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ICT Learning on Mathematics Anxiety, Motivation, and Performance Among Grade 8 Students

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ABSTRACT

This study examined the level of ICT Learning on mathematics anxiety, motivation and performance of the grade 8 students. It sought to determine the highest level of ICT Learning in terms of information processing, communication, content, safety, and problem solving. It also sought to determine the significant difference between the level of ICT Learning in Mathematics and Mathematics Anxiety; level of ICT Learning in Mathematics and Motivation; and level of ICT Learning in Mathematics in Student's Performance. The researcher used a descriptive correlational survey method with an adapted questionnaire. To gather the data needed for the study, weighted mean, standard deviation, percentage, and Pearson "r "correlation was utilized as the statistical tool. Pajo National High School was the place where the study was conducted. The total number of respondents was 227 students consisting of a grade 8 students. The findings showed that ICT Learning has a weak positive correlation towards motivation and student's performance. It means that ICT Learning affects students' motivation and performance. This also revealed that ICT Learning in mathematics motivates the students to learn and improve the academic performance of the students in the subject. Because of the result, the researcher recommended that teachers should integrate ICT in teaching mathematics to help the students to be more motivated to have a better grade.

Keywords: ICT Learning, Mathematics Anxiety, Motivation, Academic performance, Grade 8 Students, Descriptive-correlational Method, Mathematics

INTRODUCTION

The advancement of technologies is the most in demand nowadays in terms of the lives of the people in the world. Cellphones, computers, and tablets are already an omnipresent element of everyday life for students and teachers. The use of technological devices in the classroom are explored to create meaningful learning experiences for students and teachers. Utilizing different types of technology in the classroom creates learners who are actively engaged with learning objectives. The use of technology during whole-class instruction can foster student engagement for auditory and visual learners. Integrating simple technologies power points, games, internet homework assignments, or online grading systems can be difference makers in students' growth and performance in the classroom.

Numerous studies have been conducted on students' attitudes toward mathematics but have a little attention has been paid to the use of technology in mathematics instruction or Information and Communication Technology (ICT) Learning and its impact on students' attitudes and performance in

mathematics subjects. According to Picha (2018) stated that technology can be a powerful tool in mathematics instruction, with content-specific technology including computer algebra systems, dynamic geometry environments, and interactive applets, while content-neutral technology includes virtual whiteboards, handheld clickers, and student collaboration apps. The use of virtual manipulatives, such as rekenreks, geoboards, number lines, and number frames, is a popular content-neutral technology that supports students with conceptual understanding and increases student access to math. The use of ICT (Information and Communication Technology) in Mathematics gives educators the chance to take advantage of the notion that it can help students in visualizing mathematical ideas and concepts. However, ICT can really provide effective support where teachers are equipped with the necessary abilities on how to use technologies in the mathematics teaching and learning process.

However, the use of technology in mathematics instruction has gained popularity in recent years with various content-specific and content-neutral technologies being utilized to enhance students' understanding and engagement in the subject. In Pajo National High School, students and mathematics teachers face challenges in adapting the new trend by applying ICT tools to improve the performance of the students in learning and teaching mathematics subjects. The poor academic performance of the students in math subjects leads the teachers to accept the challenge and integrate ICT tools in teaching and learning process. Studies have demonstrated that the use of technology in mathematics instruction can result in increased students' engagement, improved learning outcomes and deeper understanding of mathematical concepts (Suarez and Casinillo,2020; Picha, 2018).

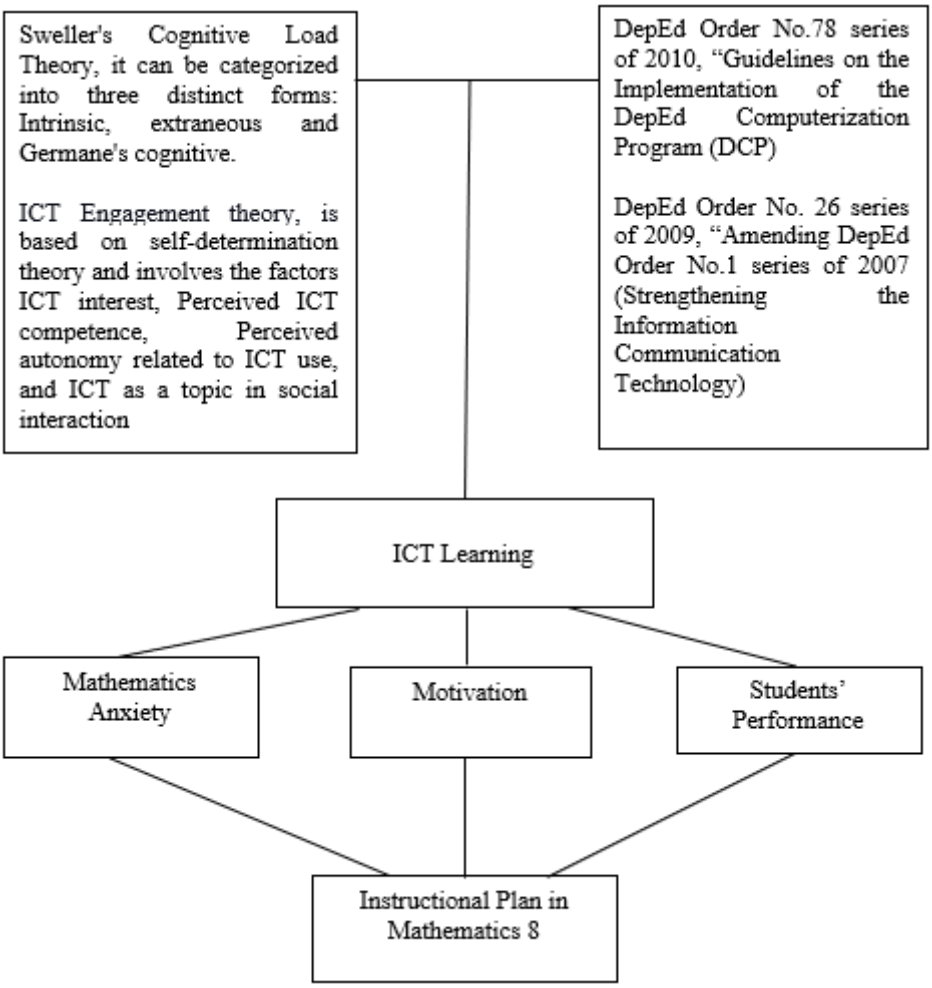
Through this study, teachers make a solution on how to address the needs of the students to increase their willingness to study math. It can lead to the answer to the question of how important ICT Learning integration is in teaching mathematics for the new generation and help future policy makers, administrations, and teachers to prepare what to do and need to do to meet the needs of the students. The results of the study will serve as a guide to develop instructional materials or plans to improve student's performance in math. This will also be a starting point for the mathematics teachers to use interactive instructional materials to catch the interest of the students in learning math lessons. This study is very timely and suitable to address the digitalization era in terms of the teaching-learning process to embrace and face the challenges in accepting the biggest changes happen in the world of teaching and serves as a steppingstone to adapt the changes in the educational system to be more competitive globally and to produce wise and skillful people.

Theoretical Framework of the Study

This study focused on the effects of ICT Learning and its influence on math anxiety, motivation, and academic performance of grade 8 students. This study helps to determine the importance of technology integration in teaching mathematics subject. The researcher determines the level of effects of ICT Learning in teaching mathematics to mold the critical thinking, motivation, decreasing the math anxiety, and creativeness and performance of the students. This section presents all the theories related to the direction of this study and justifies the existence of the problem in the world of education process. As technology increasingly transforms our daily lives, educators too are seeking strategies and resources that leverage technology to improve student learning, especially in learning mathematics.

Figure 1.

Schema of the Theoretical Framework of the Study



DepEd Order No. 26 series of 2009," Amending DepEd Order No.1 series of 2007 (Strengthening the Information Communication Technology or ICT)", sets standards in the development, acquisition, utilization and sharing of digital learning resources in all levels of public schools. Through this, all public schools must use the ICT integration in all subject areas for the improvement of quality teaching and learning in basic education. Teachers can integrate technology in delivering their lessons to the students who can easily hear and see the lessons being discussed in which the students can easily understand and have a better performance in the school.

DepEd Order No. 78 series of 2010, "Guidelines on the Implementation of the DepEd Computerization Program (DCP)", aims to provide public schools appropriate technologies that would enhance the teaching-learning process. This will help the students and teachers to have more engaging lessons in the classroom and to have better achievements or performance of the students in all subject areas, especially in math.

Sweller's Cognitive Load Theory. It can be categorized into three distinct forms: Intrinsic cognitive load refers to the inherent complexity of the material being learned and can be influenced by prior knowledge of the topic. Extraneous cognitive load arises from how the material is presented and does not facilitate learning. Germane's cognitive load pertains to the elements that support information processing and

contribute to the development of 'schemas' (Shibli, 2018). Cognitive Load Theory (CLT) asserts that completing the task becomes difficult if the cognitive load exceeds our processing capacity. As De Jong (2010) succinctly summarizes, CLT posits that "learning is hampered when working memory capacity is exceeded in a learning task." Working memory is finite and short-term, while long-term memory is infinite. The objective should be to transfer knowledge to long-term memory, as this enables students to draw on prior knowledge when they encounter new material, thereby reducing cognitive load. However, incomplete subject knowledge hampers the ability to access long-term memory and overloads working memory, leading to working memory failures (Shibli, 2018).

Information and Communication Technology (ICT) Engagement Theory. It is based theoretically on self-determination theory and involves the factors ICT interest, Perceived ICT competence, Perceived autonomy related to ICT use, and ICT as a topic in social interaction. There are different sources of validity supporting the construct interpretation of test scores in the ICT Engagement scale, which was used in PISA 2015. Lennon et al. (2003) defined ICT literacy as “the interest, attitude, and ability of individuals to appropriately use digital technology and communication tools to access, manage, integrate, and evaluate information, construct new knowledge, and communicate with others in order to participate effectively in society”. The Programme for International Student Assessment (PISA) an influential large-scale assessment carried out by the Organization for Economic Co-operation and Development (OECD 2016)—included questions on ICT availability, ICT familiarity, and ICT use in the optional ICT Familiarity Questionnaire since the first cycle in 2000. As one major change in 2015 the PISA 2015 main study moved from paper-and-pencil administrations to computer-based administration. This change strengthened the meaning of ICT literacy in the assessment context.

The attitude of students towards mathematics has been shown to significantly impact their academic performance and motivation in the subject. Karali and Aydemir (2018) conducted a study which suggests that cooperative learning can increase students' self-confidence, which in turn contributes to their positive attitude towards mathematics. However, Capuno et al. (2019) found that while Filipino students exhibited positive attitudes towards the value of mathematics, their attitudes towards self-confidence, enjoyment, and motivation in the subject were neutral. The importance of fostering a favorable self-concept and promoting good study habits to improve students' performance has been emphasized by Kamoru and Ramon (2017), who reported a positive correlation between students' attitudes towards mathematics and their academic performance.

Peteros et al. (2019) and Jufrida et al. (2019) also found a significant association between students' attitudes and their academic achievement in Mathematics education. Additionally, Hilton (2018) suggested that the use of iPads in mathematics has the potential to positively impact students' attitudes and engagement in the subject, provided teachers make pedagogically sound choices. Therefore, understanding the factors that influence students' attitudes toward mathematics is critical in improving their academic performance and motivation in the subject.

Statement of Purpose

This study aimed to assess the effects of ICT Learning and its influence on math anxiety, motivation, and performance of Grade 8 students at Pajo National High School for the school year 2024-2025.

Specifically, it sought to answer the following questions.

1. What was the level of ICT Learning in Mathematics of the respondents in terms of the following:

1.1 information processing;

1.2 communication;
1.3 content creation;
1.4 safety; and
1.5 problem solving?
2. What was the level of students' attitudes towards ICT Learning in Mathematics in terms of.
2.1 mathematics anxiety; and
2.2 motivation?
3. What was the level of mathematics' performance of Grade 8 students in the First Quarter?
4. Was there a significant relationship between the ICT Learning in Mathematics and the following.
4.1 level of students' mathematics' anxiety;
4.2 level of students' motivation; and
4.3 level of academic performance?
5. What instructional plan could be proposed based on the result of the study?

Literature Review

This section presents reviewed literature and studies relevant to the study. The information presented below supports the relevance and importance of study in the digitalization era in the educational system. Researchers have investigated the potential benefits of utilizing ICT in the teaching and learning process.

ICT Learning

ICT learning, also known as e-learning or online learning, refers to the use of digital tools and technologies to deliver educational content and facilitate learning. According to Sharma (2017), computer-assisted learning (CAL) is a promising tool that can significantly transform the education process and enhance learning efficiency. With the widespread use of smartphones and laptops, it is practically impossible to restrict students' access to technology. CAL provides an opportunity to utilize students' technological access for their benefit. The software's features such as experimentation, instant feedback, and self-pacing can motivate students to learn and improve their academic performance. CAL can also relieve teachers of some of their workload by providing additional support to students who need it. The privacy feature allows shy students to try new things without fear of being judged by their classmates. Research has demonstrated that multimedia and animation can assist students in understanding complex concepts. However, overuse of multimedia may detract from the learning process. Therefore, a balance between the use of technology and the guidance and supervision of teachers is crucial for successful implementation of CAL.

In the United States and other countries, software applications are being employed in classrooms as early as first grade, where students can choose topics from a recommended list and work on sample worksheets in their free time. These software applications are designed to be engaging and enjoyable for children. It is expected that more such trends will be adopted in Indian schools in the coming years (Sharma, 2017). ICT Learning involves using digital tools and technologies to facilitate learning and deliver educational content. Sharma (2017) highlights that computer-assisted learning (CAL) is an effective tool that can significantly transform the education process, enhance learning efficiency, and motivate students to learn. Akturk (2022) cites JCAL as a prominent journal in computer and

instructional technologies, with a focus on learning analytics, MOOCs, multimedia learning, game-based learning, blended learning, online learning, mobile learning, and virtual reality.

Prongnuch and Sitjongsataporn (2022), Technology-Assissted Learning (TAL) has emerged as a crucial element in engineering education, providing inspiration for both instructors and students, and facilitating the learning process. The primary motivation for this mode of learning is driven by attitude and passion. Embedded systems, which are microprocessor – based computer hardware systems with software are a key component of future technology. And these are expected to continue growing rapidly due to the advancement in the Internet of Things (IoT). The findings indicate that the TAL approach is more effective than traditional methods of learning.

Math Anxiety and Motivation

Studies have shown that students' attitudes toward mathematics significantly affect their academic performance and motivation in the subject. Harun, Kartowagiran, and Manaf (2021) assert that the attitudes of students play a critical role in their achievement in mathematics learning since attitudes are internal factors that originate within students. The study findings reveal a moderate category effect indicating a positive and significant influence of students' attitudes on their success in mathematics learning. According to Karali and Aydemir (2018), students' enjoyment and understanding of mathematics, as well as their ability to learn at a certain level, depend on their appreciation of individual effort within the axis of basic skills and values. Cooperative learning increases students' self-confidence, which helps to make them more positive and powerful in mathematical learning. Developing a positive attitude towards mathematics may also remove mathematical barriers that may otherwise negatively affect an individual's success in social interactions. It suggests that cooperative learning can increase students' self-confidence, which contributes to their positive attitude toward mathematics.

Capuno et al. (2019) stated mathematics is widely acknowledged as a challenging subject for Filipino learners. The research findings indicate that the respondents exhibited positive attitudes towards the value of mathematics; however, they reported neutral attitudes towards their self-confidence, enjoyment, and motivation in the subject. Additionally, the study reveals a minimal positive correlation between the respondents' attitudes towards self-confidence, enjoyment, and motivation and their academic performance in mathematics, while a weak positive correlation was found between the value of math and their academic performance in the subject. The study concludes that students' attitudes and study habits significantly influence their academic performance in mathematics. The researchers strongly recommend the implementation of an enhancement plan in the teaching of mathematics to junior high school students.

Mathematics anxiety is a common phenomenon among students, and it is a fear or apprehension of mathematics. According to Levpušček and Cukon (2022), approximately 50% of students experience mathematics anxiety. The study also found that mathematics anxiety is more prevalent among female students than male students. Another study by Paechter et al. (2017) found that statistics anxiety is a form of mathematics anxiety that can replace mathematics anxiety when students no longer must take courses in mathematics but encounter statistics tasks. There are several reasons why students fear mathematics. One reason is that mathematics is often perceived as difficult and abstract, which can lead to feelings of frustration and anxiety (Science, Association for Psychological, n.d.). Another reason is that mathematics is often taught in a way that emphasizes memorization and rote learning, rather than

understanding and problem-solving. Additionally, some students may have had negative experiences with mathematics in the past, which can lead to a lack of confidence and fear of failure (Butler, 2018).

To address mathematics anxiety, it is important to create a positive learning environment that emphasizes understanding and problem-solving, rather than memorization and rote learning. Teachers can also help students build confidence by providing opportunities for success and by emphasizing the importance of effort and persistence. Finally, it is important to recognize that mathematics anxiety is a real phenomenon and to provide support and resources for students who are struggling with it. Students' attitude towards mathematics can significantly impact their overall achievement in the subject (Prodigy Education, 2019). Attitude towards mathematics can be positive, negative, or neutral (Wakhata, Mutarutinya, & Balimuttajjo, 2022). Positive attitudes towards mathematics reflect a student's value, self-confidence, enjoyment, motivation, and anxiety levels when it comes to the subject. On the other hand, negative attitudes towards mathematics can lead to confusion and defeat. Students may dislike mathematics because they think the subject is not useful or because they doubt their ability to succeed (Prodigy Education, 2019).

According to Hilton (2018), research examining the impact of technology integration, specifically the use of iPads, on primary students' attitudes and engagement in mathematics is limited. Furthermore, there have been claims that the effectiveness of iPads for engaging students in mathematics can be strongly influenced by teachers' pedagogical choices. The present study investigates the influence of teaching and learning mathematics with iPads on students' attitudes and engagement in mathematics. Additionally, it was found that the pedagogical approaches employed by teachers when incorporating iPads into their mathematics lessons contributed positively to these outcomes (Hilton, 2018).

Kamoru and Ramon (2017), investigated the association among self-concept, attitude towards mathematics and math achievement among students. Their findings indicate that a positive correlation exist between students' attitudes towards mathematics and their academic performance. Peteros et.al, (2017) demonstrated a statistically significant association between students' attitude and academic achievement in mathematics education . The findings suggest that attitude towards mathematics play a critical role in determining students' academic success. As a result, the study's outcomes highlight the need for school administrators to conduct a thorough assessment of the teaching-learning process in mathematics and implement measures to enhance it.

Mazana et al., (2019), conducted a study to examine the factors affecting students' learning and performance in mathematics specifically their attitudes towards the subject, instructional practices employed by teachers and school environment. The study found that students' initial attitude towards mathematics is positive but it becomes less positive as they advance to higher levels of education. The study's findings provide insights for future researcher and suggest changes in teaching and learning practices to enhance mathematics enjoyment and improve performance in the subject.

Students Performance

Academic performance of Filipino students in mathematics has long been a topic of concern in the Philippines. Despite the country's strong focus on education and the high value placed on math skills, students' performance in this subject has consistently lagged behind that of their counterparts in other countries. The 2019 Trends in International Mathematics and Science Study (TIMSS) results found that Filipino students need to catch up to their peers in other countries in math and science. The results showed that Filipino students scored below the international average in both subjects, with the Philippines ranked 43rd out of the 53 countries surveyed. The study also revealed that Filipino students

must be adequately prepared to participate in the global economy, as they lack the skills to compete with their peers in other countries (Magsambol, 2020). According to Yang (2022), one of the reasons is the need for more emphasis on math in the early years of education. In the Philippines, math is often introduced as a separate subject in the third grade, while in other countries, it is integrated into the curriculum from the beginning. This means that Filipino students may have a different level of exposure to math concepts and may have yet to develop a strong foundation in the subject (Yang, 2022).

Another factor according to Landicho (2021) is contributing to poor math performance is the need for more resources for students and teachers. Many schools in the Philippines need the necessary materials or equipment to teach math concepts effectively, and teachers may need more training or support to teach the subject effectively. This can lead to a lack of understanding and difficulty grasping complex concepts, resulting in poor performance on math exams, lack of motivation and engagement in math, further hindering their performance (Landicho, 2021). Despite these challenges, there have been efforts to improve math performance in the Philippines. Balagtas et al. (2019) reported that the Department of Education has implemented programs such as the K-12 curriculum to provide a more comprehensive and relevant education to students. This includes emphasizing hands-on, experiential learning and problem-solving, which can help students develop a deeper understanding of math concepts (Balagtas et al., 2019).

In order to improve the academic performance of Filipino students in mathematics, several interventions have been implemented like the K to 12 programs, which aimed to provide students with a more comprehensive and holistic education. The program focuses on critical thinking, problem-solving, and communication skills, which are essential for success in mathematics (Dizon et al., 2019). The academic performance of Filipino students in mathematics remains a concern in the Philippines. The government and education system must prioritize math education and address the underlying issues hindering student performance by ensuring that Filipino students have the skills and knowledge they n succeed.

METHODOLOGY

This section presents all the procedures, methods and approaches needed to meet the objective of the study. It includes the location of the study, research design, sample size, sampling technique and data collection methods and its management.

Design

The researcher utilized descriptive - correlational research design. This approach is suited for the study to assess the level of ICT Learning on mathematics anxiety, motivation, and performance of the students in grade 8. This utilized quantitative strategies for data collection such as a Likert Scale Questionnaire adapted from Al Khateeb, AA.M (2017)" Measuring Digital Competence and ICT Literacy: An Exploratory Study of In-Service English Language Teachers in the Context of Saudi Arabia. It has already been used in European contexts by several institutions and individuals. Therefore, it was adopted for this research to measure the level of ICT Learning of the grade 8 students. It consists of five main categories (i.e., Information processing, Communication, Control creation, Safety and Problem Solving) for the level of ICT Learning of the students.

Furthermore, quantitative approach was used in the study. The researcher used the first quarter grades of the respondents for the student's performance in mathematics subject. To test the correlational between the level of ICT Learning and mathematics anxiety, motivation and performance of the students, the researcher used the Pearson "r" Correlational Coefficient. This is the best method to test how strong or

low the significant correlation between the level of ICT learning in math and mathematics anxiety; level of ICT learning in math and motivation; and level of ICT learning in math and student's performance.

Environment

The location of the study is in Pajo National High School. It is in Sangi New Road Pajo, Lapu-Lapu City. It has a day and night junior high school with a total number of 3, 846 students under the very large category. The school has 3 school head and 100 school teachers.

Respondents

The respondents of the study were the grade 8 students at Pajo National High School where the researcher is currently working as a public-school teacher for almost five years. This school had a total number of 3,846 enrollees for the school year 2024-2025, there are 1,732 males and 2,114 females junior high school students. The researcher used Sloven's formula to calculate the minimum sample size with a margin of error of 5% or $n = N/(1+Ne^2)$. The researcher employed systematic simple random sampling. There are 525 grade 8 students in Pajo National High School and only 227 grade 8 students are required to answer the survey questionnaires based on the result of using Sloven's formula. The researcher used random sampling, the sections chosen out of 15 sections are the following: Ruby, Sapphire, Aquamarine, Jade, Opal and SSC. Each section in grade 8 has 37 students except for the Special Science Class which has 42 students in all. The total number of students was 227.

Instrument

This study used a Likert Scale Questionnaire through a google form for those students who had mobile phones and data while printed form for those who had not phones for data collection. It supports the descriptive-correlational research design employed in the study. The questionnaire has two parts, the first part focuses on the level of ICT Learning of the students in terms of information processing, communication, content creation, safety, and problem solving and has a total of 57 items. It was adapted from Al Khateeb, AA.M (2017)" Measuring Digital Competence and ICT Literacy: An Exploratory Study of In-Service English Language Teachers in the Context of Saudi Arabia.

The second part was all about the level of ICT Learning in relation to students' attitude (anxiety and motivation) adapted by Istikomah and Wahyuni (2018)." Student's Mathematics Anxiety on the Use of Technology in Mathematics Learning" with 26 items and 10 items in motivation adapted from Ghavifekr and Rosdy (2015). "Teaching and learning with technology: Effectiveness of ICT integration schools". The reliability shows the result of alpha value are more than 0.7 which it shows good and satisfactory reliability of the items and accepted as research instruments to the respondents. There were 36 total items in part II of the questionnaire. The students were asked to rate each statement for the level of ICT in terms of Information Processing, Communication, Content Creation, Safety, and Problem Solving, using Likert Scale as follows with the following indicator and interpreted as follows: 4 (Strongly Agree/Very high); 3 (Agree/High); 2 (Disagree/Low); 1 (Strongly Disagree/Very low). Students were given ample time to answer the questions. The researcher gave a google link for the respondents to answer through their own mobile phones and they rated his/her experiences of ICT Learning. The purpose of the questionnaire was to assess the effectiveness of ICT Learning to Students' math anxiety, motivation, and performance among grade 8 students in Pajo National High School. To protect confidentiality and secure anonymity among the respondents, indicating their personal details on the questionnaires were not encouraged.

Data Gathering Procedure

The researcher had allotted time and effort in preparing the steps in gathering the data needed for this stu

dy. She asked for a permit to study from the principal and submitted a proposal for a design hearing to the Dean. The researcher sought approval from the Dean of the Graduate School of Education at the University of Visayas and from the panel of examinees 'recommendations for the data collection procedures. Submitted the proposal to the Institutional Review Board (IRB) and waited for the approval. After receiving the notice, the researcher proceeded by requesting approval from the principal to administer the test for the grade 8 students.

After receiving a signal to gather data, the students from each section were gathered in the room and the researcher had 10 minutes to give instructions to have a smooth and peaceful event and answered correctly some questions from the respondents before giving the questionnaires. The printed questionnaires were distributed to those students who had no data or mobile phones with them while some students answered the questionnaire through the link provided. Students were given adequate time to complete the questionnaire, and responses were automatically collected as soon as they were completed. It was held after their class hours. Encode the responses in excel from the first response to the last response of a participant and encode the data. If the respondent's rate is strongly agreed (4), agree (3), disagree (2) and strongly disagree (1). After the encoding, calculate the Mean Percentage Score (MPS) of the two questionnaires. The information was tabulated, evaluated and interpreted.

Finally, the questionnaires were properly gathered and disposed of in accordance with ethical norms, data security, participant privacy, and research integrity. All printed surveys were shredded and burned, and all digital copies of the data were erased from computers. All ethical rules were observed for data disposal.

Data Analysis

To determine the study's conclusions, the data acquired and collected in the study were examined using inferential statistics, especially Pearson's Correlation Coefficient, mean, standard deviation and percentage. Statistical tools were utilized to obtain the most accurate findings from the MPS of the two questionnaires. Mean, standard deviation and Pearson's Correlation Coefficient were utilized in analyzing and interpreting the data gathered on the respondents. These tools were used to find out how strong relationships are between ICT Learning towards mathematics anxiety, motivation and performance in mathematics among the grade 8 students.

And for the assessment on the level of impact of ICT Learning on math anxiety, motivation, and performance of Grade 8 Mathematics students. Descriptive-Correlational design analysis was employed to assess the level of ICT Learning in mathematics in mathematics anxiety, motivation, and student's performance. A significant level of $p < 0.05$ was set for all statistical tests to determine the relevance of the findings.

Ethical Considerations

The study followed the university's ethical consideration criteria. It has been approved following the protocol of the Research and Ethics Committee of the University of the Visayas with Reference No. NP2024MAED-291 dated September 12, 2024. The research involved grade 8 students participating voluntarily in the survey. Before the completion of the questionnaires, a cover letter explained the confidentiality and purpose of the study, potential objectives, and voluntary participation. There are no financial incentives provided, and authors declare no conflict of interest.

Furthermore, by adhering to these ethical principles, this study contributed to assessing the effects of ICT Learning and its influence on math anxiety, motivation, and performance of Grade 8 students at Pajo National High School for the school year 2024-2025. As a token of appreciation for participation,

students received a school supply (1 ballpen and 1 bundle of intermediate pad) after the data collection process. It recognized their contribution to the research.

RESULTS AND DISCUSSIONS

ICT Learning is a type of learning associated with different digital tools, applications or technology. The details below represent the statistical analysis of the gathered data which aimed to determine the level of ICT Learning in Mathematics in terms of Information Processing, Communication, Content, Safety, and Problem Solving.

Level of ICT Learning in Mathematics

It shows the level of ICT Learning in Mathematics in terms of Information Processing, Communication, Content, Safety, and Problem Solving.

Table 1.
Level of ICT Learning in Mathematics

Description	WM	SD	Interpretation
Information Processing			
I can look for information online using a search engine	3.00	2.60	High
I can use different search engines to find information	2.93	2.51	High
I can use advanced search strategies to find reliable information on the internet such as using web feeds	2.80	2.43	High
I know not all online information is reliable	2.97	2.57	High
I use some filters when searching to compare and assess the reliability of the information I find	2.72	2.31	High
I can assess the validity and credibility of information using a range of criteria	2.72	2.32	High
I can save or store files or content and retrieve them once saved or stored	2.99	2.60	High
I classify the information in a methodical way using folders. I backups of information or files I have stored	2.60	2.21	High
I can save information found on the internet in different formats. I can use cloud information storage services	2.65	2.27	High
Communication			
I can communicate with others using Skype or chat using basic features (voice messaging, SMS, text exchange)	3.02	2.62	High
I can use advanced features of several communication tools (using Skype and sharing files)	2.64	2.26	High
I actively use a wide range of communication tools (e-mails, chat, SMS, instant messaging, blogs,) for online communication	3.04	2.63	High
I can share files and content using simple tools	2.89	2.48	High
I can use collaboration tools and contribute to (shared documents/files) someone else has created	2.75	2.38	High
I can create and manage content with collaboration tools	2.67	2.30	High

I know I can use online services (e-banking, e-governments)	2.58	2.21	High
I use features of online services (e-banking, online shopping)	2.85	2.47	High
I actively participate in online spaces and use several online services	2.60	2.23	High
I am aware of social networking sites and online collaboration tools	2.78	2.40	High
I pass on or share knowledge with others online (networking)	2.91	2.52	High
I can use advanced features of communication tools (video conferencing, application sharing)	2.63	2.25	High
Content	2.74	2.38	High
I can produce simple digital content (text, tables, images, audio files) in at least one format using digital tools			
I can produce complex digital content in different formats. I can use tools for creating webpages or blogs	2.61	2.27	High
I can produce complex, multimedia content in different formats using a variety of digital tools and environments. I can create a website using a programming language	2.61	2.26	High
I can make basic editing to content produced by others	2.81	2.43	High
I can apply basic formatting to the content I have produced	2.72	2.35	High
I can use advanced formatting functions of different tools	2.76	2.38	High
I know that content can be covered by copyright	2.87	2.49	High
I know how to reference and reuse content covered by copyright	2.72	2.35	High
I know how to and when it is necessary to apply for licenses and copyrights	2.69	2.34	High
I can modify simple functions of software and applications by changing default settings	2.64	2.30	High
I know the basic principles of one programming language	2.58	2.26	High
I can use several programming languages. I know how to design, create, modify databases with computer tool	2.87	2.46	High
Safety			
I can take basic steps to protect my devices	2.79	2.44	High
I have installed security programs on the device that I use to access the internet	2.79	2.43	High
I frequently check the security configuration and systems of my devices I use on a regular basis to access the internet	2.78	2.40	High
I am aware that my credentials can be stolen. I know I	3.04	2.65	High

should not reveal private information online			
I use different passwords to access equipment, devices and digital services and I modify them on a periodic basis	2.89	2.51	High
I know how to react if my computer is infected by a virus. I can configure or modify the firewall and security settings of my digital devices	2.71	2.37	High
I know that using digital technology too extensively can affect my health	2.82	2.48	High
I understand the health risks associated with the use of digital technology	2.89	2.51	High
To avoid health problems (physical and psychological), I can make use of information and communication technology	2.87	2.49	High
I take basic measures and actions to save energy	2.88	2.51	High
I understand the positive and negative impact of technology on the environment	2.86	2.50	High
I have an informed stance on the impact of digital technologies on everyday life and the environment	2.85	2.47	High
Problem Solving			
I find support when a technical problem occurs or when using a new program	2.82	2.43	High
I can solve most of the more frequent problems that arise when using digital technologies	2.70	2.32	High
I can solve almost all problems that arise when using digital technology	2.67	2.30	High
I know that digital tools can help me in solving problems	2.70	2.35	High
I can use digital technologies to solve (non-technical) problems	2.71	2.34	High
I can frequently choose the right tool, device, application, software or service to solve problems	2.71	2.34	High
When confronted with a technological problem, I can use tools I know to solve it	2.78	2.40	High
I can solve technological problems by exploring the settings and options of programs and tools	2.74	2.36	High
I am aware of new technological developments. I understand how new tools work	2.76	2.38	High
I am aware that I need to update my digital skills regularly	2.92	2.52	High
I regularly update my digital skills. I am aware of my limits and try to fill my gaps	2.76	2.38	High
I frequently update my digital skills to decrease my limits and increase my digital knowledge	2.78	2.40	High

Note. 1.00 – 1.74 - Strongly Disagree/Very low; 1.75 – 2. 49; Disagree/Low;2.50– 3.24;Agre e/High; 3.25 – 4.00 Strongly Agree/Very high

Table 1 shows the highest students' skill in terms of Information Processing, Communication, Content, Safety, and Problem Solving are the following: they can look for information online using a search engine with weighted mean of 3.00; I can communicate with others using Skype or chat using basic features (voice messaging, SMS, text exchange) with a weighted mean of 3.02; I can use several programming languages, I know how to design, create, modify databases with computer tool with a weighted mean of 2.87; I am aware that my credentials can be stolen. I know I should not reveal private information online with a weighted mean of 3.04; and I am aware that I need to update my digital skills regularly with a weighted mean of 2.92 respectively. These shows that the students have identified the digital skills in the 21st century, inclusive of technical, informational, communicative, and collaborative competencies in a digital environment according to Van Laar, (2020). Cam and Kiyici (2017) stressed out that digital literacy consists of multiple factors which includes, information literacy, software literacy, technology literacy, and computer literacy. Furthermore, Khateeb (2017) also considered information processing and communication, digital content creation and problem solving and digital safety as components of digital competence and literacy.

It also shows the lowest students' skill in terms of Information Processing, Communication, Content, Safety , and Problem Solving are the following: classify the information in a methodical way using folders or backups of information or files they have stored is the lowest which have a weighted mean of 2.59; know to use online services is the lowest with a weighted mean of 2.58; can produce complex digital content in different formats has the lowest weighted mean of 2.61; know how to react if the computer is infected by a virus and can modify firewall and security settings of the digital devices has the lowest weighted mean of 2.71; they can troubleshoot some errands or errors when they face some problems in their digital devices with a weighted mean of 2.67.

Overall Level of ICT Learning in Mathematics

Table 2 shows the overall weighted mean of the five categories of ICT Learning in Mathematics of the students in terms of information processing, communication, content, safety, and problem solving.

Table 2
Overall Level of ICT Learning in Mathematics

Category	WM	SD	Interpretation
Information Processing	2.82	2.43	High
Communication	2.78	2.40	High
Content	2.72	2.32	High
Safety	2.85	2.47	High
Problem Solving	2.75	2.38	High
Overall mean	**2.78**	**2.40**	**High**

Note. 1.00 – 1.74 - Strongly Disagree/Very low; 1.75 – 2. 49; Disagree/Low; 2.50 – 3.24;Agree/High; 3.25 – 4.00 Strongly Agree/Very high

It shows that the level of ICT Learning in Mathematics in terms of the five categories Safety has the highest level among the five. It means that they are aware that their credentials can be stolen. They know

that they should not reveal private information online. They are aware of the safety of information and how to protect their personal information when using technology while the least level is the content in which they know the basic principles of one programming language. It means that they are not familiar with programming languages.

According to Boetje et al., (2024) the students are in "process information phase" in which they exhibit a variety of strategies with different levels of depth in processing. The participants did not use transforming strategies, they simply extracted information without adapting it. This aligns with previous research showing that students often copy and paste information from digital sources without transforming it on their own according to Azevedo et al., (2004); Probert, (2009).

The students show basic skills in terms of information processing, communication, content, safety, and problem solving like browsing, locating and searching of information. This finding is supported by past studies (Jewel et.al. 2020; Sauders, 2018), which found that browsing, searching and locating data are considered lower-order skills.

Mathematics anxiety is a student's feelings, beliefs, interest, and values towards mathematics subject and its applications of technology. It measures the student's feelings and willingness to learn mathematics using technology.

Mathematics Anxiety of the Students

This shows the level of ICT in terms of mathematics anxiety.

Table 3

Weighted Mean Distribution and Verbal Interpretation of the Level of ICT Learning in Mathematics in terms of Mathematics Anxiety

Description	WM	SD	Interpretation
I am not nervous when my mathematic lecturer approaches me	2.65	2.31	High
I get stressed when there is a math quiz on the next day	2.73	2.38	High
It is difficult for me to concentrate on using technology in mathematics learning	2.70	2.33	High
I blank out identifying procedures in the use of technology in learning media	2.66	2.29	High
I am relieved when I finish my presentation with technology learning media	2.91	2.52	High
I am unpleasant when the lecturer gives a task that requires Geogebra	2.72	2.35	High
I enjoy drawing constructs with Geogebra	2.73	2.35	High
I am less interested in math class since the lecturer explicates too fast and less understandable	2.66	2.31	High
I panic every time the lecturer asks me to solve a problem using learning media or software	2.73	2.38	High
I am convinced that I am capable to solve the problems using Geogebra	2.60	2.23	High
I am nauseous during math quiz	2.61	2.26	High
I am prepared when the lecturer asks over an assignment	2.88	2.49	High

I am confident that I win the competition of the best score	2.57	2.26	High
If I am instructed to solve problems in front of the class using learning media or software, I never have excessive sweating	2.56	2.20	High
Mathematics is such a difficult course	2.81	2.44	High
I have no dizziness even when the problem requires technology-based learning media	2.64	2.27	High
I love math since it explores my intellectuality	2.69	2.33	High
I am nervous every time the class involves learning media	2.62	2.25	High
If I am instructed to solve a problem in front of the class, I am not sure I can do it appropriately	2.84	2.48	High
Despite being nauseous, I will do my best to complete the test	2.94	2.55	High
I panic when the lecturer asks me, have you understood it?	2.64	2.30	High
I sweat excessively when I cannot answer the lecturer's question	2.76	2.39	High
Technology-based mathematics learning is boring	2.47	2.12	Low
It is easy for me to recall steps in GeoGebra	2.46	2.10	Low
I less understand the material; hence, I ask the lecturer about it	2.77	2.40	High
If I have not understood material, I will directly ask about it	2.86	2.50	High
Mean	**2.70**	**2.33**	**High**

Note. 1.00 – 1.74 - Strongly Disagree/Very low; 1.75 – 2. 49; Disagree/Low; 2.50 – 3.24;Agree/High; 3.25 – 4.00 Strongly Agree/Very high

Table 3 shows that students agree to do their best to complete the test despite having nausea obtained the highest weighted mean of 2.94 and they also disagree with the statement that Technology-based Mathematics learning is boring, and it is easy for them to recall steps in GeoGebra have the lowest weighted mean of 2.47 and 2.46 respectively.

This shows that the Impact of ICT Learning in Mathematics in terms of Mathematics Anxiety obtained a 2.70 weighted mean which means that students have high level of ICT Learning in terms of mathematics anxiety. It means that they have experienced anxieties but minimal. On the other hand, the integration of technology in mathematics education serves as a factor that contributes the mathematics anxiety to the students. It is supported by Karali and Aydemir (2018), stated that students' enjoyment and ability to learn depends on their appreciation of individual effort within the axis of basic skills.

Motivation is a student's desire to study more about the subjects or that can raise the curiosity and interest of the students to study well. It measures the student's feelings and willingness to learn mathematics using technology.

Motivation of Students

This shows the level of ICT Learning in terms of motivation.

Table 4
Weighted Mean Distribution and Verbal Interpretation of the Level of ICT Learning in Mathematics in terms of Motivation

Description	WM	SD	Interpretation
ICT allows students to be more creative and imaginative	2.80	2.42	High
The use of ICT helps students to find related knowledge and information for learning	2.87	2.48	High
The use of ICT encourages students to communicate more with their classmates	2.89	2.49	High
The use of ICT increases students' confidence to participate actively in the class	2.89	2.48	High
I think students learn more effectively with the use of ICT	2.79	2.40	High
I think the use of ICT helps to broaden students' knowledge paradigm	2.84	2.44	High
I think the use of ICT helps to improve students' ability specifically in reading, writing and solving	2.93	2.53	High
The students are more behaved and under control with the use of ICT	2.86	2.46	High
The use of ICT enables students to express their ideas and thoughts better	2.88	2.49	High
The use of ICT promotes active and engaging lessons for students' best learning experience	2.93	2.54	High
Mean	**2.87**	**2.48**	**High**

Note. 1.00 – 1.74 - Strongly Disagree/Very low; 1.75 – 2. 49; Disagree/Low; 2.50 – 3.24;Agree/High; 3.25 – 4.00 Strongly Agree/Very high

Table 4 shows that students have a high level of ICT Learning in terms of motivation. The use of ICT promotes active and engaging lessons for students' best learning experience and the use of ICT helps to improve students' ability in reading, writing and solving obtained the highest weighted mean of 2.93 and students learn more effectively with the use of ICT has the lowest weighted mean of 2.79. This shows that the level of ICT Learning in Mathematics in terms of Motivation obtained a weighted mean of 2.87, which means that students agree that they are motivated to study and learn with the use of technology. According to Atteh et al., (2020) and Ozel et al., (2008), technology-based instructional strategies such as the use of educational software, interactive whiteboards, and online learning platforms, have been shown to enhance students' understanding of mathematical concepts and facilitate more engaging and effective learning experiences. It is also supported by Hambira et al., (2017), which states that technology-integrated instruction can foster a greater sense of interest and enjoyment in mathematics among students by providing more engaging and interactive learning experiences.

Students' Performance

Students' performance is the students' academic achievement during the first quarter. Academic achievement is the result of a student's performance with the use of technology in learning mathematics.

Table 5
Weighted Mean Distribution and Verbal Interpretation of the Level of Academic Performance of the Students in the First Quarter

Grading Scale	No. of Students	Interpretation
90 – 100	22	Outstanding
85 – 89	80	Very Satisfactory
80 – 84	88	Satisfactory
75 – 79	37	Fairly Satisfactory
Below 75	0	Failed
Total	227	
Mean	83.88	Satisfactory

Note: 90 – 100 Outstanding; 85 – 89 Very Satisfactory; 80 – 84 Satisfactory. 75 -79 Fairly Satisfactory; Below 75 Failed

ICT Learning in Mathematics and Math Anxiety, Motivation, and Performance of the Students

Table 5 shows that the performance of the students obtained a general weighted mean of 83.88 is satisfactory. It means that most of the students have a satisfactory grade in mathematics subject. This table shows that 9.69% of the students have a grade of 90-100, 38.77% of the students have a grade of 80-84 and no students have a below 75 grades. It means that most of the students have a grade of 80-84. ICT Learning involves using digital tools and technologies to facilitate learning and deliver educational content. It measures the significant relationship between ICT Learning and mathematics anxiety, motivation, and performance of the students.

Table 6
Significant Relationship Between ICT Learning in Mathematics and Math Anxiety, Motivation, and Performance of the Students

Variables	r- value	p-value	DECISION	INTERPRETATION
ICT Learning and Mathematics Anxiety	0.0403	0.0604	Accept Ho	Not Significant
ICT Learning and Motivation	0.0529	0.0328	Reject Ho	Significant
ICT Learning and Student's Performance	0.0034	0.0001	Reject Ho	Significant

Note. N = 227; significant at the level of 0.05

As shown in table 6, the r- value of ICT Learning and mathematics anxiety is 0.0403 or 4.03 % while p-value is 0.0604 or 6.04% which is greater than r- value, so it means accept null hypothesis and there is no significant relationship between ICT Learning and mathematics anxiety. The r-value of ICT Learning and motivation is 0.0529 or 5.29 % while p- value is 0.0328 or 3.28% which is lesser than r- value so, it means accept reject hypothesis and there is significant difference between ICT Learning and motivation. ICT Learning and student's performance r- value is 0.0034 or 0.34% while p- value is 0.0001 or 0.01%

which is lower than r-value. It means that reject null hypothesis and there is significant relationship between ICT Learning and student's performance.

The table indicates that ICT Learning is a way of motivating the students to study and to learn mathematics. It helps the students to engage actively during the class and get away their boredom in learning mathematics. It is supported by Hambira et al., (2017) stated that the integration of technology in mathematics education can also serve as a motivating factor for students through providing more engaging and interactive learning experiences, technology-integrated instruction can foster a greater sense of interest and enjoyment in mathematics among students. ICT Learning has a very low correlation towards mathematics anxiety and the students' performance of the students. Mazana, Montero, Olifage, and Respickius (2019) conducted a study to examine the factors affecting students' learning and performance in mathematics, specifically their attitudes towards the subject, instructional practices employed by teachers, and school environment. The study found that students' initial attitude towards mathematics is positive, but it becomes less positive as they advance to higher levels of education. A significant positive weak correlation was established between students' attitude and performance, and enjoyment and attitude towards mathematics significantly predicted their performance in the subject.

INSTRUCTIONAL PLAN IN MATHEMATICS 8 MELISSA P. QUIJANO

Lesson Plan in Mathematics 8

Learning Objectives:

a. Describe the points in the Cartesian Plane
b. Plot and connect the points in the Cartesian Plane using GeoGebra
c. Share and participate during class activities

Content: Cartesian Plane

Learning across curriculum:

Mapeh / Arts: Students can connect mathematics with art by creating geometric shapes and patterns using GeoGebra, thus enhancing their understanding of symmetry and design in mathematics.

TLE. The use of GeoGebra as a digital tool aligns with the curriculum's emphasis on integrating technology in learning, preparing students for a future where digital literacy is essential in various fields.

Motivation: "Coordinate Scavenger Hunt" - Divide students into pairs and assign them different coordinates on the Cartesian plane. They must find and plot these points on GeoGebra, then share their findings with the class.

Activity: Instructions: 1. Open GeoGebra and select the "Graphing Calculator" option.

2. Input the given coordinates (e.g., (2,3), (-1, -1), (4,0)) to plot the points on the Cartesian plane.

3. Discuss with peers how the placement of each point relates to its coordinates.

4. Using the coordinates provided by the teacher, connect the plotted points on GeoGebra to form a shape (e.g., triangle, square).

5. Identify the properties of the created shape (e.g., number of sides, angles).

6. Present the shape to the class and explain how you connected the points.

Questions:

1.What shape did you create, and what are its defining characteristics?

2. How did the coordinates influence the shape you made?

3. Can you identify any patterns in the shapes formed by different sets of points?

Abstraction:

Plotting points and creating shapes in the Cartesian plane, emphasizing the relationship between algebra and geometry. Understanding coordinates fosters deeper insights into geometric properties and spatial reasoning. Concepts such as symmetry and transformations can further enrich students' comprehension of geometry and its applications. Quadrant I (all positive), Quadrant II (negative and positive), Quadrant III (all negative), Quadrant IV (positive and negative).

Assessment:

Task: Create a map of your school using GeoGebra, plotting important locations (e.g., classrooms, offices) as points. Design a video game level using geometric shapes plotted on the Cartesian plane in GeoGebra.

Assignment:

Create a poster that illustrates different shapes formed by various coordinates on the Cartesian plane, including a brief description of each shape's properties. Use GeoGebra to plot your examples and be prepared to present your poster to the class.

CONCLUSION AND RECOMMENDATIONS

This section discusses the conclusion based on the given hypothesis in the study. It indicates the findings and recommendations of the researcher for future writers who could possibly improve this study.

Conclusions

Based on the results, the level of ICT Learning in mathematics has no correlation towards mathematics anxiety. Thus, the level of ICT Learning has no impact towards mathematics anxiety. The study concluded that the level of ICT Learning has no effect on students' anxiety which means that ICT Learning is not one of the factors that students do not like to learn mathematics.

The study concluded that the level of ICT Learning in mathematics has a very weak correlation towards student's motivation. The findings revealed that ICT Learning has a weak positively affects the student's motivation to learn mathematics therefore, it is suggested that teachers should integrate ICT in teaching mathematics subject. It helps the students to improve their abilities in reading, writing and problem solving. It also encourages the students to have active and engaging lessons for students' best learning experience.

The level of ICT Learning has a very weak correlation towards student's performance. The study revealed that ICT Learning has a weak positively affects the performance of the students. The study concluded that ICT Learning causes the student to be motivated in the subject, that's why their performance in the subject is also affected. The study revealed that ICT Learning has a positive effect towards motivation and student's performance so, the researcher suggests that ICT integration in teaching mathematics is positively encouraged in the teaching-learning process.

Recommendations

From the findings and conclusions of the study, the following recommendations were suggested.

First, teachers should integrate ICT Learning in daily lessons in teaching mathematics through having an online or offline engaging activity to motivate the students to learn and take consideration in choosing strategies that they will use during the presentation of the topic.

Second, parents are encouraged to motivate their children through giving them technology like android phones or even buying laptops to provide the needs of their students in the school.

Third, school Administration or Principal should let the students use the ICT Laboratories not for science subjects only but instead to all subjects, especially in mathematics because they are motivated to study if they have a laptop or technology being used in school.

Lastly, Division/Region Superintendent should allocate some projects to make our classrooms have a 1:1 laptop for the students or even 1:3 because teachers could teach better if there are tools to be used in teaching and they can't apply what they learn from different trainings and workshops if there are no gadgets or laptops and technologies to be used.

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