INTERACTIVE MATHEMATICAL APPLICATIONS: A FACTOR ON ENHANCING GRADE 9 MATH STUDENTS' ACADEMIC PERFORMANCE

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ABSTRACT

The researcher observes the needs of the students to be transformed and integrated information and communications technology in the teaching and learning process. The students should be exposed to new technology in mathematics. This study investigated interactive mathematical applications representation as a strategy in teaching Trigonometry. The research subjects of this study were the two sections of Grade 9 through purposive sampling. Two sections were subjected to different teaching methods. The Grade 9 Ruby was the experimental group, and section Diamond was the control group. There is no significant difference between the pre-test scores. The post-test scores in trigonometry of the learners in the control and experimental groups can be observed that after applying the study, the experimental group which greater than the score of the traditional group, 15.7857. This can be concluded that students who received experimental treatment outscored the ones who received traditional treatment. The significant difference between the post-test mean scores of the experimental and control groups is that the P-value is 0.000, less than 0.05. This means that there is a significant difference between the pre-test scores. It can also be implied that the intervention is effective because the experimental group's post-test is greater than the control group. The researcher believed that learning using the proper methods and media will positively impact student learning outcomes, primarily supported by technology that is now increasingly developing. Teachers are required to update information and learning materials, while students must be independent in learning both at and outside of school.

Keywords: *Academic Performance, Achievement in Trigonometry, Conventional Teaching Approach, Interactive Mathematical Applications, Trigonometry mathematics learner's series app, Trigonometry Practice & Prep App.*

1. INTRODUCTION

Mathematics holds a relevant and unique place in the school curriculum as it is essential for a better living for the individual. Evidently, most students considered mathematics as a complex subject in all areas, to include trigonometry. Poor student's assessment in trigonometry calls for a need to improve the strategy in the learning process to avoid deterioration. Learning and defining trigonometry concepts as a process was in itself complex and challenging. This observation stemmed from the difficulties encountered while analyzing and distinguishing the properties of various shapes. Mastery of its basic concepts has a significant concern for students. Preliminary researches suggests that students learn best if exposed to interactive application tools and technologies. Improving student achievement calls for an urgent need for an intervention program to ensure its effectiveness.

In India, a study examined the difficulties perceived by the high school students and teachers in learning and teaching mathematics. The factors making mathematics difficult for students to learn included difficulty in remembering the content learned in the previous classes, rapid forgetting of the learned material, and difficulty in understanding of the mathematics concepts. The study concluded that there is a need for teachers to realize the importance of transforming mathematics enjoyable for students to make an effort to learn it (Gafoor & Kurukkan, 2015).

In its national perspective, the Philippines demonstrated lower performance in Mathematics than the other 34 high-performing countries worldwide. In the 2018 Program for International Student Assessment PISA 2018, the Philippines ranked 78th out of 79 participating countries in Mathematics (OECD, 2019). Moreover, the numeracy level of Filipino students could be higher, particularly in embracing abstract concepts, which reflects poor mathematical skills (Magsambol, 2020).

Mangayon National High School is a rural school situated in a rural community as it is located in an interior Barangay of Mangayon, Municipality of Compostela, and Province of Davao de Oro. As such, the introduction of online classes due to the Corona Virus pandemic, opened the door of the increasing use of new devices and methods unto which the school community had to catch up in upgrading technology. The researcher observed the needs of the students to be transformed and be integrated to information' and communications' technology in the teaching and learning process. The students should be exposed to new strategies in all areas of the learning process and the researcher, being a Mathematics Teacher, in mathematics' areas.

This paper's contribution presents the literature on the concepts related using the interactive mathematical applications as a factor on enhancing the students on their math academic performance. A literature review of this study, focuses on the aspects related to the academic concepts relevant to the teaching and learning Mathematics using the Interactive Mathematical Applications.

Mastery of Mathematics. Mastery of mathematics concepts has always been a challenge among teachers, especially since mathematics is one of the subjects that students consider difficult (Reyes, 2019). Moreover, during the pandemic, students and teachers experienced many challenges on the online and distance learning modality, where students struggled learning the competencies in mathematics which affected their mastery in the basic concepts of mathematics (Bringula et al. 2021).

Mastery of a mathematical concept means a learner can use their knowledge of the concept to solve unfamiliar word problems, and undertake complex reasoning, using the appropriate mathematical vocabulary (Verschaffel et al., 2020).

Study revealed that parents cannot contribute much on the mastery of mathematics of their children because of lack knowledge of the lessons of their children (Dulay et al., 2019

The effective mastery of mathematics requires a deep understanding of fundamental concepts and the ability to apply them in various contexts. Students who demonstrated a strong conceptual understanding and were able to apply their knowledge to real-life situations showed higher levels of mastery. This highlights the importance of developing students' conceptual understanding and providing them with opportunities to apply their mathematical knowledge in meaningful ways.

In addition to conceptual understanding, metacognitive skills play a crucial role in the mastery of mathematics. Metacognition refers to the ability to think about one's own thinking and learning processes. Students who possess strong metacognitive skills are more likely to monitor their understanding, identify areas of difficulty, and employ effective learning strategies.

The development of mathematical mastery is a dynamic and continuous process that requires ongoing assessment and feedback. In a study conducted in the United Kingdom, researchers found that regular formative assessment and timely feedback significantly contributed to students' mathematical mastery (Black & Wiliam, 2018). Formative assessment involves gathering information about students' understanding throughout the learning process, while feedback provides specific guidance on how to improve. By incorporating regular assessment and feedback practices into their instruction, teachers can identify students' misconceptions or areas of weakness and provide targeted support to help them master mathematical concepts more effectively.

The integration of interactive mathematical applications has shown promise in enhancing students' mastery of mathematics. Research conducted by Huang et al. (2018) explored the use of interactive mobile applications in mathematics education and found that students who engaged with these applications showed significant improvement in their understanding and retention of mathematical concepts.

The effective mastery of mathematics requires a deep understanding of fundamental concepts and the ability to apply them in various contexts. In a study conducted in South Africa, researchers found that students' mastery of mathematics was influenced by their conceptual understanding and problem-solving skills (Mthethwa et al., 2017). Students who demonstrated a strong conceptual understanding and were able to apply their knowledge to real-life situations showed higher levels of mastery. This highlights the importance of developing students' conceptual understanding and providing them with opportunities to apply their mathematical knowledge in meaningful ways.

In addition to conceptual understanding, metacognitive skills play a crucial role in the mastery of mathematics. Metacognition refers to the ability to think about one's own thinking and learning processes. Students who possess strong metacognitive skills are more likely to monitor their understanding, identify areas of difficulty, and employ effective learning strategies. A study conducted in the United States found that students who were trained in metacognitive strategies showed significant improvement in their mathematical mastery (Schoenfeld, 2016). This suggests that explicitly teaching students metacognitive skills can enhance their ability to master mathematical concepts.

Effective technology integration in mathematics education goes beyond simply using digital tools. Teachers need to be knowledgeable and skilled in utilizing technology to support mathematical thinking and learning. In a study by Leatham et al. (2017), it was found that teacher professional development programs focused on technology integration helped teachers develop a deeper understanding of how technology can enhance mathematical practices and instructional strategies. The study also emphasized the importance of ongoing support and collaboration among teachers to share best practices and overcome challenges in implementing technology in the mathematics classroom. Therefore, providing teachers with the necessary training and support is crucial in promoting the effective integration of technology in mathematics education.

The researchers suggested that technology should be used to create authentic and meaningful mathematical tasks that allow students to explore, conjecture, and justify their mathematical reasoning. Therefore, the integration of technology should be thoughtfully planned and implemented to ensure its effectiveness in supporting students' mathematical learning.

The popularity of mobile devices and widespread adoption of e-learning or mobile learning provides them the required push. Technology has influenced almost everything in the world for the past few decades. In the past, education was only associated with money. With time, things have changed, and there has been an innovation in the education system worldwide. The world has witnessed a revolutionary way to impart education. This system of education has changed with the invention of mobile educational apps. It has accommodated a new pattern of learning. The students today are fully equipped with an enhanced understanding of their subject. Educational apps are interactive and helpful in improving productivity to attract students to studies. Mobile apps give us access to infinite information and data. This digital technology has revolutionized the education system (Handal et al., 2013; Skillen, 2015; Friedl et al., 2020).

The interactive multimedia educational application applies the cognitive learning objectives through technology with a robust theoretical underpinning. Teachers and educators should be able to use this interactive application to introduce many mathematical concepts relevant to their classroom and curriculum. It improves educational quality by affording more opportunities to develop higher-order thinking skills (Kurbanova, 2023).

The integration of interactive mathematical applications has become increasingly prominent in education, particularly with the rise of mobile devices and e-learning. Educational apps offer a revolutionary approach to learning, providing students with enhanced subject understanding and interactive experiences. These apps have the potential to improve productivity and attract students to their studies by offering access to infinite information and data. They have transformed the education system by providing a new pattern of learning that accommodates individual needs and preferences. Numerous studies have highlighted the positive impact of educational apps on student engagement and learning outcomes (Handal et al., 2013; Skillen, 2015; Friedl et al., 2020).

Interactive multimedia educational applications have demonstrated their effectiveness in supporting cognitive learning objectives and enhancing educational quality. Teachers can leverage these applications to introduce various mathematical concepts relevant to their curriculum, fostering the development of higher-order thinking skills. Dynamic geometry and computer algebra systems have been particularly effective in improving students' skills in geometry, abstract algebra, and calculus. These tools enable visualization of mathematical

concepts, promote creativity, and facilitate a deeper understanding of fundamental ideas in mathematics (Kurbanova, 2023; Villa-Ochoa & Suarez-Tellez, 2021).

In the Philippines, the K to 12 Curriculum of the Department of Education (DepEd) recognizes that calculators, computers, smartphones, tablets, and PCs can be appropriate tools in teaching mathematics. These can help learners demonstrate understanding and appreciation of key concepts and principles of mathematics as applied in problem-solving, communicating, reasoning, and making connections, representations, and decisions in real life. However, the COVID-19 pandemic has changed education. It has resulted in schools shutting down all across the world. Globally, over 1.2 billion children are out of the classroom. While countries are at different points in their COVID-19 infection rates, with this sudden shift away from school in many parts of the globe, some are wondering whether the adoption of online learning will continue to persist post-pandemic and how such a shift would impact the worldwide education market (Dayagbil et al., 2021)

The survival in the COVID world impels us to stretch our thoughts beyond the common imagination and penetrate in the future and as Oliver Wendell Holmes Jr. quoted, these thoughts may never return to its original dimension. COVID-19 pandemic has reconditioned the whole digital space and has compelled people, policy makers and organizations to transform their 'Ways of Working and Thinking'. Educational institutions globally are undergoing transformation to partner with technology more than ever before, to impart knowledge and reach out to students remotely, resulting in online classrooms and virtual teaching. Since public and private schools were closed to protect the health of learners and educators, teaching had to be performed remotely with the use of modular and digital

From the standpoint of the Department of Education, "blended learning" or "hybrid learning" is a fusion of online distance learning and in-person delivery of printed materials to the learners' homes through the barangays for those without internet access to interactive facilities in the comforts of their home. Blended learning is a learning approach that combines traditional face-to-face teaching methods with online-based instructions. Addressing the growing belief that this is an entirely fresh approach, Department cleared that the country has been practicing distance learning for decades (DepEd, 2019).

Additionally, the integration of SLMs (Self-Learning Modules) with the alternative learning delivery modalities (modular, television-based, radio-based instruction, blended, and online) will help DepEd ensure that all learners have access to quality primary education for SY 2020-2021 with face-to-face classes still prohibited due to the public health situation. The SLMs and the other alternative learning delivery modalities are in place to address the needs, concerns, and resources of every learner. They will cover all the bases in ensuring that primary education will be accessible amid the present crisis posed by COVID-19. There are, however, challenges to overcome. Some students without reliable internet access or technology struggle to participate in digital learning (DepEd, 2019).

In the educational field, technological progress is reflected in the development of the so-called information and communication technologies (ICT). These pedagogical events enhance the transformation of the classroom as we know it since they allow for eliminating spatial-temporal barriers and access to a large amount of information with different formats. It has also promoted the improvement of students' motivation, autonomy, involvement, and attitude toward educational content (Nikolopoulou, 2019). Among the pedagogical actions based on ICTs is e-learning, defined as the pedagogical act that takes place online, thanks to the use of the Internet and technological devices, whether mobile or not, with synchronous or asynchronous connection, and from anywhere. Therefore, e-learning, such as interactive applications, becomes a pedagogical tool that facilitates access to learning for society (Baron, 2020).

Thus, interactive Mathematical Applications Access to information through mobile handheld devices has become an everyday experience in personal, social, and working lives. In this new nomadic lifestyle landscape, education must respond to portable devices. Educational institutions must now appropriate personal technologies, the mobile phone, partly due to student demand for mobile access and partially because these tools facilitate interactions that can support educational ends (Kukulska-Hulme, 2021. Researchers point to numerous benefits of mobile education for both learners and education systems nationally and internationally.

The COVID-19 pandemic has accelerated the integration of technology into distance learning, bringing forth various advantages. The K to 12 Curriculum of the Department of Education in the Philippines recognizes the potential of technology, such as calculators, computers, smartphones, tablets, and PCs, in teaching mathematics. These tools can help students demonstrate their understanding and appreciation of mathematical concepts through problem-solving, communication, reasoning, and decision-making in real-life contexts. The pandemic has forced schools to shift to remote learning, leading to the widespread adoption of online classrooms and virtual teaching. This transformation has prompted educational institutions to partner with technology more than ever before to ensure continuity in education (Dayagbil et al., 2021; Aguilar & Torres, 2021).

The Department of Science and Technology (DOST) and the Department of Education (DepEd) in the Philippines have collaborated to introduce the DOST Courseware, an interactive multimedia educational application aimed at improving science and mathematics education. The DOST Courseware, developed in partnership with the DOST-Advanced Science and Technology Institute and in cooperation with DepEd, offers digitized and animated lessons, creating an interactive learning environment for teachers and students. With face-to-face classes prohibited due to the public health situation, the DOST Courseware has been recognized as one of the modalities in the blended learning approach, ensuring accessibility to quality education in the "new normal" (The Department of Science and Technology, 2020).

Blended learning, a combination of online distance learning and in-person delivery of printed materials, has been adopted by the Department of Education in the Philippines as an alternative during the pandemic. This approach aims to address the diverse needs and resources of learners. Self-Learning Modules (SLMs) have been integrated with other alternative learning delivery modalities, including modular, television-based, radio-based instruction, blended, and online methods. The goal is to ensure that primary education remains accessible despite the challenges posed by COVID-19. However, it is crucial to acknowledge that not all students have reliable internet access or technology, which hinders their participation in digital learning (DepEd, 2019).

Traditional Method. Conventional teaching or traditional teaching refers to a method involving instructors and the students interacting face-to-face in the classroom. These instructors initiate discussions in the classroom and focus exclusively on knowing content in textbooks and notes. Students receive the information passively and reiterate the information memorized in the exams. Technology in education is not new in today's classrooms, but many education systems are still limited by conventional teaching and learning methods (Yap, 2016).

Many teachers are still teaching their students in the same manner as to how they were taught and how their teachers were taught, not much progress in terms of the teaching perspectives. Transformation to less conventional teaching methods results is in fear and reluctance from teachers, who find the change challenging and risky (Weart, 2011). Lizada (2011) noted that many lecturers are still using conventional teaching. In conventional teaching classrooms, while the lecturer is explaining and writing on the board, students will copy the same thing onto their notes, daydreaming, and some sleeping. It would be difficult to stop students from copying the notes from the board and at the same time ensured that every student was paying attention in the class because the lecturer was too busy explaining the lecture. Conventional teaching is also limiting the room for more creative thinking and also seldom considering individual differences. It is necessary to realize these limitations in conventional teaching and take a step to move forward.

Information and Communication Technology is playing an active role now in education where it can promote learning through the interactivity feature that exists in it. Technology serves as the mediator to form interactive learning with students' participation (Dreamson, 2019). In Malaysia, the Ministry of Education had implemented the smart school project with the name of Malaysian Smart School Flagship since 1999. In this initiative, it is believed that the teaching and learning process can be reinvented, and the students are well prepared in this current information age. The traditional classroom teaching is transformed into a different setting where Information and Communication Technology (ICT) and multimedia technologies are involved. The role of the teacher is changed from purely providing information to a facilitator where students are encouraged to explore for more information and justify the correctness of the information (Multimedia Super Corridor Malaysia). Another reason for having such a project in Malaysia is that students are growing up in technology. Using the Internet to search for information is not strange to them anymore. Students like to see lecturers develop the teaching materials in presentation software such as Microsoft PowerPoint. The multimedia elements (graphics, animation, sound, video, and text) can attract the students' attention. The use of technology in the classroom has not increased much on the learner-centered practices. It is also noted that when traditional education involves technology, it does not mean that education will automatically take place. Educational institutions need to understand students' learning needs and not focus on technology alone (Ehat, 2009). Therefore, technology is to be treated as part of the learning process but not the process itself. Traditional teaching methods have long been the cornerstone of education, but the emergence of technology in the classroom has prompted a shift in instructional approaches. Research conducted by Zhang and Zhu (2016) highlights that traditional teaching, characterized by face-to-face interactions, often leads to passive learning experiences and limited student engagement. In contrast, innovative teaching methods that incorporate technology have shown promising results in promoting active learning and enhancing student motivation (So and Kim, 2018). As educators embrace technology, they can leverage digital tools and multimedia resources to

create interactive learning environments that cater to students' diverse learning styles and preferences (Wong and Liu, 2019).

The integration of technology in education has gained significant momentum, particularly with the rapid advancement of mobile devices and the widespread availability of internet access. Mobile learning, or m-learning, has emerged as an effective educational approach that enables students to access learning materials anytime and anywhere (Lu and Lei, 2019). The use of educational mobile applications, or apps, has been shown to enhance student engagement and facilitate personalized learning experiences (Kemp and Grieve, 2018). In a study by Seo and Lee (2020), it was found that the integration of mobile apps in mathematics instruction significantly improved students' problem-solving abilities and mathematical achievement. These findings underscore the potential of technology, particularly mobile applications, in transforming traditional teaching practices and improving student outcomes.

The COVID-19 pandemic has accelerated the adoption of technology in education, leading to a significant increase in online and remote learning. As schools worldwide shifted to distance learning models, educators and students faced various challenges in ensuring effective teaching and learning experiences (Hodges et al., 2020). The use of video conferencing tools, learning management systems, and online collaboration platforms became essential in facilitating remote instruction and maintaining instructional continuity (Tanner and Greeno, 2017). Research conducted during the pandemic highlighted the importance of training and support for teachers to effectively integrate technology into their teaching practices (Kimmons et al., 2020). The incorporation of interactive online platforms and digital resources has the potential to enhance student engagement and foster active participation in virtual classrooms (Hashim and Hashim, 2020).

The future of education lies in embracing technology as a catalyst for transformative learning experiences. Teacher professional development programs that focus on technology integration can enhance educators' digital competencies and empower them to create innovative learning environments (López-Meneses et al., 2018). By harnessing the potential of technology, educators can personalize instruction, promote active learning, and foster collaboration among students (Reiser and Dempsey, 2017). These advancements in technology-enhanced instruction have the potential to revolutionize traditional teaching methods and cultivate 21st-century skills essential for students' success in an increasingly digital world.

In conclusion, both traditional and technological teaching methods have their unique strengths in enhancing students' mathematical understanding. Effective teaching should involve a balance between the two, using technology to enhance and complement traditional teaching methods.

2. THEORETICAL FRAMEWORK

The study was anchored on Bruner's Multiple Representations Theory or BMRT (Post & Prediger, 2022). Bruner's concepts centered on cognitive, developmental, and Jerome educational psychology. Bruner's learning method was founded on two modes of human thought: logic-scientific and storytelling. Bruner emphasized that learners would better understand abstract concepts if a differentiated learning technique was created and implemented. The approach emphasized differentiation through representations and three stages of each mode of thought: enactive, iconic, and symbolic.

This theory explains that, when faced with new material, a child goes through three stages of representation and follow the progression from an inactive to an iconic to a symbolic representation. In the enactive stage, the child needs action with materials in order to understand a concept. The iconic level a child creates mental representations of the objects but doesn't manipulate them. Finally, in the symbolic level the child strictly manipulates symbols and does not need to manipulate the objects (Gningue et al., 2022).

The study consisted of the main variables, namely: the independent and the dependent variables. Figure 1 shows the variables of the study. The independent variables were the teaching strategies namely the traditional and experimental methods used in the study. The traditional method utilized the self-learning materials provided by the Department of Education during the pandemic period while the experimental method used the interactive mathematical application instruction as an intervention to the teaching in learning process.

The approach of mathematics software for schools can calculate geometry, algebra, statistics, and trigonometry. The dependent variable was the achievement of the students in Trigonometry in both groups. The

Mathematics' achievements in Trigonometry were the scores garnered from a researcher-made assessment tool administered for the purpose.

Incorporating technology into teaching strategies, especially in mathematics, can significantly improve students' mastery of the subject. Interactive applications and digital tools provide unique opportunities for students to engage in mathematical problem-solving, thus fostering a deeper understanding of the subject (Pepin & Roesken-Winter, 2015).

Moreover, the advent of technology has revolutionized distance learning. It provides students with the flexibility to learn at their own pace and on their own schedule. This is particularly beneficial for students who may not be able to attend traditional face-to-face classes due to geographical or other constraints (Nguyen, 2015).

In conclusion, both traditional and technological teaching methods have their unique strengths in enhancing students' mathematical understanding. Effective teaching should involve a balance between the two, using technology to enhance and complement traditional teaching methods.

Schematic Diagram of the Study

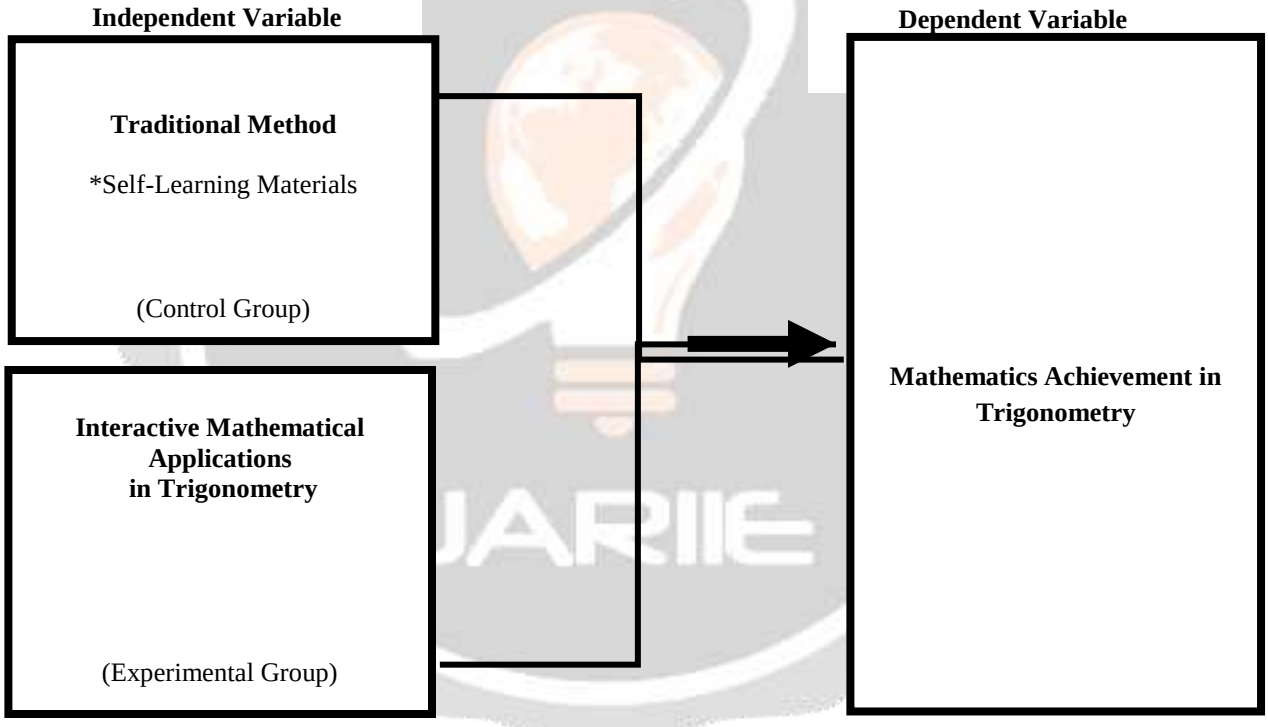

Figure 1. Research Paradigm

3. METHODOLOGY

This study was conducted at Mangayon National High School, where a quasi-experimental design was adopted aiming to establish a cause-effect relationship between an independent and dependent variable (Janssen & Kollar, 2021). Quasi-experimental research involved the manipulation of an independent variable without the random assignment of participants to conditions or orders of conditions. Among the essential types are non-equivalent groups' designs, pre-test-posttest and interrupted time-series designs (Cox, 2019: Da Silva, 2019: Singh ,2021).

The research subjects of this study were the two sections of Grade 9 students. The two sections were subjected to two teaching methods. Section Ruby of Grade 9 was the experimental group, and section Diamond was the control group. Both sections were heterogeneous classes.

The research instrument used for both groups were the learner's self-learner module (SLMs) and a textbook duly approved by the Department of Education. However, the experimental group were given the access to the interactive mathematical applications containing topics aligned with the national curriculum such as Trigonometry mathematics learner's series app and Trigonometry Practice & Prep App.

The pretests and posttest were a researcher-made tests of two (3) modules that utilized multiple-choice types consisting of thirty (10) items per topic and four (4) options for each item. The contents of the test were referred to from a table of specifications (TOS) of the topics covered.
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4. RESULT AND DISCUSSION

Two sections were utilized during the research study to serve as subjects of the experiment conducted. Table 3 shows the distribution of the students enrolled during the academic year 2022-2023 serving as control (traditional) and experimental groups.

The pretest scores of the traditional and experimental groups were also analyzed before the conduct of the experiment. Table 3 shows the results of the comparison of the pretest scores of the groups.

Table 3

Pre-test and Post -test Scores of the Control & Experimental Group

		Pretest		Posttest	
Group	N	$\bar{X}$	SD	$\bar{X}$	SD
Traditional	42	7.8095	2.69813	15.7857	2.15877
Experimental	40	7.8750	2.23248	20.3500	3.34779

The result shows were analyzed before the conduct of the experiment. It can be observed that at the start of the study. This result implied a demand for an immediate intervention that has moved the researcher to adopt Interactive mathematical applications representation as a strategy in teaching Trigonometry to address the learning of

Table 4

Comparative Scores between the Pre-test Scores of the Control and Experimental Groups

F	Sig	T	Dt	Sig(2t)	Finding	Conclusion
0.766	0.384	-0.119	80	0.905	0.905>p=0.05	Accept H_o; Not Significant

As shown in table 4, in the pretest mean of control, 16.9, mean experimental 18.6. P-value is 0.905 greater than .05, this means that there is no significant difference between the pretest scores. It can be concluded that Ho1 is accepted and the two groups were academically equivalent.

This result supports the claim that students need an intervention in learning trigonometry. Literature supported that in the educational field, technological progress is reflected in the development of the so-called information and communication technologies (ICT). These pedagogical events enhance the transformation of the classroom as we know it since they allow for eliminating spatial-temporal barriers and access to a large amount of information with different formats. It has also promoted the improvement of students' motivation, autonomy, involvement, and attitude toward educational content (Pereira et al., 2019: Cabero, 2018; Nikolopoulou, 2019). Among the pedagogical actions based on ICTs is e-learning, defined as the pedagogical act that takes place online, thanks to the use of the Internet and technological devices, whether mobile or not, with synchronous or asynchronous connection, and from anywhere. Therefore, e-learning, such as interactive applications, becomes a pedagogical tool that facilitates access to learning for society (Cole, et al., 2020; Baby et al., 2020).

It can be observed that after applying the study, experimental group which greater than to the score of traditional groups, 15.7857. This can be concluded that students who received experimental treatment outscored the ones who received traditional treatment.

This result is supported by the various researchers who indicated that interactive applications improved learning in mathematics. Pitchford et al. (2018) emphasize that interactive apps delivered on touch-screen tablets can effectively support the acquisition of basic skills in mainstream primary school children. Digital educational interactive applications with sufficient content for children to interact with regularly for months will have the potential for effective learning and development. Therefore, it is important to understand the impact that various technologies may have on children's learning and development (Arnott, 2016).

Table 5

Comparative Scores between the post-test Scores of the Control and Experimental Groups

F	Sig	T	dt	Sig(2t)	Finding	Conclusion
11.427	0.001	-7.373	80	0.000	0.000<p=0.05	Reject H_{o2}; Significant

As shown in Table 5, computed P-value is 0.000 less than .05. This means that there was a significant difference between the pretest scores. It can also be implied that the intervention is effective because the experimental group's post-test is greater than the control group.

With the applied with Interactive mathematical applications representation as a strategy in teaching Trigonometry, it can be reckoned that students, in terms of knowledge, abilities, and understanding, exceed the essential criteria and can convey them naturally and flexibly through real performances in learning trigonometry. The result is similar in the various study conducted. Anggoro et al. (2018) survey created an interactive multimedia-based teaching material to support students in comprehending trigonometry subject matter. This android-based application was developed by defining, designing, developing, and disseminating. Teachers stated that the application was beneficial to the delivered concept of trigonometry, while the students expressed that it helps them understand trigonometry concepts. The result is also corroborated by the study of Mandalina et al. (2019), who developed and produced interactive multimedia for practical and effective mathematical learning. These results show that the learning media is well developed and in the national education application standards.

5. CONCLUSION AND RECOMMENDATION

Summary of the Study

Based on the study's findings, the experimental group's learning of trigonometry has improved. After undergoing the activities, the experimental group showed better results than the control group on the post-test. Hence, the Interactive Applications were more effective than the traditional approach to teaching trigonometry. Hence, the researcher believed that learning using the proper methods and media will positively impact student learning outcomes, primarily supported by technology that is now increasingly developing.

Implications

From the findings and conclusions drawn in this study, the following recommendations are hereby presented: the Interactive application showed that it could yield better results than the traditional approaches. Therefore, policymakers are encouraged to consider the interactive application's applicability at all levels of education; teachers should choose an interactive application designed as attractive as possible and understandable to all users, as well as a broader range of material; Mathematics teachers who teach trigonometry are encouraged to use the interactive application used in this study to enhance student learning; school administrators and arithmetic coordinators must consistently conduct and monitor an effective intervention toward learning trigonometry in the school to help struggling students, especially those who belong to a poor and fair level and; this experimental investigation was carried out at the secondary level in a rural setting. Despite the good results, further research on increasing students' trigonometry should be conducted at all levels and in diverse educational environments.

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