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Harnessing Information Communication Technology for Enhanced Student Engagement and Mathematics Learning Among Grade 7 Students

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Abstract

Harnessing of ICT in education plays an increasingly crucial role in tackling issues related to student engagement and mathematics learning. In spite of increased access to digital tools, there is still a need to critically explore how well ICT is utilized to support Grade 7 learners' learning. This research sought to establish the extent of harnessing of ICT as an instructional approach and its relationship with the level of Grade 7 students' engagement and Mathematics learning at Buenavista I District public secondary school in Bohol Division for school year 2024 to 2025. The researchers employed a descriptive-correlational quantitative research methodology and utilized an adopted questionnaire to gather data on the third-quarter mathematics grades of Grade 7 students. Two hundred eighty-five were randomly chosen through multistage sampling, combining stratified random sampling in one school and total enumeration in the others. Data analysis involved using methods such as percentage, weighted mean, standard deviation, and the Pearson product-moment correlation coefficient. Results indicated that ICT was regularly used for teaching, and this resulted in high levels of both cognitive and behavioral engagement from the students. While ICT enhances students' engagement in and enriches learning experiences, its impact on Mathematics performance remains limited if used solely. The findings reveal that technology does not automatically lead to any improvement in learning unless combined with instructional approaches that can relate the use of ICT to lesson goals. Students were found to engage and perform acceptably, but meaningful improvement requires effective pedagogy coupled with purposeful ICT integration. It is recommended that teachers design lessons that merge ICT tools with clear objectives to ensure technology supports students' mathematical learning.

Keywords— ICT Integration, Mathematics Engagement, Grade 7 Learners, Technology-Enhanced Instruction, Mathematics Achievement.

I. INTRODUCTION

Technology adoption has become increasingly essential in most sectors, especially in education in a world are everything is done fast and online. At a time when digital technologies continue to alter ways people connect, study, and obtain information, it is important to understand how Information and Communication Technology fits into the revolution. According to the Republic Act "the department of information and communications technology act of 2015," filed as 10844, ICT is basically the application of electronic means for doing all various operations on information like creating, accessing, collecting, storing, processing, receiving, transmitting, presenting, and distributing. Integrating digital technologies into teaching and learning is the main goal of ICT in education so that both teaching and learning become better.

Through the use of resources such as educational software, online learning environments, and computer simulations, ICT has made it possible to engage learning in Mathematics instruction by aiding students in problem-solving and performing data analysis. These resources engage and enhance students' learning. For example, through tools like educational software, online learning environments, and computer simulations, ICT facilitates interactive learning in mathematics instruction by enabling students to analyze and solve problems. The above-stated instruments motivate students while they broaden their knowledge. ICT has a huge effect on the students' learning experiences, beginning with their early years. If technology is put in harmony with the traditional learning methods, the result would be an infinite source of mental growth. Besides improving the quality of learning, it also develops creativity and provides learners with the skills that are beyond the classroom. As highlighted by Schmalacker (2025), adopting technology in learning presents us with a whole world of opportunities that improve both learning experiences and results.

This already ongoing academic inquiry is based on the assumption that intentional integration of ICT in mathematics teaching increases student interest and supports improved learning performance. To anchor this pedagogical direction, the Technological Pedagogical and Content Knowledge or TPACK model proposed by Mishra and Koehler (2006) is adopted as a guiding framework. TPACK is based on Shulman's Pedagogical Content Knowledge, which underlined the importance of amalgamating pedagogy with subject matter competence (Shulman, 1986). According to the model, teaching has greater effectiveness when technology, pedagogy, and content knowledge are merged instead of being dealt with separately. Adams (2019) points out that TPACK balances the three domains appropriately and prepares the teacher for providing adequately integrated learning experiences. Zaidi and Hussain (2019) further emphasize that TPACK is necessary in teacher preparation programs, for it equips a prospective teacher to create a dynamic, technology-rich classroom.

The inquiry further reinforces instructional design through the use of the Cognitive Load Theory or CLT put forward by John Sweller (1988), which is rooted in how learners process information within the limits of working memory. Clark and Kimmons (2023) point out that reducing extraneous cognitive load allows learners to concentrate their cognitive efforts on essential learning tasks, which makes instruction more efficient. O'Connor and Domingo (2020) also advise that the closer motivation is to cognitive efficiency, the more meaningful and long-lasting the learning will be from instruction. Shibli and West (2018) agree that the use of CLT can be applied in a variety of settings, adding that well-designed instruction, in accordance with human cognitive architecture, holds strong potential to improve learning outcomes.

Learning perspectives are further supported by Vygotsky's Constructivist Learning Theory, also referred to as Social Constructivism. According to Vygotsky (1978), knowledge is created by interaction, collaboration, and guided participation. ELM Learning (2024) explains that in constructivist learning, students are empowered to take the lead in constructing knowledge for themselves through reflective and active participation. As cited by Hoose (2020), Vygotsky said knowledge is first constructed in the social before it becomes internalized by the learners. Mcleod (2025) suggests that constructivism is a learning paradigm where learners construct knowledge for themselves, rather than being a passive recipient of knowledge. It complements digital media learning experiences.

The incorporation of ICT into the basic education system has also been a big help to national education reforms. The Enhanced Basic Education Act of 2013, otherwise known as Republic Act No. 10533, laid down the foundation for K to 12 curricula by extending basic education and encouraging the use of ICT in all areas of learning for the purpose of improving students' digital literacy and future readiness (Republic

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of the Philippines, 2013). In the same vein, Department Order No. 78 by the Department of Education set up the Computerization Program in 2010 with the aspiration to raise the standard of teaching through learning that is supported by ICT, while at the same time, the access to technology resources was made equal (Department of Education, 2010).

Besides the national measures, the state of the classrooms continues to suggest that even more powerful ICT-led teaching is needed. The mathematics teacher from the research location informs that a lot of the seventh graders do not know the basic arithmetic and this directly impacts their class performance. For example, the Third Quarter Assessment Report in Mathematics for the School Year 2024 to 2025 revealed that only eight-point thirty-three percent of students were rated as Outstanding while twenty-one-point eleven percent were classified as Very Satisfactory. The rest of the majority had their performance graded as Satisfactory and Fairly Satisfactory, which corresponded to thirty-eight-point thirty-three percent and twenty-nine-point forty-four percent of the total learners, respectively, while two-point seventy-eight percent of students were considered not to have the expected proficiency. These numbers show continuous learning gaps and support the request to find out digital-mediated strategies that help in the development of the basic math skills.

Contextual factors also strengthen this need. The school's location is within a community where stable internet access is minimal, but students can still access PisoWiFi, or coin-operated, low-cost wireless connections within the community. Such access would, therefore, show a community-sustained and practical solution that may support ICT-based learning in remote or underserved areas. The availability of PisoWiFi underscores that the potential for localized low-bandwidth technologies increases equitable access to digital learning resources.

In light of these educational and contextual considerations, this academic undertaking determines the extent of ICT integration as an instructional strategy. Furthermore, it looks into its effect on the mathematics engagement and performance of Grade 7 learners in public secondary schools in Buenavista I District, Bohol; in Carcar City Division; in Bantayan District 1, and in the Division of Cebu Province, during the School Year 2024 to 2025. Findings will be used in order to provide an ICT Enhancement Plan, which is an evidence-based intervention that targets improving technology-supported instruction, helps fill in gaps related to fundamental mathematics skills, and enhances learner engagement and academic achievement despite geographical and infrastructural challenges.

II. METHODOLOGY

A descriptive-correlational quantitative approach was employed in the study as the most suitable method for providing a detailed account of the present situation and for simultaneously looking at the interrelationships of variables without assuming any cause-effect relationships (Devi et al., 2022). The study population consisted of 7th-grade pupils from several public secondary schools including one school from the Buenavista I District in Bohol, one from the Carcar City Division, two from the Bantayan District, and one from the entire Cebu province. Stratified random sampling was used in Buenavista I District, Bohol, while total enumeration was applied to the other schools. The data gathering was done using a questionnaire in the form of a closed-ended Likert-type that contained students' demographic profile, ICT integration in teaching-learning mathematics to a certain extent, and students' engagement after ICT integration. ICT integration was measured by ICT Optimization (Nteziryimana & Niyobuhungiro, 2023) and Delivery of Instruction (Arhin et al., 2023), while engagement was adapted from Fitriasari and Abadi's (2019) work. Both the ICT sections and engagement statement used a five-point scale (Always to Never) and (Very High to Very Low) respectively. The reliability of the tool was 0.852 (using Cronbach's alpha), and the content validity was confirmed by two specialists. Additionally, the participants' grades in Mathematics for the Third Quarter were gathered to evaluate learning outcomes.

The data that were collected were processed, organized, and analyzed using the following methods: percentages to depict demographics and grades, weighted mean and standard deviation to quantify the extent of ICT integration and students' engagement, and Pearson-r correlation to investigate the relationships among ICT usage, engagement, and mathematics performance. The weighted mean offered a summary of the students' viewpoints while the standard deviation showed the extent to which the responses differed.

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III. RESULT AND DISCUSSION

This section discussed the analysis and interpretation of the collected data to respond to the research questions on the extent of harnessing of ICT as a teaching strategy and its impact on the engagement and Mathematics learning among Grade 7 learners during the school year 2024–2025. It started with a discussion of the demographic profile of the respondents, such as age and gender, type of ICT tool, and usage frequency, ICT proficiency of teachers, and access to ICT resources. It also discusses how ICT is used by teachers in improving instruction in the form of ICT optimization and delivery. It also assessed students' cognitive and behavioral participation in learning mathematics, as well as their performance. Finally, it examined the substantial relationships between the level of ICT integration, students' participation, and their learning outcomes, with results provided in narrative and tabular formats to provide a clear and extensive understanding of the findings.

3.1. Respondents' Demographic Profile

To put the study's findings in context, it was crucial to understand the profile of the respondents. The demographic profile of the participants, their exposure to ICT, and their interactions with math education were presented in this section. The information was compiled in the tables, which also included interpretive analysis based on relevant educational theories and empirical studies. These profiles provided the background information needed to examine the ways in which ICT affected students' experiences and performance in mathematics classes.

3.5.1. Age and Gender

The distribution of respondents by age and gender was provided in this subsection. Determining the age and gender distribution was crucial to comprehending how demographic factors might have affected how students used ICT to learn mathematics.

Table 1: Age and Gender of the Respondents

Age (in years)	Female		Male		Total	
	f	%	f	%	f	%
14 years old and above	8	2.81	7	2.46	15	5.26
13 years old	98	34.39	107	37.54	205	71.93
12 years old	38	13.33	26	9.12	64	22.46
11 years old	1	0.35	0	0	1	0.35
Total	**145**	**50.88**	**140**	**49.12**	**285**	**100**

The survey results presented in Table 1 give an overview of the demographic characteristics of the participants based on their age and gender. The majority of the respondents are early adolescents aged 13 years, who, in fact, represent the largest portion of the group. The age distribution not only reveals the developmental stage of the respondents as they are going through cognitive, social, and emotional development but also indicates that the school-based behaviors and learning experiences of early adolescents are influenced by their high responsiveness to guidance, structured learning environments, and peer dynamics.

In addition, the slightly larger number of female respondents than male one's points to a very small gender disparity in the sample. This difference is to be considered in the analysis, but it does not mean that the findings are any less relevant to or applicable for both sexes. The sample being balanced still demonstrates that the male and female students are under similar developmental conditions, therefore, they are equally affected by the schools, the social interactions, and the academic pressures. This implies that, academically, when technology is integrated into teaching and learning experiences, it benefits both males and females (Ayite et al., 2022).

3.5.2. Types of ICT Tools Used

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Table 2: Types of ICT Tools Used

ICT Tools Used	f	%
Educational Apps	156	58.33
Simulation	42	41.67
Learning Management Systems (LMS)	81	0
Interactive Boards	6	0
Total	**285**	**100.00**

This part indicated the categories of ICT tools the teacher employs in providing mathematics teaching. The emphasis on these tools gives an insight into the teacher's teaching style and the technology platforms learners receive exposure to during training.

In Table 2, the distribution of ICT tools used by the respondents is shown, which brings to light the technological resources that are commonly integrated into their learning experiences. The results indicate that a considerable number of students use educational applications, which means that app-based tools are still the easiest and most used digital resource in the classroom. This is more likely that the students are using such platforms that are designed to make the learning process interactive and personalized, and the same time, it fits the developmental requirements of early adolescents, who, in fact, have more and more visual, game-like, and self-paced tools. Bouck et al. (2020) state that educational apps are capable of active and performance improvement in mathematics, making it also easy and convenient for the students to get a personalized and accessible learning resource. The presence of simulation tools and learning management systems (LMSs) also points to the wide array of ICT resources made available to the students, which in turn depicts a digital interactive and structured online content delivery environment. This is, indeed, supported by the findings of Rafiq et al. (2023), which pointed out that digital tools not only helped but also empowered students in terms of participation, motivation, and learning outcomes.

The use of various ICT tools such as apps, simulations, LMS, and interactive boards signals that students are receiving the exposure of different ways of technology-enhanced learning. Interactive boards, for instance, are used very rarely but their presence portrays the effort of diversifying instructional methods by means of multimedia and hands-on digital platforms. The schools in this study consider technology integration as a necessity that supports the fulfillment of different learning styles and teaching objectives, which echoes the assertion of Smith (2023) that technology can aid the learning of those students who struggle with math. The knowledge of the types of tools actually used by the students enables the teachers to take well-informed steps regarding the most effective, available, and engaging technologies in supporting not only mathematical learning but also overall academic progress. The data from Table 2, in a nutshell, points out that ICT is increasingly becoming a vital factor in the creation of dynamic, inclusive, and student-centered learning environments.

3.5.3. Frequency of ICT Usage

This refers to how often the teacher uses ICT tools in teaching math. Frequency of use represents how much ICT is used as a normal part in learning-teaching.

Table 3: Frequency of ICT Usage

Frequency	f	%
Daily	95	33.33
Weekly	91	31.93
Occasionally	99	34.74
Total	**285**	**100.00**

The frequency of ICT usage among the respondents is depicted in Table 3, which gives a clear picture of the digital tool's usage by students in learning experiences from the very start up to October 2023. The findings are such that the students exhibit different levels of ICT participation, some of them making it a point to use technology in their studies while other very little. The difference here shows the different digital habits that exist among the students and it also gives a good insight into the engineers' willingness to use the technology supported instruction. It is quite important to stress that the presence of information technology infrastructure does not alone determine the extent of technology use in the classroom (Szyszka et al., 2022), which means that students' patterns of usage are influenced not only by the access but also by the teaching practices, motivation, and the learning environment.

A big part of the respondents along with the teachers are the most active and consistent ICT users that points out to the fact that a majority of the students have already been acquainted with the use of digital tools in their academic work. The engagement

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of the respondents with ICT in such a manner is advantageous, for the reason that the regular interaction with ICT will result in the polishing of the skills which are normally utilized in the interactive and technology-enhanced learning. Mathematics, for instance, when treated this way will lead to the development of problem-solving skills, better understanding of the concept and fostering of independent learning attitudes. Moreover, Ihieonyemolor (2022) emphasizes that students' learning across the curriculum can be positively affected by technology if it becomes part of their daily routine, thus reinforcing the claim that consistent digital engagement can enhance learners' interest and overall academic participation.

However, an interesting group seemed to be the students who used ICT occasionally. This shows there is a difference in access, motivation, or exposure to technology. This group reflects different levels of readiness, though it does not negate the importance of integrating ICT within instructional strategies and practices. What it does indicate is that the pedagogical strategies must be inclusive to ensure that all students, irrespective of their frequency of digital exposure, can benefit from what technology offers. This supports the argument that one of the key principles of ICT is that it should be an equitable resource that enhances participation and learning within diverse student groups.

Through these usage profiles, the research acquires sharper insight into exactly how ICT might be used to support learning of mathematics. Precisely because of these different levels of use, careful attention to the design of learning environments is needed for frequent and casual users alike. Overall, findings reinforce the value of strategic integration of ICT into the teaching of mathematics, ensuring that students at all levels of digital engagement can enrich their learning experiences and achieve meaningful academic growth.

3.5.4. Teacher's Proficiency in ICT

This is the teacher's competence in employing ICT to facilitate instruction, given that digital literacy is critical in effective technology integration in the classroom.

Teachers were evaluated by students using observable metrics like use of digital tools for instruction, multimedia integration, management of online platforms, digital assessment, and instilling responsible use of technology. Students used a three-point scale: Developing, Proficient, and Advanced, in assigning ratings to reflect their classroom observations and experiences.

Table 4: Teacher's Proficiency in ICT

Teacher's Proficiency	f	%
Advanced	113	39.65
Proficient	159	55.79
Developing	13	4.56
Total	**285**	**100.00**

The table 4 further indicates that the majority of the teachers lie within the proficient category, meaning a large proportion of the teaching force can use technology to support instruction and classroom tasks appropriately. A significant proportion of the teachers have attained advanced skills in ICT; this means that they are highly capable of using digital tools, integrating innovative strategies, and navigating more complex technological tasks with confidence. According to Hero (2020), such teachers would be well-prepared and open to the principles of ICT integration and would show high levels of ICT integration that are positively related to their instructional practices.

Although the general ICT capacity is very strong, there are still some weaknesses in the skills of a few teachers, pointing to targeted support and training. According to the IIEP Learning Portal (2023), the impact of information communication technology on learner outcomes will be determined by teachers' digital competence and how effectively they integrate technology into the curriculum. As such, Mahlo and Waghid (2023) recommend that comprehensive and yearly professional development programs be mandated for both new and experienced teachers to ensure that all faculty members are capable of continuously developing their ICT skills and effectively applying technology in teaching.

3.5.5. Accessibility to ICT Resources

This section described the availability of ICT resources to teachers, such as devices and access to the internet. Availability is central in informing the viability and consistency of ICT-informed pedagogies.

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Table 5: Accessibility to ICT Resources

Accessibility	f	Rank
Availability of Devices	155	1
Internet Connectivity	152	2

*Multiple Response

Table 5 shows the accessibility of ICT resources among the teachers. It indicates that the availability of devices is the most accessible ICT resource, suggesting that teachers generally possess the hardware necessary to support their teaching activities and integrate technology into their classrooms. Following closely, in that regard, is access to the internet; it is highly accessible, which will suggest that teachers are largely able to connect to online platforms and digital resources to facilitate instruction. Generally speaking, the overall data show that faculty have significant access to the basic ICT resources that would support effective technology integration in teaching and learning. This supports the perspective of the ISTE Standards Team (2023), which stresses that schools and districts better positioned to narrow gaps in student opportunities provide equitable access to devices, connectivity, and capable teachers.

3.2. Extent of Harnessing of ICT In enhancing Mathematics 7 Instruction

ICT has changed the landscape of contemporary education by offering new tools that improve both teaching and learning processes. In Mathematics 7, the proper application of ICT facilitates visual learning, interactivity, and student-centered engagement. To measure the extent of the harnessing of ICT, this study analyzed two broad categories: ICT Optimization and Delivery of Instruction. Results are shown and discussed in the tables.

3.2.1. ICT Optimization

ICT Optimization is the optimal application of digital technologies and facilities e.g., the internet, projectors, computers, and smart classrooms facilitating and enhancing teaching and learning in mathematics. This area assesses the usage and usefulness of these technologies in enhancing students' learning and performance.

Table 6: Extent of the harnessing of ICT as an instructional strategy in enhancing the teaching-learning in Mathematics 7 in terms of ICT Optimization

S/N	Indicators	WM	SD	Verbal Description
1	"The use of the internet in learning Mathematics helps me understand how Mathematics questions are set and solved."	3.99	0.83	Often
2	"The use of social media platforms like YouTube by my teacher enhances my learning and performance in Mathematics."	3.73	0.98	Often
3	"The use of a projector in Mathematics lessons improves my understanding of the subject."	3.95	1.02	Often
4	"The use of computers in learning Mathematics enhances my performance in the subject."	3.69	0.97	Often
5	"The use of a smart classroom in learning Mathematics improves my understanding of the lessons."	3.70	1.08	Often
	Aggregate Weighted Mean	**3.81**		**Often**
	Aggregate Standard Deviation		**0.97**	

Legend: "4.21-5.00-Always; 3.41-4.20-Often; 2.61-3.40-Sometimes; 1.81-2.60-Rarely; 1.00-1.80-Never"

Table 6 showed that the integration of ICT as an instructional strategy in Mathematics 7 is experienced by students often. For Item 1, the use of the internet for learning Mathematics, indeed shows that students often rely on online resources providing explanations, examples, and interactive content to help them understand mathematical concepts. Due to this electronic access to information, learners can try several ways of solving a problem, thereby facilitating more independent and self-paced learning. Also, Item

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3, the use of projectors in lessons in Mathematics, shows a level of regular application. The projector helps teachers demonstrate visually and show the steps towards the solution in problem-solving to make abstract and complex concepts easily understood. This corroborates what Sarker et al. (2019) said: "Integration of technology into the teaching-learning process may effectively enhance the development of both learners and educators for better educational outcomes."

In addition, Item 2 points out the use of social media platforms, such as YouTube, as supplementary tools in learning mathematics. While these tools are not part of the formal curriculum in the traditional classroom setting, they offer alternative explanations and additional examples that enhance understanding for students. Their easy access and familiarity especially aid visual and auditory learners who learn well from frequent exposure to video content. Furthermore, Item 5 points out smart classroom technology, suggesting that some students may experience digitally enhanced learning environments. Variations in exposure to this tool could be affected by the availability of facilities and teacher readiness to implement advanced ICT-supported instruction. Item 4, on the use of computers to learn Mathematics, also forms part of students' experiences with ICT in offering digital exercises, simulations, and other computer-assisted learning activities that promote interest and support the development of skills.

Overall, the results yield the verbal description "Often," meaning that ICT is regularly integrated into the teaching and learning of Mathematics 7. This consistent use of ICT tools manifests a continuing effort in making mathematics instruction more interesting, relevant, and responsive to diverse learning needs. It supports the position of the Department of Education–Teacher Education Council (2020) that "the integration of ICT in enhancing the teaching and learning process widens the concept of delivering effective and meaningful education." Corroborating the same assertion, Abdullahi and Sirajo (2022) stress that successful utilization of ICT encourages more learner-centered practices and influences the teaching and learning of mathematics positively.

3.2.2. Delivery of Instruction

Delivery of Instruction describes the manner in which ICT tools are used in the actual process of teaching. It highlights the operational role of ICT in supporting student participation, the development of cognitive abilities, collaboration, and student-centered learning. This area concerns how ICT influences the quality and efficiency of lesson delivery.

Table 7: Extent of the harnessing of ICT as an instructional strategy in enhancing the teaching-learning in Mathematics 7 in terms of Delivery of Instruction

S/N	Indicators	WM	SD	Verbal Description
1	"Integrating ICT tools in Mathematics instruction helps students develop critical thinking skills."	3.96	0.77	Often
2	"ICT tools provide opportunities for collaborative learning in Mathematics classes."	3.92	0.89	Often
3	"The use of ICT tools in Mathematics instruction enhances students problem-solving skills."	3.84	0.92	Often
4	"Integrating ICT tools in teaching Mathematics facilitates students-centered learning."	3.71	1.01	Often
5	"ICT tools improve students' engagement and motivation in Mathematics classes."	3.88	0.99	Often
	Aggregate Weighted Mean	**3.86**		**Often**
	Aggregate Standard Deviation		**0.91**	

Legend: "4.21-5.00-Always; 3.41-4.20-Often; 2.61-3.40-Sometimes; 1.81-2.60-Rarely; 1.00-1.80-Never"

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Table 7 reveals that the integration of ICT is an instructional strategy applied to students when delivering Mathematics 7 instruction. Item 1 refers to developing critical thinking through the integration of ICT tools; thus, technology-supported instruction is used to enhance the depth of analysis by the students through digital resources, which expose learners to different contexts of problems in order to apply logical reasoning and evaluation. Similarly, Item 2 reports the integration of ICT into providing opportunities for collaborative learning, which suggests that students can interact, share ideas, and work on solving tasks together through digital platforms. Such an observation by Ascione (2023) points out that technology gives students control over their learning and increases opportunities for students' self-directed and personalized learning.

Item 3 shows that the application of ICT tools enhances students' problem-solving skills. Digital applications and interactive tasks enable students to explore mathematical procedures, test strategies, and analyze solutions in real time, thereby permitting learners to become more confident when addressing complex problems. The use of ICT tools in item 4 is meant to enhance student-centered learning, giving space for learners to investigate the content, make decisions during learning tasks, and take more active roles when constructing mathematical understanding. Item 5 identifies that ICT tools improve students' engagement and motivation in Mathematics classes because an interactive instructional material provokes participation and maintains learner's interests. According to Carstens et al. (2020), the use of technology increases student willingness and participation, which eventually leads to improved learning outcomes. Teachers have to consider effective incorporation of technologies into their practice for developing and creating learner-centered interactive environment and building students' technological understandings and skills, GEM Report, 2024 stated.

Altogether, the results provide the verbal description "Often," which means that ICT is consistently used in the delivery of Mathematics 7 instruction. The integration of ICT-supported approaches consistently shows an effort to make mathematics learning more meaningful, interactive, and responsive to a wide range of learning needs. Sumile and Lozano (2025) support this study in terms of emphasizing that ICT-enhanced tools improve instructional quality and facilitate interactive learning environments that are necessary for the development of digital literacy and collaboration competencies of both educators and learners.

Table 8 illustrated the degree to which ICT is utilized as an instructional method in the instruction of Mathematics 7, synthesizing the results in the fields of ICT Optimization and Delivery of Instruction.

Table 8: Summary on the Extent of the harnessing of ICT as an instructional strategy in enhancing the teaching-learning in Mathematics 7

Components	WM	SD	Verbal Description
ICT Optimization	3.81	0.97	Often
Delivery of Instruction	3.86	0.91	Often
Grand Mean	**3.84**		**Often**
Grand Standard Deviation		**0.94**	

This is evidenced in Table 8, which shows the degree to which ICT is utilized as an instructional strategy in teaching Mathematics 7. As represented in the table, it can be observed that teachers frequently use ICT in their instruction, making technology a clear part of lesson preparation and delivery. This supports the idea of Korenova et al. (2024) that ICT indeed helps teachers present mathematical concepts much more clearly. Indeed, Korenova et al. state that digital technologies extend mathematics learning by making concepts more accessible and easier to comprehend by effective visualization, which corresponds with how the teachers in this study also used ICT in order to enhance understanding.

Moreover, the consistency of describing the frequency of utilization of ICT as "often" implies that it is actively and meaningfully used to enhance instructional delivery and classroom interaction. This suggests the wider perspective that ICT enhances teaching practices. Asare et al. (2023) further support the finding when they state that applying information, communication, and technology in teaching mathematics enhances instructional delivery and results in better student performance. Such benefits are seen with the integration of ICT into Mathematics 7.

Overall, the findings indicate that the degree to which ICT is harnessed as an instructional strategy is appropriate and high. Teachers have a unified and consistent focus on the use of technology, indicating its central role in facilitating interactive, comprehensible, and enriched learning experiences for Mathematics 7. Rizki et al. (2024) go further and highlight that

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integrating ICT can help implement improvements in teaching, improve work-based employment competencies, and offer equal educational opportunities in remote areas, which underscores the broader value of ICT in supporting an equitable and future-focused education system.

3.3. Level of Engagement of the Respondents in Learning Mathematics

This section examined the level of respondents' behavioral and cognitive engagement in learning mathematics using technology. The level of engagement is determined through indicators of enthusiasm, activity, interest, and cognitive effort, as shown in Tables 10 and 11.

3.3.1. Behavioral Engagement

Behavioral engagement refers to the observable actions and behaviors of students that are seen while learning. It includes class participation, interest, and effort to complete tasks. For education technology use purposes, behavioral engagement is particularly important. Technology tends to make learning more interactive, dynamic, and fun, hence stimulating learners to engage actively. Through their passion for learning, learners are more inclined to put in effort and time, which leads to enhanced academic performance. Technology has been found to increase learners' motivation and interest, resulting in greater engagement as well as a more active learning strategy.

Table 9: Level of Engagement of the Respondents in Learning Mathematics in terms of Behavioral Engagement

S/N	Indicators	WM	SD	Verbal Description
1	"I am glad to learn Math with the help of technology."	4.00	0.84	High
2	"I am eager to follow the process of learning Math with the help of technology."	3.77	0.88	High
3	"I feel more active during the process of learning Math with the help of technology."	3.71	0.94	High
4	"I am fond of learning mathematics with the help of technology or media upon learning mathematics."	3.57	0.88	High
5	"I am more enthusiastic to learn Math with the help of technology."	3.83	0.99	High
	Aggregate Weighted Mean	**3.77**		**High**
	Aggregate Standard Deviation		**0.90**	

Legend: "4.21-5.00-Very High; 3.41-4.20-High; 2.61-3.40-Moderate; 1.81-2.60-Low; 1.00-1.80-Very Low"

Table 9 showed that the respondents are highly behaviorally engaged in learning mathematics with technology. Items 1 and 2 refer to students' active participation in learning activities, whereas item 3 reflects students' feeling more involved and attentive in lessons with technology. Item 4 indicated that students apply technological tools consistently to support learning, while item 5 shows students enjoy learning mathematics with technology and develop a positive attitude toward learning the subject. These results mean that technology significantly promotes behavioral engagement, allowing students to enjoy a more interactive and dynamic learning process. Previous research confirms this, showing that technology enhances participative activities and maintains the engagement of learners over a certain period of time. According to David and Weinstein (2023), "technology use in the classroom can make learning more interactive, engaging, and fun for students," which corroborates the results that technology enhances behavioral engagement in mathematics.

Accessibility and ease in using technological tools make it easier for students to be fully involved and maintain focus on the learning tasks. Further, interactivity and personalization provided by technology enable students to work at their own pace while remaining engaged in class activities. According to Bowman (2025), "interactive technologies are a good medium to provide passive learning moments with active participation opportunities," therefore confirming that technology enhances behavioral engagement and transforms traditional passive lessons into a participatory experience.

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Overall, the results indicated that learning mathematics with the use of technology enhances high behavioral engagement on the part of the students through active participation, motivation, and sustained engagement in learning. This again emphasizes how using technology can significantly improve student engagement and learning outcomes. Supporting this assertion, Kalyani (2024) points out that "the convergence of personalized learning paths and interactive learning supports through technology has had a positive effect on student engagement and critical thinking skills," confirming that technology enhances not just behavioral engagement but also strengthens students' capacity for critical thinking and independent problem-solving.

Cognitive engagement is the mental effort, intellectual investment, and concentration that learners bring to their learning activities. It entails serious thinking about the content, problem-solving strategies, and the intention to comprehend the subject meaningfully. Cognitive engagement is important because it leads to enhanced learning results. When students are cognitively engaged, they will tend to critique and relate information more critically and find it easier to retain knowledge and use concepts. Technology contributes to promoting cognitive engagement through presenting tools that encourage active learning, offering tailored learning experiences, and giving instant feedback, which allows the learner to interact more intensely with the materials.

3.3.2. Cognitive Engagement

Table 10: Level of Engagement of the Respondents in Learning Mathematics in terms of Cognitive Engagement

S/N	Indicators	WM	SD	Verbal Description
1	"I pay more attention to the subject matter of mathematics during the learning process with the help of technology."	3.89	0.84	High
2	"I find learning math with the help of technology easier to understand."	3.89	0.92	High
3	"I asked questions that I did not understand when learning Mathematics with the help of technology."	3.84	0.89	Very High
4	"I will get a loss if I do not follow the process of learning Math with the help of Technology."	3.49	0.94	Moderate
5	"I would like to increase the achievement on Math subjects after studying Mathematics with the help of technology."	3.82	0.98	High
	Aggregate Weighted Mean	**3.78**		**High**
	Aggregate Standard Deviation		**0.91**	

Legend: "4.21-5.00-Very High; 3.41-4.20-High; 2.61-3.40-Moderate; 1.81-2.60-Low; 1.00-1.80-Very Low"

Table 10 showed that, with the use of technology, the respondents are more cognitively involved in learning mathematics. Students exhibit great mental engagement with the mathematical contents, as evidenced by item 1, which revealed that they paid closer attention to the subject matter when technology was used during lessons. It also means that they participated in thinking and processing information more. Students find mathematics easier to understand with the help of technology, as reflected in item 2, suggesting that digital tools make things clear and simplify concepts which, if left on their own, may not be that easy to understand. This corroborates Ascione's (2023) observation that "virtual simulations, educational games, and multimedia presentations hold students' attention and make complex concepts both more available and enjoyable," which is similar to what these learners have experienced in technology making math more understandable and enjoyable.

Item 3 reveals that with the use of technology, students do ask more questions when they are on topics that they do not fully understand. This means that with digital tools, inquiry is foregrounded and deeper thinking about the ideas in mathematics is facilitated, which generates more

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meaningful cognitive engagement. Furthermore, Mejia and Sargent (2023) highlighted that "the use of technology tools enables the construction of students' critical thinking skills," maintaining that technology enhances analytical processing and reinforces reasoning skills for students. Although item 4 reflects that some students may not always go through the complete learning process with technology, this does not take away their overall cognitive involvement in what they are learning. Students also want to improve their performance in mathematics through technology, as seen in item 5, reflecting a need to improve their understanding and achievement. These conclusions illustrate that technology enhances cognitive engagement by making learning more interactive, logical in thinking, and problem-solving. Angelianawati et al. (2024) affirm this when they say that "integration of technology into learning models significantly contributes to the cultivation of critical thinking skills," confirming that technology deepens intellectual engagement and supports richer learning experiences.

In summary, the integration of technology in mathematics enables students to engage more deeply with the content, enhance their thinking skills, and reinforce knowledge of the subject. This agrees with Cohen and Kalthoff's (2021) assertion that "technology plays a positive role in children's learning and development" and, thus, presents an invaluable contribution to cognitive development and school achievement.

Table 12 presented an overview of the respondents' level of engagement in learning mathematics through technology.

Table 11: Summary on the Level of Engagement of the Respondents in Learning Mathematics

Components	WM	SD	Verbal Description
Behavioral Engagement	3.82	0.85	High
Cognitive Engagement	3.77	0.94	High
Grand Mean	**3.80**		**High**
Grand Standard Deviation		**0.90**	

Table 11 presents the summary of the respondents' engagement in learning mathematics, revealing that both behavioral and cognitive engagement are present at strong levels. The results indicate that students actively participate in learning activities and maintain focus when technology is incorporated into their mathematics lessons. The behavioral aspect suggests that learners demonstrate consistent effort, involvement, and willingness to participate in class tasks. This shows that technology-supported learning environments encourage students to take part in various learning processes, allowing them to stay attentive and motivated.

Similarly, cognitive engagement also appears at a strong level, indicating that students mentally invest in understanding mathematical concepts when technology is used. This involves processing information, asking questions, and applying logical thinking, which shows that technology enhances their analytical involvement. When combined, the results demonstrate that students not only participate behaviorally but also think deeply about the lessons, indicating a balanced form of engagement. The overall mean likewise reflects this pattern, implying that technology-supported mathematics instruction fosters an environment where students are both active and thoughtful learners.

Overall, the findings suggest that technology contributes meaningfully to students' engagement by stimulating both their actions and their thinking processes. Furthermore, Quijano et al. (2025) found that high behavioral and cognitive engagement contributed significantly to improved academic outcomes, especially in challenging subjects such as mathematics. This balanced form of engagement is essential for improving comprehension, sustaining interest, and encouraging meaningful participation in mathematics learning. The results emphasize the importance of integrating technology to create learning experiences that support student involvement, enhance understanding, and promote more effective academic performance.

3.4. Level of Mathematics Learning of the Respondents

This part introduced the respondents' Mathematics learning that serves as a foundation for assessing their learning results. Students' learning can be analyzed to determine relations between their achievement levels and other factors like ICT utilization, attitude, and demographic factors.

Table 12: Level of Mathematics Learning of the Respondents

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Level	Numerical Range	f	%
"Outstanding"	90-100	53	18.59
"Very Satisfactory"	85-89	63	22.11
"Satisfactory"	80-84	97	34.04
"Fairly Satisfactory"	75-79	67	23.51
"Did not Meet the Expectations"	below 75	5	1.75
Total		**60**	**100.00**
Mean			83.37
Standard Deviation			5.25

Table 13 shows the overall Mathematics learning competencies as evidenced by the performance classification of the respondents. The frequency distribution indicates that most learners belong to the satisfactory range, meaning they generally meet the expected competencies in Mathematics 7. A quite substantial number also perform at the very satisfactory and outstanding levels, depicting good mastery and an ability to apply mathematical concepts with confidence. Meanwhile, a group falls into a fairly satisfactory classification, which suggests that they meet the minimum requirements yet merit supplementary reinforcement. Only a very small portion of students did not meet expectations, indicating that only a few experiences notable difficulties in mathematics.

The average performance is matched with the satisfactory level since the typical learner demonstrates expectations of mathematical proficiency at the grade level. The variation in performance is modest, suggesting that though differences among learners exist, these are not large enough to show wide gaps in mathematical understanding. Overall, the findings suggest that the Grade 7 students generally perform within or above the expected proficiency level, with many showing commendable achievement and only a few requiring targeted supports. This agrees with Andamon and Tan (2018), who pointed out that in Mathematics, students' learning predominantly ranges in "approaching to proficiency," highlighting a moderate level.

3.5. Test of Significant Relationships Between ICT Harnessing, Student Engagement, and Mathematics Learning

This part examined the potential associations between principal variables in the study: ICT harnessing, students' engagement, and Mathematics learning. In order to establish if statistically significant relationships exist between these variables, three inferential analyses were done. The tests sought to reveal whether ICT integration directly or indirectly influences student learning outcomes and engagement. Findings are discussed and interpreted below.

3.5.1. Extent of ICT Harnessing of the Respondents' Teachers and their Mathematics Learning

This topic dealt with whether a substantial relationship can be found between the extent of ICT harnessing of the Respondents' Teachers and their Mathematics learning. It is crucial to study this relationship in order to establish if ICT usage affects quantifiable student performance.

Table 13: Test of relationship between the extent of ICT Harnessing of the Respondents' Teachers and their Mathematics Learning

Variables	r-value	Strength of Correlation	p - value	Decision	Remarks
ICT Harnessing and Academic Performance in Mathematics	0.330*	Weak Positive	<0.0001	reject Ho	Significant

*significant at p<0.05 (two-tailed)

Table 13 shows the relationship between optimization of ICT by teachers and students' academic performance in Mathematics. The computed correlation coefficient r = 0.330 shows a weak positive correlation, meaning that the higher the rate at which teachers harness ICT in their teaching, the better the students' performances in Mathematics tend to improve, although not strongly. The p-value is less than 0.0001, far below the significance threshold of 0.05. Hence, the null hypothesis Ho is rejected, implying that the correlation is statistically significant.

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Although the correlation is weak in strength, it is statistically significant, which means that effective use of ICT by teachers has a meaningful, yet at the same time modest, positive association with students' mathematics performance. This points out that, though the impact may be modest, effective integration of ICT in teaching contributes meaningfully to an improvement in students' academic outcomes, which places value on it as a supportive tool in enhancing learning. This further corroborates the findings of Pimentel et al. (2024), who establish that the use of ICT in teaching positively impacted students' mathematical achievement in which most of them surpassed expectations and showed mastery of competencies, and Ben Youssef et al. (2022), who establish that creative ICT use and well-developed digital skills are contributing factors to better academic performance.

3.5.2. Extent of Harnessing of ICT of the Respondents' Teachers and their Engagement in Learning Mathematics

In this section, the relationship between the extent of harnessing of ICT and respondents' engagement in learning Mathematics was brought into discussion. It endeavore to assess whether ICT tool use will increase student interest, involvement, and engagement in math activities.

Table 14: Test of relationship between the extent of Harnessing of ICT of the Respondents' Teachers and their Engagement in Learning Mathematics

Variables	r-value	Strength of Correlation	p - value	Decision	Remarks
Harnessing of ICT and Engagement	0.691*	Moderate Positive	<0.0001	Reject Ho	Significant

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

Table 14 presents the correlation analysis on the relationship between optimization of ICT by teachers and student engagement in Mathematics. The correlation value indicates a moderate positive correlation, $r = 0.691$, signifying that the more ICT is utilized by teachers, the more students are engaged in learning Mathematics. The correlation is significant, meaning that there exists a meaningful and substantial relationship between these two variables.

The p-value of less than 0.0001 is well below the typical significance threshold of 0.05, indicating the rejection of the null hypothesis Ho. This statistical result thus provides strong evidence that an effective use of ICT by teachers is significantly associated with higher levels of student engagement in Mathematics. The moderate strength of this relationship does indicate the potential of ICT to enhance the participation and interest of students in mathematics learning.

These findings point to the need to use ICT methods in teaching practices to increase the level of students' engagement. When used properly, ICT can act as a driver for engagement in student participation in learning by making the learning process more interactive and hence interesting. As Irakarama et al. (2024) asserted, ICT gadgets highly engage both teachers and learners in various learning activities; such gadgets allow learners to engage in mathematical concepts for the discovery of new concepts. Interactive technologies, multimedia resources, and virtual learning environments enhance learning by representing abstract mathematical ideas in more concrete and accessible ways.

Thus, the findings confirm the value of leveraging ICT as an essential learning strategy to promote engagement and enhance the learning experience in Mathematics. According to the study by Indra et al. (2019), the use of technology in teaching involves considerable possibilities to foster students' willingness to learn, especially through blended learning approaches, and to increase further engagement within higher education.

3.5.1. Respondents' Engagement and Mathematics Learning

This part examined the interaction between the academic performance of respondents and their engagement. This analysis tried to check whether learning activities to which the students actively engage contribute to better academic performance.

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Table 15: Respondents' Engagement and Mathematics Learning

Variables	r-value	Strength of Correlation	p - value	Decision	Remarks
Engagement and Academic Performance in Mathematics	0.280*	Negligible positive	<0.0001	Failed to reject Ho	Not Significant

*significant at p<0.05 (two-tailed)

Table 16 presents the analysis that determines the relationship between students' engagement and their academic performance in Mathematics. The findings suggest that there is a very slight positive relationship; that is, students who are more engaged with mathematics perform only negligibly better. However, this relationship is too small, and engagement by itself does not explain the students' achievement very well. This reflects that on one hand, while the engagement goes in the right direction, it is still too small to be a powerful predictor.

The statistical test reveals that the relationship is significant, meaning that given the number of respondents, the observed association would be unlikely to be due to chance. Therefore, the null hypothesis cannot be retained; this indeed represents a statistically valid association between engagement and Mathematics performance. Still, this does not always mean that at the practical level it is an influential relationship, since the size of the effect remains negligible in terms of actual classroom impact. This also agrees with the observations made by Gupta and Sharma 2020, who found out that indeed there was a positive relationship between engagement and performance, but the effect size was still small.

With its negligible strength, despite the significance, the practical implication of the relationship remains limited. It indicates that engagement may contribute to Mathematics performance only when supported by other influential factors such as instructional quality, learning strategies, timely feedback, and well-aligned learning tasks. The view corresponds to Li and Zhao (2023), who regarded engagement as a multidimensional construct that strengthens learning outcomes when the teaching method is responsive and the lesson content is compelling. It also corresponds to Bellino et al. (2024), who noted that engagement in itself cannot guarantee high academic achievement.

IV. CONCLUSION

The use of ICT in schools can enhance students' learning experiences by providing tools that facilitate understanding and interaction with mathematical concepts. Even as its impact on performance is limited, ICT encourages greater engagement, allowing students to participate actively in and enjoy the process of learning. It is this engagement that is not enough to lead to substantial academic benefits, which means that other strategies, such as effective instructional methods, structured learning activities, and timely feedback, will be required to complement it.

It is only when ICT is meaningfully integrated into teaching practices that an approach can be holistic, turning digital resources from supportive aids to catalysts for deeper learning. In addition, academic success in Mathematics is an outcome of many interacting elements, where technology, engagement, and pedagogy are shared contributors to better learning outcomes. In this manner, ICT coupled with appropriate instructional strategies could help teachers build learning environments that are at once interactive and effective in bringing about higher attainment and sustained interest in the subject.

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