between the extent of technology utilization and academic performance of the respondents in Mathematics

Variables	***r* - value**	**Strength and direction of the Correlation**	***p* - value**	**Decision**	**Result**
Effectiveness of Technology Utilization and Academic Performance	0.046	Negligible Positive	0.776	Do not reject Ho	Not Significant

**significant at p<0.05 (two-tailed)*

The statistical analysis for the relationship between the effectiveness of technology utilization and academic performance in Mathematics showed an *r* - value of 0.046, indicating a negligible positive correlation. The *p* - value of 0.776 exceeds the 0.05 threshold, categorically illustrating that the relationship is not statistically significant. As a result, the null hypothesis is not rejected, and the findings are classified as not significant.

This result give emphasis that the perceived effectiveness of technology utilization in Mathematics does not significantly impact students' academic performance. Although, the result set with same findings, it also showed the importance of considering refining methodological approaches in future research to uncover other potential relationships or contextual influences that may affect academic outcomes.

The findings presented in Table 6, indicating a non-significant relationship between the effectiveness of technology utilization and academic performance in Mathematics, carry several important implications. This outcome suggests that simply integrating technology into mathematics education does not automatically lead to improved academic performance among students. This aligns with some previous research, which has highlighted that the effectiveness of technology in education largely depends on how it is implemented rather than its mere presence.

For instance, a study by Major et.al, (2021) conducted a meta-analysis and found that educational technology applications generally produced small to moderate positive effects on mathematics achievement. However, these effects varied greatly depending on the type of technology used and the manner of its integration into the curriculum. The study emphasized that technology needs to be carefully aligned with educational goals and supported by effective teaching practices to realize its potential benefits.

In the study of Mejia et al. (2019) revealed the results of the technology-based learners and the traditional learners showed a substantial disparity in scores, according to the researchers. It was found that learning based on tradition outperforms learning based on technology. The researchers draw the conclusion that a student's learning style has an impact on their academic achievement. Please take note that the file does not have a cover page or preparatory pages.

Moreover, another research by Li and Ma (2010) suggested that the pedagogical approaches accompanying the use of technology play a crucial role. They concluded that teacher preparedness and the integration of technology with constructive teaching methods are key factors influencing the impact of technology on students' learning outcomes. This underscores the importance of professional development and training for educators in effectively leveraging technology in their teaching strategies.

In the study of Sampasa-Kanyinga et al. (2022), they concluded that students in secondary schools who are notoriously prone to problem and excessive use of technology, is linked to poorer academic outcomes and a less connected school community. It was revealed that in both boys and girls, heavy technology usage was correlated differently with lower academic performance and lower degrees of school connectedness. Male students who exhibited moderate-to-severe signs of problem technology use performed worse academically.

However, the study of Simões et al. (2023) negates the findings of this present study. It is interesting to note that computer use, mothers' education, and job goals are the main factors that have a beneficial impact on academic achievement of the students. On the other hand, AA is adversely affected by loneliness, interest motives, the educational atmosphere, and enjoyment attitudes. Additionally, there is a moderating effect from family size and computer self-efficacy, and a mediating effect from computer use between academic accomplishment and computer learning environments.

The researcher concurs with Simões et al. (2023) on the mediating effect from computer use between academic accomplishment and computer learning environments. In this world today where industries make use of technology, it is incumbent upon school administrators to invest on this particular aspect so that its graduates will be able to cope with the needs of the industry.

Implications of these positive and negative findings are significant for educational policy and practice. Educational institutions should not only invest in technological resources but also in training teachers to use these tools effectively. Additionally, there should be an emphasis on developing pedagogical strategies that integrate technology in ways that enhance learning experiences and outcomes.

Thus, while the data from Table 6 shows that the direct relationship between technology use and mathematics performance is not significant, this does not diminish the potential value of technology in education. Rather, it highlights the need for thoughtful implementation and supportive teaching practices. Future research should continue to explore the conditions under which technology can be most beneficial to students' academic success in mathematics.

CONCLUSION AND RECOMMENDATIONS

In conclusion, the findings reveal that while technology is significantly integrated in mathematics education, evidenced by utilization and perceived effectiveness in enhancing student engagement and motivation, this integration does not correlate with improved academic performance. Most students achieved satisfactory grades, yet the data shows no significant relationship between the extent or effectiveness of technology use and their educational outcomes in mathematics.

To address the gap between technology integration and academic performance in mathematics, it is recommended that the proposed action plan be adopted, which focuses on enhancing the effectiveness of technology use through strategic implementation and supportive practices. This includes professional development for teachers, integrating collaborative learning activities, and using interactive tools tailored to student needs. Regular assessment and feedback mechanisms should also be implemented to monitor the plan's impact on student performance. By aligning technological tools with pedagogical goals and providing ongoing support for educators, the action plan aims to improve academic outcomes in Mathematics.

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